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JUNE 3 & 4, 2014

International Multi Track Conference on Sciences, Engineering & Technical Innovations

VOL - 2

Edited By
Dr Manoj Kumar

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CT INSTITUTE OF ENGINEERING MANAGEMENT & TECHNOLOGY

Proceedings of

International Multi Track Conference on Sciences, Engineering & Technical Innovations

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PREFACE

This book contains the proceedings of the International Multi Track Conference on Sciences, Engineering & Technical Innovations (IMTC-14) which was organized by CT Institute of Engineering, Management & Technology (CTIEMT), Jalandhar on June 3-4, 2014.This conference aims to disseminate the latest research in Wireless Networks & Mobile Computing, Optical Communication, Software Engineering/Cloud Computing/Biomedical Signal Processing, Image/Speech Processing, Neural Network/Fuzzy Logic, Analog/Digital/VLSI/Antenna, Civil Engineering, Electrical Engineering, Mechanical Engineering, Pharmaceutical & Biotechnology, Applied Sciences, Management & Education and other relevant topics and applications. This conference is co-sponsored by Department of Science and Technology, India and Punjab Technical University, Jalandhar.

The friendliness and candidness of IMTC-14 shall enhance the ability of all the delegates to grow by interacting with the experienced resource persons and young researchers.

My gratitude is due to S. Charanjit Singh Channi, Chairman, CT Group of Institutions Jalandhar, who has been really very encouraging and supportive.

This conference and the proceedings have been possible due to the unstinted support of the Management of CT group.

I am very thankful to my colleagues and whole staff rendering their services as co-editors in compilation of this volume. Finally, I very cordially thank all the people of CT group for their efforts to maintain the high scientific level of conference and proceedings.

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Track 2

Civil Engineering

Treatment of Municipal Wastewater Using Sequencing Batch Reactor-A Laboratory study

Athira Rajeev
SVNIT
Surat, India
athieev@gmail.com

Bhaven N .Tandel
SVNIT
Surat India

Abstract-The performance of a sequencing batch reactor treating municipal wastewater was studied in a laboratory scale. The sequencing batch reactor had a working volume of 40L. 20L of fresh sewage with an average BOD5, COD, NH_4-N and TKN concentration of 83.42 mg/L, 295.6 mg/L, 14.6 mg//L and 25.3 mg/L respectively was fed into the reactor during the fill phase for each cycle. The reactor had a cycle period of 8 hours, which comprised of 0.25 hours fill phase, 6 hours react phase, 1 hour settling phase, 0.25 hours decant phase and 0.5 hours idle phase. During the react phase, aeration and stirring at 100 rpm was supplied. Aeration was supplied using 3 fish tank aerators giving an air supply of 0.078 L/min each. The reactor gave an average removal of 40.12%, 84.35% and 52.18% for COD, NH_4-N and TKN respectively. The destruction of biomass due to the lack of power supply for two days, brought a greater impact on the COD removal than on NH_4-N and TKN removal. The COD removal decreased from 47.86% on day 24 to 24.14% on day 27. The reactor gave good performance at MLVSS concentration between 2500 mg/L and 3000 mg/L.

Keywords- Treatment;COD;ammoniacal nitrogen; total kjeldahl nitrogen; mixed liquor volatile suspended solids

I. INTRODUCTION

In recent years, biological processes have been considered to be of significant importance for the treatment of organic wastewater, because of cost effective and environmentally sustainable alternative technology. Conventional biological treatment systems(e.g: activated sludge) have shown limited success in removing potentially toxic substances. Sequential batch reactors(SBR) has recently become an alternative technology for the biological treatment of industrial wastewaters having very high concentration of COD, BOD, phenolic compounds and other hazardous pollutants. SBR process is a suspended growth process operating under non-steady state conditions which utilizes a fill and draw reactor with complete mixing during the batch reaction step (after filling) and where the subsequent steps of aeration and clarification occur inthe same tank. All SBR systems have five steps in common, which are carried out in sequence as follows, (1) fill (2) react (3) settle(sedimentation/clarification) (4)draw (decant) and (5) idle. It is reported that the treatment of SBR is economical than conventional continuous mode activated sludge process in the tune of 20% , being equally efficient from the viewpoint of organic carbon removal.

In the recent period, SBR has achieved considerable attention, though the theoretical fact of the process is not a novel one. Irvine and Busch(1979), in their pioneering research established that SBR could be an excellent alternative of conventional activated sludge process for both municipal

and industrial wastewater treatment.It can also be used as a package treatment unit for simultaneous treatment of organic and nitrogen bearing waste in a single reactor system.Aerobic conditions in SBRs are optimal owing to clearly lower biomass production with comparable effectiveness of BOD_5 and COD removal (K. Dorota et al,2007). When SBRs are working under higher organic loadings, it is very effective in removing carbon and nitrogen. Major fraction of soluble COD(SCOD) removal takes place during the aerobic reaction period and further SCOD removal takes place in the anoxic phase(AnupamDebsarkar et al,2006). Also, longer aerobic reaction phase increases the efficiency of COD removal and NH_4^+-N removal(W. Jamile et al, 2013).

Ammonia is converted into nitrate (NO_3^-) through an intermediate product as nitrite by the process of nitrification. The essence of effective nitrification lies with high degree of nitrate formation and its recovery. However, unless nitrite is formed substantially by the autotrophic nitrosomonas, through utilization of NH_4^+-N as substrate, the nitrate level cannot be elevated in the reactor. Thus, to allow the maximum utilization of ammonia by the nitrifiers, longer aeration period is necessary (AnupamDebsarkar et al, 2006). Denitrification in any biological reactor can be achieved only when dissolved oxygen (DO) level in the reactor is very low or even absent(<1mg/L). Such anoxic environmental conditions can be maintained in the SBR system when the supply of air is shut off (AnupamDebsarkar et al, 2006).Thus, low DO concentration and the presence of carbon source improves the denitrification process, thus resulting in a better total nitrogen removal efficiency (W. Jamile et al, 2013).

Usually in SBRs biological nitrogen removal occurs through pre-denitrification,which occurs during the fill phase. The nitrate-N(NO_3^-) /nitrite-N (NO_2^-) which is produced in the preceeding operational cycle is converted into N-gas by the anoxic heterotrophic denitrifiers. The denitrifiers consume the readily biodegradable COD (rbCOD).

Presently, the use of SBRs in the biological treatment of wastewater has been widely extended from lab-scale studies to real wastewater treatment plants. While lab-scale SBRs have been used for research on carbon and nutrient removal and the development of urban/industrial wastewater biodegradability assays, real plant applications are still mainly focused on carbon removal. Nevertheless, when operating real time SBRs, the efficiency of nitrogen removal sometimes turn out to be better than the legally required effluent standards (Al-Rekabi et al, 2007). The aim of the present study was to study the performance of SBR treating municipal wastewater by considering the removal of the following parameters; COD,

ammoniacal nitrogen (NH4-N) and total kjeldahl nitrogen(TKN).

II. MATERIALS AND METHODS

A. Experimental set-up

The experimental work was carried out in a laboratory scale SBR with a working volume of 40L.The SBR had dimensions of 44cmX30cmX70cm and was made of 10mm thick acrylic sheet. Mechanical stirrer of 100rpm was used to provide stirring to maintain a homogeneous mixture in the reactor. Oxygen was supplied by means of three fish tank aerators where each gave an air output of 0.078 L/minute.

B. Seed activated sludge

The SBR reactor was seeded with the return activated sludge taken from a nearby municipal wastewater treatment plant .The reactor was seeded with 15L of activated sludge. The volatile suspended solids (VSS) to suspended solids (SS) ratio of the seed sludge was 0.73.After seeding, the reactor had an MLSS concentration of 3800mg/L.

C. Experimental procedure

The duration of a complete cycle was 8 hours.The cycle period was divided into different phases in sequence as follows-0.25 hours fill phase, 6 hours react period, 1 hour settling phase, 0.5 hours decant period and 0.25 hours idle phase. During the fill phase, 20L of raw sewage was fed into the reactor tank. The raw sewage used for the study was obtained from the nearby pumping station.The mechanical stirrer was operated continuously during the react period with a speed of 100rpm. From the 15th minute, the reactor was aerated,upto the end of the react phase. During the react phase, both aeration and stirring was given to mixed liquor. After the react phase,1 hour settling period was provided followed by decanting. The reactor was then kept idle for 0.25 hrs.

Influent and effluent samples were analysed for pH, COD, BOD5, NH4-N and alkalinity.Dissolved oxygen level during the react period, MLSS and MLVSS was also measured thrice a week. All analysis were carried out as per the methods described in Standard Methods.

III. RESULTS AND DISCUSSIONS

A. Performance of SBR in COD removal

The raw sewage which was used for the study had an average chemical oxygen demand of 300mg/L. Chemical oxygen demand is the amount of biodegradable and non-biodegradable organic matter present in the wastewater.It is the source of energy for microbial metabolism. From the graph showing the percentage COD removal in various days,it can be seen that the removal of COD was only 11.76% in the first day of operation.It increased upto 46% in 22 days.Almost constant removal of about 40% was observed from day 11 to day 15. From day 15 to day 24, the reactor again showed an increase in removal from 40% to 49%. A sudden drop in curve is found from day 24 to day 28.This was because, the reactor was not working for days 25 and 26 due to the lack of power supply. The MLVSS concentration in the reactor on day 24 was 2812mg/L. It reduced to 1432 mg/L on day 27.The loss of

biomass is the reason for the decrease in the COD removal. Then the COD removal gradually increased from the 27th day of operation to the 50th day, where it reached upto 56.36%. The greater influent COD concentration (greater than 350 mg/L), contributed to the higher effluent COD concentration on days 20 to 23.
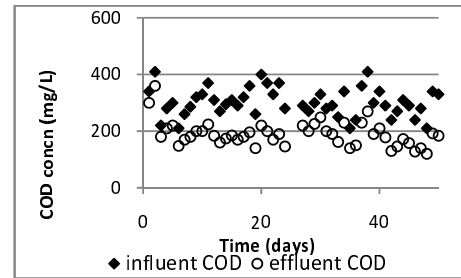
Fig. 1. Profile of influent and effluent COD concentrations
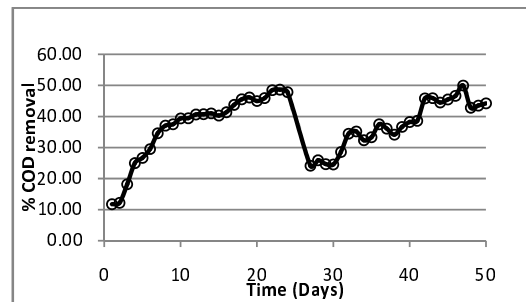
Fig. 2. Profile of COD removal

By the 20th day, the MLVSS concentration in the reactor was 2800mg/L. On this day, the reactor gave a C0D removal of 45% for the influent COD concentration of 400mg/L. But, it can be seen that on day 38, the removal was 34.14% for the influent COD concentration of 410 mg/L. On this day, the MLVSS concentration in the reactor was 2250mg/L, which was less than that on the 20th day of operation. The lower concentration of biomass gave the lower removal of COD. The decrease in COD removal on day 48 was due to the increase in biomass concentration. The MLVSS concentration was 3236 mg/L on day 48. This caused a portion of the accumulated solids to find their way to the system effluent, which contributed to the effluent COD. The reactor gave good COD removal when the MLVSS concentration in the reactor was between 2500 mg/L and 3000 mg/L.

B. Performance of SBR in the removal of NH_4-N

The influent raw sewage had an average ammoniacal nitrogen concentration of 14.6 mg/L. From fig 4; the ammoniancal nitrogen removal was 69.11% on the first day of operation. It increased to 86.85% on day 10. The removal decreased from 88.71% on day 23 to 81.73 on day 27. This decrease is due to the loss of biomass, since the system had ceased working due to the lack of power supply. The reactor regained its removal capacity to 89.66% by day 30.
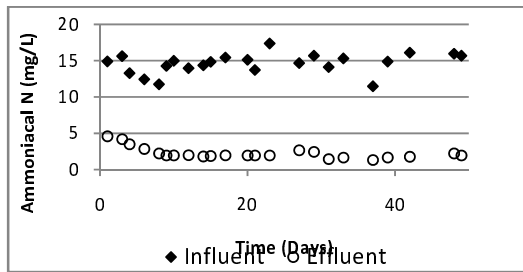
Fig. 3.   Profile of influent and effluent NH4-N concentration
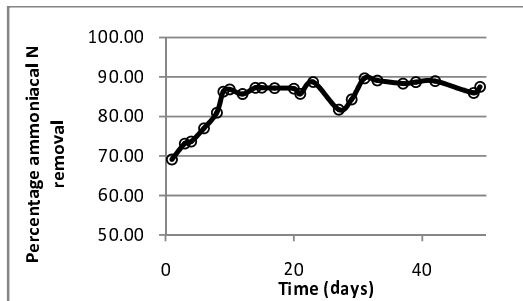
Fig. 4.   Profile of percentage NH4-N removal

A slight jump in curve on day 23 is due to the higher influent ammoniacalnitogen concentration. The removal rate was more when the influent ammoniacal nitrogen concentration was high. The reactor gave an effluent ammoniacal nitrogen concentration less than 2 mg/L. This indicates almost complete ammonium oxidation.

C.   Performance of SBR in the removal of TKN

The influent raw sewage had an average TKN concentration of 25.3 mg/L. On days 38, 46 and 50, the influent TKN concentration as about 30 mg/L. This increased influent concentration accounts for the, slight increase in the effluent TKN concentration on these days. After almost 10 days of operation, the reactor gave almost constant removal of TKN,which was between 50 and 60%. TKN removal slightly decreased from 56.12% on day 22 to 51.24% on day 30. This decrease in removal was also due to the destruction of biomass due to the lack of power supply for 2 days. Then the biomass growth progressed and the removal of TKN roseupto 58.39% on day 50.
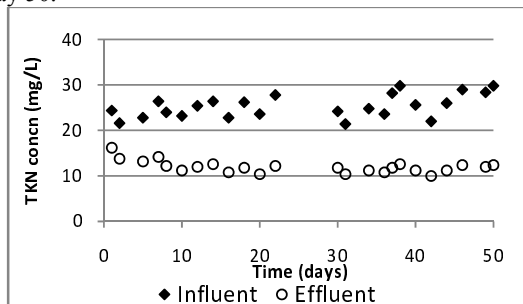
Fig. 5.   Profile of influent and effluent TKN concentration
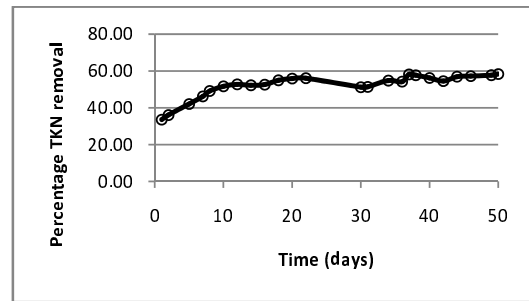
Fig. 6.   Profile of percentage removal of TKN

IV.   CONCLUSIONS

The laboratory study on the treatment of municipal wastewater using SBR with 6 hours aerobic reaction period gave the following conclusions.

- The average effluent COD, NH$_4$-N and TKN concentrations were 178 mg/L, 2.3 mg/L and 12.01 mg/L respectively with an average removal of 40.12%, 84.35% and 52.18% respectively

- The reactor gave better COD removal at MLVSS concentrations between 2500 mg/L and 3000 mg/L.

- The decrease in COD removal on day 48 was due to greater MLVSS concentration of 3236 mg/l, where the accumulated solids found their way to the system effluent.

- The lack of power supply on days 25 and 26 led to the destruction of biomass. The effect of this reduction of biomass had a greater influence on the COD removal than on NH$_4$-N and TKN removal.

- Greater concentration of NH$_4$-N and TKN in the influent contributed to the greater effluent NH$_4$-N and TKN concentration in certain days of operation.

- In future,the performance of SBR could be studied by introducing an anoxic phase into the react period after aeration. Also the study can be carried out by varying the influent COD and NH$_4$-N concentrations.

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Laboratory Studies on Up-Flow Fixed Film Fixed Bed (UAFFB) Reactor for Treatment of Domestic Wastewater

Manoj Yadav
Department of Civil Engineering
NIT Hamirpur (HP) – 177005.
Email: manoj.yadav249@gmail.com

Dharmendra
Department of Civil Engineering,
NIT Hamirpur (HP) – 177005.
Email: djha@nith.ac.in

Abstract—**The use of anaerobic processes to treat wastewater has been increasing in recent years due to their favorable performance-costs balance. For optimal results, it is necessary to identify reactor configurations that are best suited for this kind of application. This paper reports on the laboratory study carried out on up-flow anaerobic fixed film fixed bed (UAFFB) reactor systems with the objective of evaluating their performances when used for the treatment of low-strength wastewater. Pine cone was used as a reactor bed material in the reactor with capacity (10.8L) UAFFB reactor operated for 60 days. Two sets of experiments were carried out. During each set the flow rate to the digester was kept constant, giving hydraulic retention times of 72, 48 h, respectively within controlled ambient temperature. During the experiments loading rate kept between 0.75- 1.5Kg COD/m3day. The production of the biogas was small. The COD removal efficiency varied between 35-55%.**

Keywords— UAFFB Reactor; Acclimatizatio; Spent wash; Pall rings; Organic loading rate.

I. INTRODUCTION

As early of eighteen century the formation of methane from anaerobic decomposition of organic deposits was known and in the middle of nineteenth century the involvement of bacteria in this decomposition became clear. It was just one century ago (1881) when anaerobic treatment was reported to be useful for reducing mass and putrescible nature of suspended organic material (sludge) removal from municipal wastewaters.

Anaerobic processes are an attractive technology for wastewater treatment. The high costs of aeration and sludge handling associated with aerobic sewage treatment are dramatically lower as no oxygen is needed and the production of sludge is 3–20 times lower. However, its use is usually limited to high strength industrial wastewater with soluble substrates. Domestic wastewater has typically low concentrations of COD, resulting in relatively small methane production that is insufficient to heat the reactor to more favorable mesophilic temperatures. Moreover, the relatively high concentration of particulate matter present in domestic wastewater requires an initial hydrolysis step, which is significantly affected by temperature and is usually the rate-limiting step in sub-tropical climate regions. In tropical countries UASB reactors for domestic wastewater have found wide acceptance. There are several full-scale plants already in operation in Colombia, Brazil, Indonesia, India and Egypt and COD removals above 70% have been observed by several authors [1], [2],[3]

The effluent quality at these installations is reported to be 140 mg COD/l, 75 mg BOD/l and 30 mg TSS/l. At low temperatures, the low hydrolysis rate and a decrease in the degradable organic matter fraction were found to cause the deterioration of the overall anaerobic reactor performance [4]. UASB COD removals of ~65% at 20°C and of 55–65% at 13–17°C were observed by several authors [5],[6],[7],[10]. A decrease in the effluent quality was also observed, together with a decline in the gas production rate.

II. MATERIALS AND METHODS USED

A. Reactor set up

Construction detail of UASB Reactor and characteristics of seed are given below in table I and table II respectively:

TABLE I. CONSTRUCTION DETAIL OF UASB REACTOR

Sr. No.	Particular	Specification
1	Reactor type	Circular PVC pipe
2	Diameter	14.5 cm
3	Total height	35 cm
4	Effective height	31 cm
5	Working volume	10.8 Lit
6	Total volume	13.8 Lit
7	Packing Media depth	25 cm
8	No. of pine cone	11

Sr. No.	Parameter	Concentration
1	pH	8
2	Total Solid (mg L-1)	5975
3	Volatile Solid (mg L-1)	1150
4	Total BOD5 (mg L−1)	485
5	Total COD (mg L−1)	2575
6	Alkalinity (mg L−1 as CaCO3)	950
7	Chlorides (mg L-1)	430
8	Electrical conductivity (μmhos/cm)	1750

B. Tower packing material

The Tower packing materials (Pine cone) were used as fixed bed. It was easily available in himachal and here pine cone used as a packing media. its first time in UASB reactor history ever use pine cone as a packing material. Its fully biodegrable material. Size of pine cone was used length 18 cm. Physical characteristics of tower packing material. [9]

Name - Mature female Pinus coulteri cone

Shape – cylindrical or ovoid (egg-shaped)

Volume –open pine cone– 0.00016 m³,

Sink pine cone – 0.00014 m3

Cone fresh weight (g)- 110

Cone length (cm)- 18

Cone width (mm)- 30.00

Seed length (mm)- 6.45

Seed width (mm) -5

Seed weight (g)- 6

C.   Feed Sample

The wastewater used in the experiment was from the outlet of the primary sedimentation tanks of the municipal treatment plant of the NIT hamirpur (India).

III.   ANALYTICAL PROCEDURE

In this study, standard method (APHA et al. 1998) was used for all analytical measurements (e.g., pH, COD, total suspended solids (TSS), volatile suspended solids (VSS), alkalinity, and gas composition). The pH was measured by Thermo ORION model 210 pH meter. The COD was detected using the closed reflux, titrimetric method with 20× 150 mm culture tubes. The suspended solids testing was performed with Whatman (Florham Park, New Jersey) GF/C glass microfiber filters (1.2 μ). [8]

IV.   REACTORS PERFORMANCE

The performance of the reactor system was characterized by varying, substrate concentration from 700 to 2000 mg/l and hydraulic detention period from 24 to 72 hours. The experimental observation of the reactor system is depicted in Fig.1. The corresponding steady state removal efficiency was 65%. Similar pattern was observed on further increase in substrate loading but the time required for regaining stability reduced with time span. At high loading rate of 1.0 kgCOD/m³ day, fall in steady state substrate removal efficiency was as low as 41.2%. However, studies have been carried out up to a maximum loading of 2.2 kgCOD/m³ day. The corresponding substrate removal efficiency achieved was 55 to 60%.

V.   KINETICS OF HUASB REACTOR

A.   Model Selected

Several investigators have proposed kinetic models for the anaerobic digestion process. An overview of the popular models is given in Table 3. According to Heertjes and Van Der Meer (1978), the UASB reactor has two distinct characteristics. The sludge bed and blanket could be described as a combination of completely mixed region and well mixed region, while the flow characteristics in the settling zone could be described as a plug flow (i.e., the content of waste water follows the principle 'first-in-first-out' and that longitudinal mixing is assumed to be almost negligible). However, rising gas bubbles from the sludge bed and blanket also provide mixing of the settling zone and hence, the flow regime in the settling zone cannot be considered as a perfect plug flow.

TABLE III.   OVERVIEW OF KINETIC MODELS FOR ANAEROBIC DIGESTION PROCESS

Sl. No.	Name of Model	Proposer/ Investigator(s)
1	Monod model	Monod (1949) Laurence and McCarty (1970) Chin (1981)
2	First order model	Pfeffer (1974)
3	Chen-Hashimoto model	Chen and Hashimoto (1978)
4	Diffusion model	Suidan et,al. (1987)
5	Singh model	Singh et,al. (1963)
6	Modified Monod model	Roels (1983)
7	Step-diffusion model	Lau-Wong (1985) Cecchi et,al. (1990, 1991)
8	Modified first order model	Converti et,al. (1997)
9	Inert nuclei model	Lettinga et,al. (1980)
10	Selection pressure model	Hulshoff Pol et,al. (1988)
11	Surface tension model Syntropic micro colony model	Rouhet and Mozes (1990) Fang (2000)
12	Heetjes and Van der Meer model	Heertjes and Van der Meer (1978)

But, Hwang and Hansen (1992) assumed the UAFFB reactor as a completely mixed, rather than, a plug flow reactor, taking the whole reactor volume as a control volume. In this study, the above approach was adopted and hence the kinetic model and equations described by them was assumed to be valid for determining the bio-kinetic coefficients of UAFFB reactor. Therefore, from among the several models as outlined in Table III, Heertjes and Van Der Meer model which is based on Monod-type kinetic model is assessed to be more suitable to explain the biological processes in the reactor considered in this study. A brief theoretical background of the above kinetic model, based on the model development presented by Hwang et al. (1992), is described in the following section. [11]

VI. RESULT AND DISCUSSION

The performance of the reactors during the study. Effluent COD progressively decreased with time in reactor until very low and stable COD concentrations were attained by the end of the run. Correspondingly, COD removal efficiency improved along the study from acceptable to very good levels in reactor Mean values under stable operation varied from 55% total COD removal by the UAFFB reactor. Result below Table IV.

TABLE IV. SUMMARY RESULT OF EXPERIMENTS ON PILOT

Days of Experiment	Q (lit/day)	HRT (hr)	Up flow velocity (m/hr)	Influent COD (mg/Lit)	Organic loading rate kgCOD/m3.d	Maximum Efficiency (%)
1-10	3.6	72	0.0043	750	0.25	14
11-20	3.6	72	0.0043	975	0.32	28
21-30	3.6	72	0.0043	1156	0.38	28
31-40	5.4	48	0.0064	1265	0.63	34.9
41-50	5.4	48	0.0064	1320	0.66	41
51-60	5.4	48	0.0064	1360	0.68	43

The results given in above table are for 60 days and the whole study period is 120 days, so the expected efficiency of reactor for 120 days period will be around 55 to 60 %.

VII. CONCLUSION

A programmed startup operation was essential for effective commissioning of the Up flow anaerobic Fixed Film Fixed Bad reactor system. A period of around 120 days was required for complete stabilization of the reactor system to be fed directly with Municipal wastewater. Results of the experiments conducted at various substrate loading rates are indicative of the fact that as the organic loading rate increases there is a decline in the substrate conversion efficiency bearing a linear relationship.

Based on the experimental investigation on Upflow anaerobic Fixed Film Fixed Bad reactor treating low strength wastewater, the optimum operational conditions in reference to system performance evaluated were:

- pH—7.0
- Temperature—30°C
- Hydraulic detention time—1.0 to 2.2 days
- Optimum loading rate—0.7 KgCOD/m^3 day
- Maximum loading rate—2.2 KgCOD/m^3 day

The studies relating to susceptibility of the reactor system to shock loading, namely organic, hydraulic, and pH shock load indicated that:

Upflow staged fixed bed reactors have been shown here to be a good alternative for the anaerobic treatment of complex low-strength wastewater because. Solids are effectively entrapped and removed in the sludge bed and phase separation occurs promoting the efficient degradation of substrates. COD removal efficiency Expected increased (up to 50- 60%). Experimental runs conducted on Fixed Film reactor module with varying organic loading rates in the range of 0.750 to 1.50 kg COD/m^3/day.

Based on the results of this research project it can be concluded that the UAFFB reactor can be a good alternative for domestic wastewater treatment even in temperate climates.

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Effect of Polypropylene Fiber Inclusion on the Shear Strength Characteristics of Yamuna Sand

Ashwani Jain
Dept. of Civil Engineering
National Institute of Technology
Kurukshetra, India
ashwani.jain@rediffmail.com

Jatin Dhamija
Dept. of Civil Engineering
National Institute of Technology
Kurukshetra, India
jatindhamija90@gmail.com

Abstract— Soil reinforcement is an effective and reliable technique for improving shear strength and stability of soils. The main objective of this study is to determine the contribution of fibre reinforcement to the shear strength of sand. A series of direct shear tests is carried out to investigate the effect of fibre content on the behavior of sand. Two sizes of polypropylene fibre of length 6mm and 12mm is used .The volumetric fibre content of polypropylene fibre varies from 0.1 to 0.5%. Incorporating reinforcement inclusions within a soil mass is an effective and reliable technique for improving the engineering properties of soils. The primary purpose of reinforcing soil is to improve its stability, increase its bearing capacity, and reduce settlements and lateral deformation. The influence of various percentages of fibres on the shear strength of soils has been investigated by direct shear tests.

Keywords— Shear strength; polypropylene fibre; fibre reinforcement; settlement.

I. INTRODUCTION

Randomly oriented tensile inclusions incorporated into granular soil improve its load-deformation behavior by interacting with the soil particles mechanically through surface friction (bond) and also by interlocking and not creating any internal forces at molecular levels. The function of the bond or interlock is to transfer the stress from the soil to the tensile inclusions, and to mobilize their tensile strength and impart this resisting force to the soil, thus reducing the strains induced in reinforced soil which lead to the improvement in load carrying capacity of the soil. Various types of inclusions have been employed, such as discrete and continuous fibres and mesh elements. The main objective of this study is to determine the contribution of fibre reinforcement to the shear strength of sand. A series of direct shear tests will be carried out to investigate the effect of fibre content on the behavior of sand at all stages: prefailure, failure, and post-failure. Fibres are usually blended into the soil to create an ideal reinforcement system for the repair of slope failures, the reinforcement of pavement sub-grades, the foundation stabilization and for the improvement of retaining wall backfill. The concept of reinforcing soil with fibre materials originated in ancient times. However, randomly distributed fibre-reinforced soils have recently acquired increased attention in many geotechnical engineering applications. One of the main advantages of randomly distributed fibres is the maintenance of strength isotropy and absence of potential failure plane that can develop parallel to oriented reinforcement. A wide range of reinforcement has been used to improve soil performance. Increasing the soil strength has caused increased interest in identifying new available resources for reinforcement. One of the main advantages of randomly distributed fibres is the maintenance of strength isotropy and absence of potential failure plane that can develop parallel to oriented reinforcement. A wide range of reinforcement has been used to improve soil performance. Increasing the soil strength has caused increased interest in identifying new available resources for reinforcement. Short discrete fibres made of polymeric or natural material have also been used to improve the shear strength of soil. Polypropylene fibre is the most widely used inclusion in the laboratory testing of soil reinforcement. Currently, PP fibres are used to enhance the soil strength properties, to reduce the shrinkage properties and to overcome chemical and biological degradation.

Ghazavi and Roustaie showed that the addition of 3% polypropylene fibres (12 mm) results in the increase of UCS of the soil before and after applying freeze–thaw cycles by 60–160% and decrease of frost heave by 70%. Tang et al. investigated the micromechanical interaction behavior between soil particles and reinforcing PP fibres. They concluded that the interfacial shear resistance of fibre/soil depends primarily on the rearrangement resistance of soil particles, effective interface contact area, fibre surface roughness and soil composition. As well, a soil–fibre pull out test apparatus was made by the authors.

The main objective of this study is to investigate the effect of polypropylene fibre on some physical properties of sandy soil. The parameters investigated in this study include shear strength properties and angle of internal friction at different fibre percentages and aspect ratios.

II. EXPERIMENTAL INVESTIGATIONS

A. Materials used

1) *Yamuna sand:* The sand used in the investigations has been collected from the banks of river Yamuna from a village near Radaur in Yamunanagar district of Haryana. The particle size distribution curve for Yamuna sand is shown in Fig. 3.1. According to the Indian Standard on classification and identification of soils for general engineering purposes, as per IS: 1498 (1970), the soil is

classified as poorly graded sand (SP). The maximum and minimum void ratios of sand have been computed as per Indian Standard for determination of density index for cohesion less soils, IS: 2720 (Part 14) (1983).

GRAPH 1. PARTICLE SIZE DISTRIBUTION CURVE OF YAMUNA SAND.
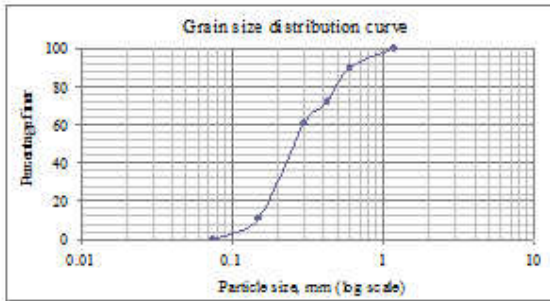
TABLE I. PHYSICAL PROPERTIES OF YAMUNA SAND

Sl. No	Property	Value
1.	Effective size (D_{10})	0.140mm
2.	Uniformity coefficient (C_u)	2.07
3.	Coefficient of curvature (C_c)	0.985
4.	IS Classification	SP
5.	Passing 1.18 mm IS Sieve	100%
6.	Mean specific gravity (G)	2.65
7.	Minimum void ratio e_{min} /max. dry density	0.56/1.696 gm/cc
8.	Maximum void ratio e_{max}/min. dry density	0.79/1.477 gm/cc

2) *Polypropylene fibre:* Polypropylene fibre has been procured from Shivananda Marketing Pvt. Ltd., Ansari Road, Daryaganj, New Delhi. Polypropylene fibre has been divided into two categories on the basis of size (6mm and 12mm) for its inclusion in various percentages (volumetric fibre content = 0.1, 0.20, 0.3,0.4 and 0.5 %) to the parent soil. The specific gravity of polypropylene fibre varies from 0.90-0.91, value as obtained from manufacturer. Its alkaline strength is very good as reported by manufacturer. The physical properties of polypropylene fibre as obtained from manufacturer are given in Table 2.

TABLE II. PHYSICAL PROPERTIES OF POLYPROPYLENE FIBRE

Sl. No.	Property	Description
1.	Shape	Triangular
2.	Cut length	6mm, 12mm

3.	Effective Diameter	25-40μm
4.	Specific Gravity	0.90-0.91
5.	Melting Point	160-165°C
6.	Tensile Strength	320-490 MPa
7.	Young's Modulus	> 4000 MPa

B. *Sample preparation*

The fabrication procedures involve two stages: mixing and formation. The mixing stage begins with the manual mixing of the soil with a controlled amount of water. The water is required to enable the mixing of the sand with the fibres and also to prevent fibre sand segregation. Then, small amounts of fibres are added progressively until, by visual examination, the fibres appear to be well distributed throughout the soil mass. The concentration of fibres used in the reinforced specimens is defined as the ratio of the weight of fibres and the dry weight of sand while the moisture content is defined in the classical way as weight of water to weight of dry soil.

Void ratio, as a reference parameter, is applied for the preparation of the specimens, and not the relative density. The choice of void ratio rather than relative density as the reference parameter is made based on the fact that the fibre inclusion interferes with particle packing and thus causes lower sand densities, and the fibre inclusion modifies the maximum and minimum void ratios of fibre reinforced sand (FRS) mixtures, rendering the relative density impractical for the description of the FRS degree of compaction. Consequently, the sample global void ratio (e) is adopted to indicate the qualitative level of dense state of the sands and for the interpretation of experimental results. It should be pointed out that parameters such as optimum water content and maximum dry unit weight of the sands are not determined since the present study did not aim at relating the mechanical behavior of FRSs with the optimum density obtained after a specific compaction effort (Proctor compaction tests), but relating the mechanical behavior of FRSs with a specific value of e similar to the one of the unreinforced sand which reflects the dense state of the particular sand. The volume of fibres is considered part of the skeleton, and hence, the void ratio is defined as the volume of voids relative to the combined volume of fibre and sand. Compaction of the specimens is characterized by the void ratio. In all tests, the initial void ratio of prepared specimens is proposed as e = 0.629, corresponding to a relative density = 70% for unreinforced sand.

The concentration of fibres in the composite is described by their volumetric content (ρ_v) which is defined as the ratio of the volume of fibres (V_f) and overall volume (V) of the composite. Reinforced sands will have a volumetric fibre content ranging from 0.1 to 0.5 %. The fibre reinforced specimens are prepared by hand-mixing sand, water and fibres. Water is added to prevent fibre segregation during sample formation. The water content for all specimens ranged from 8 to 10 %. The mixing process for the sand, water and fibres was stopped when the fibres were evenly distributed

and randomly oriented throughout the sand. Afterwards, the reinforced sands with different fibre concentrations are compacted to an equivalent target void ratio, e_o, for the unreinforced sands inside the shear box. The compaction process is performed by tapping on the sides of the specimen with a metal rammer weighing 4.5 kg.

The calculations of the sand and fibre weights used to obtain a reinforced specimen with volume V and equivalent target void ratio, e_o, equal to those for an unreinforced specimen are based on equations established for the hypothetical case. In this case, a particular mixture of soil is altered by replacing a part of the solid component with another solid that has a lower specific gravity in such a way that the total mass of solids remains unchanged. Specifically, the following procedure is followed:

1) Using the required void ratio (e_o) and the fibre concentration (ρ_v) by volume, the corresponding fibre concentration (ρ_f) by weight is calculated as:

$$\rho_f = \frac{(1+e_o)G_f\rho_v}{(1+e_o)(G_f - G_s)\rho_v + G_s}$$

Where, G_s and G_f are the specific gravity of sand and fibre respectively. ρ_f is defined as the mass of fibres relative to the mass of dry sand.

2) The mass of dry sand W_s and the mass of fibre W_f required for obtaining test specimen with the required volume V, are calculated by the following equations:

$$W_s = \frac{V}{1+e_o}\frac{(1-\rho_f)G_sG_f}{(1-\rho_f)G_f + \rho_f G_s}\gamma_w \ \&$$

$$W_f = \frac{V}{1+e_o}\frac{\rho_f G_s G_f}{(1-\rho_f)G_f + \rho_f G_s}\gamma_w$$

Where, V = required volume of the mixture and γ_w = unit weight of water.

3) During the compaction process, the specimen height (h) inside the shear box is carefully measured and recorded to estimate the required volume V.

III.   RESULTS AND DISCUSSIONS

- Shear strength of sand in case of 12mm fibre   is more as compared to 6mm fibre.
- Shear strength shows a linearly increasing trend when fibre % increase from 0.1% to 0.5%.
- Shear strength with 0.5% fibre content of 12mm size shows a significant increase in shear strength as compared to fibre of 6mm size.
- Angle of shearing resistance increase slightly in case of 6mm fibre but it shows a significant increase in angle of shearing resistance as the fibre content increases from 0.1% to0.5%.
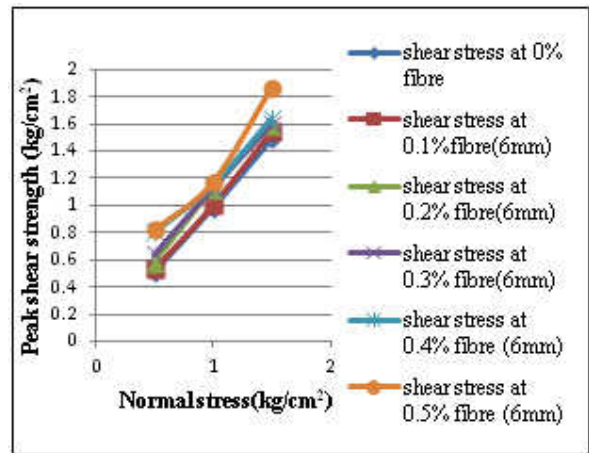
Fig. 1.   Peak shear strength vs normal stress curve (6 mm fibre)
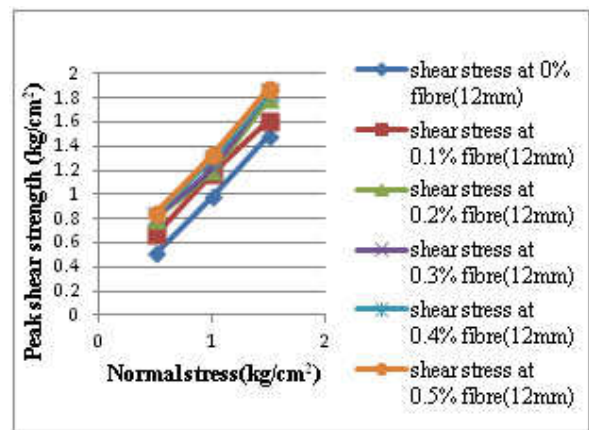
Fig. 2.   Peak shear strength vs normal stress curve (12 mm fibre)

IV.   CONCLUSIONS

Experimental results show that the addition of fibres in a soil mass increases the shear strength. However, a general rule cannot be deduced because the research conclusions have, on the most part, been contradictive. This inconsistency between the published results may be due to the different combinations of soil grain size, relative density, type of fibres and fabrication method, which probably influences the interaction mechanism of the fibre/soil interface.

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Improving Soil Subgrade Strength Of Kurukshetra Soil Using Stone Dust

Muhammad Nawazish Husain
Dept. of Civil Engineering
National Institute of Technology
Kurukshetra, India
princenawazish@gmail.com

Praveen Aggarwal
Dept. of Civil Engineering
National Institute of Technology
Kurukshetra, India
Praveen_agg@hotmail.com

Abstract— **California Bearing Ratio (CBR) value is an important criterion in checking the soil subgrade strength of a soil. It can be improved by a number of ways but if we use waste materials for improving it, we not only can obtain good soil sub grade strength but we can save considerable money also. Present paper describes the potential of stone dust in improving CBR of Kurukshetra soil which is a silty soil. Experimental investigations like Modified Proctor Compaction tests, CBR tests, Atterberg tests, Specific gravity determination were conducted. Experimental results revealed that Stone dust increased the CBR value of the stabilized silty soil when mixed at different percentages of 2 %, 4 %, 6 %, 8 %, and 10 % of the dry weight of soil in the increasing order of its mixing. By utilizing stone dust in soil stabilization the environmental pollution created by it can be minimized.**

Keywords—Kurukshetra soil; Stone dust; Maximum dry density; Optimum moisture content; California Bearing Ratio.

I. INTRODUCTION

India produces a huge amount of waste materials as by-products from different sectors like industrial, construction, agricultural, etc. These waste materials if not deposited safely it may be hazardous. A large quantity of waste material is dumped at land filling site, which if investigated properly can be utilized in road construction sector. The utilization of these waste materials can be an economical and eco-friendly alternative in nearby areas for rural road construction. In India, research is currently underway to examine the potential for use of some locally available wastes in road construction. The results, to date, indicate that there is a wide scope for the use of such materials. However, in India, only a few materials have been used and that too on experimental basis. An attempt has been made in the similar directions for investigating the potential use of some industrial waste materials viz. cement and lime kiln dusts, quarry waste, slags, fly ash, construction & demolition wastes, rice husk ash bagasse ash, etc. for rural road construction [1].

In the present work stone dust is used as a stabilizer to improve the CBR value of the local soil. Stabilization is a useful technique for improving the performance (strength) of subgrade soil. The mixed soil is then compacted to the required density after adding the predetermined quantity of water. Investigation consists of evaluation of index properties (Specific gravity, Atterberg's limits and Wet sieve analysis), maximum dry density, optimum moisture content and CBR

tests on the silty soil and stabilized silty soil with stone dust as an additive. A series of Modified proctor compaction and CBR tests (soaked with static compaction) are carried out on silty soil and silty soil mixed with stone dust in 2%, 4%, 6 %, 8 % and 10 % by weight of dry soil respectively.

II. MATERIALS USED

A. Local soil

For understanding the behavior of local soil mixed with stone dust, local soil was collected from NIT campus Kurukshetra State Haryana. According to IS soil classification system IS (1498) : 1970 [2], the soil has been classified as silty soil of low plasticity which is quite fine and inorganic in nature (ML) and having the particle size between 0.002 mm and 0.075 mm . The index properties of soil are determined as per Indian standard test procedure (IS 2720 Part 5 1970 [3] and IS 2720 Part 3 Sect 2 1981 [4]) and tabulated in Table 1.

TABLE I. PROPERTIES OF SOIL

Sl. No.	Properties	Test Results
1	Wet sieve analysis (Sieve Size)	% Passing
	4.75 mm	100.0
	2.0 mm	100.0
	1.0 mm	100.0
	425 μ	99.4
	75 μ	73.0
2	Specific gravity	2.68
3	Liquid limit (%)	19.7
4	Plastic limit (%)	18.9
5	Plasticity index (%)	0.8
6	Optimum moisture content (%)	12.09
7	Maximum dry density (g/cm³)	1.997
8	California Bearing Ratio (%)	3.50

B. Stone dust

Stone dust which is also known as crusher sand is a natural material obtained from the river bed as aggregates. After grinded in crusher's plant and converted to powder form it can be successfully used as a soil stabilizer in improving soil sub grade strength. In crusher's plant big aggregates are

cutted into small and desired shapes, the residue remained is of no use which is stone dust. If it can be used as a substituting agent in road construction it can considerably save the construction cost and the menace of dust created by the crusher's plant can be minimized. The quarry dust/ crusher dust is obtained as solid wastes, during crushing of stones to obtain aggregates. The annual production of quarry dust is roughly around 200 million tonnes (Soosan et al.2005).The disposal of which creates a lot of geoenvironmental problems) [5].

TABLE II.   Properties of STONE DUST

Sl. No.	Properties	Test Results
1	Wet sieve analysis (Sieve Size)	% Passing
	10.0 mm	100.0
	4.75 mm	95.2
	425 µ	49.3
	75 µ	20.8
2	Specific gravity	2.67

C. Water

Potable water was used for the experimental work.

III.   EXPERIMENTAL WORK

A number of tests like determination of index properties of soil, Modified Proctor compaction and California bearing ratio were carried out on the basis of guidelines provided in Indian Standards Codes of practice. Five different percentages of soil – stone dust mixture were made (2%, 4 %, 6 %, 8 % and 10 % of the total dry weight of the soil). Local soil of Kurukshetra soil was used as the parent material.

IV.   RESULTS AND DISCUSSIONS

A. Modified Proctor Compaction test results

Modified Proctor Compaction tests were carried out on parent soil and parent soil mixed with 2%, 4%, 6%, 8%, 10% of stone dust as per the procedure and guidelines laid down in IS: 2720 (Part 8) 1983 [6]. Figure 1 shows the maximum dry density (MDD) and corresponding optimum moisture content (OMC) for silty subgrade soil and variation in silty soil mixed with stone dust in different percentages.

TABLE III.   MODIFIED PROCTOR COMPACTION TEST RESULTS ON SOIL STABIZIED WITH STONE DUST

Sample type	Maximum Dry Density (g/cm³)	Optimum Moisture Content (%)
Soil	1.997	12.09
Soil + 2 % Stone dust	2.052	10.00
Soil + 4 % Stone dust	2.071	10.07
Soil + 6 % Stone dust	2.056	9.17
Soil + 8 % Stone dust	2.030	10.22
Soil + 10 % Stone dust	2.057	7.59
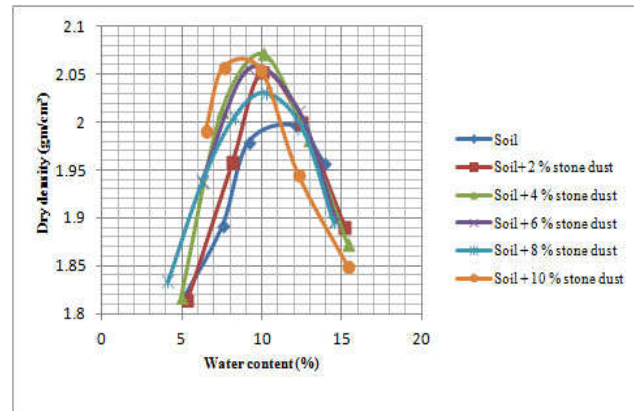
Fig. 1. Dry density v/s water content curve of soil – stone dust mixture.

B. CBR test results

California Bearing Ratio (CBR) tests were carried as per the guidelines laid down in IS 2720 : Part 16: 1987 [7] using static compaction in soaked condition on local subgrade soil and local soil mixed with different proportion of stone dust. CBR moulds were filled at MDD obtained from Modified proctor compaction test. Figure 2 is showing the CBR value of local soil and local soil mixed with stone dust in different percentages i.e. 2 %, 4 %, 6 %, 8 %, 10 % of total weight of soil in soaked conditition respectively.

TABLE IV.   CBR TEST RESULTS ON SOIL STABILIZED WITH STONE DUST

Sample type	California bearing ratio (CBR) (%)
Soil	3.50
Soil + 2 % Stone dust	8.10
Soil + 4 % Stone dust	9.41
Soil + 6 % Stone dust	10.36
Soil + 8 % Stone dust	12.77
Soil + 10 % Stone dust	15.32
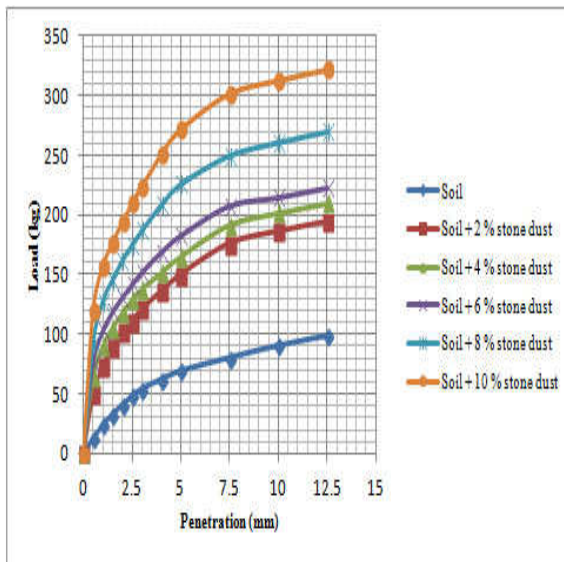
Fig. 2. Load v/s penetration curve of soil – stone dust mixture

V. CONCLUSION

No clear cut relation of MDD and OMC obtained from the modified proctor tests on soil- stone dust mixture. The possible reason for this may be temperature conditions and various laboratory conditions.

CBR value of soil is increasing with the increasing percentage of stone dust. Stone dust is showing a CBR value of 13.50 % at 10 % soil – stone dust mixture with respect to the CBR value of parent soil which is 3.50 %.

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Equilibrium and Isotherm Studies for the Uptake of Lead Ions onto Orange Peel

Kirti Goyal
Dept. of Civil Engineering,
PEC University of Technology,
Chandigarh
goyalkirti2012@gmail.com

Shakti Kumar,
Dept. of Civil Engineering
PEC University of Technology,
Chandigarh

R.K. Khitoliya
Dept. of Civil Engineering
PEC University of Technology,
Chandigarh

Abstract- **Heavy metals are extensively released into the environment as a result of industrialization and have created a major global concern. Industrial waste constitutes the major source of various kinds of pollution in natural water and toxicity from heavy metals has been reported worldwide. The metals are of special concern because of their persistence and toxicity. One of the heavy metals being produced is lead which is toxic to human body systems. The presence of lead in drinking water is of utmost concern due to its high toxicity and persistence Adsorption has been investigated as a simple cost effective and eco-friendly method for the remediation of lead from industrial wastewater. The adsorption of Pb (II) metal ions on orange peel has been found to be concentration, pH, contact time, adsorbent dose and initial metal ion concentration dependent. The maximum removal efficiency is 80%. The adsorption parameters were determined using Langmuir and Freundlich isotherm models. The data fits better to the Langmuir isotherm model.**

Keywords- Adsorption, Pb (II); Isotherm; Orange Peel; Removal; Ions; Adsorbent.

I. INTRODUCTION

Extensive pollution of fresh water is posing a serious and growing threat to sustainable development as well as protection of the environment. Human health, agricultural development, industrial development and the ecosystem are all at risk, unless water and land systems are effectively managed [1]. Due to their toxicological significance on the ecosystem and human health, pollution by heavy metals has received wide spread attention in the recent years. Heavy metal pollution has become a serious problem today and its treatment is of special concern due to its resistance and persistence in the environment. Many industries, like metal plating, mining operations, tanneries, alkali, radiator manufacturing, smelting, alloy industries and storage batteries industries, etc. release these severely toxic heavy metal ions in their wastewaters contaminating natural streams they are disposed in, which is a major concern as it is injurious to many life forms. Lead is an industrial pollutant, which enters the ecosystem through soil, air and water. Inorganic lead is an enzyme inhibitor, which also affects the nervous system [2]. It is very toxic in nature. According to the WHO, the maximum permissible limit (MPL) of lead in drinking water is 0.01 mg/L [3]. Hence proper treatment of industrial wastewaters which are

releasing lead into the aquatic and land systems is very important. Most of the treatment methods employed are costly and not economically feasible and also not eco-friendly in nature due their secondary effluent impact on the recipient environment. Various researchers have studied and revealed that physical adsorption using low cost adsorbents is a highly effective and economic technique for the removal of heavy metal from waste stream. Many studies have been performed using agricultural materials which are low cost (or of no economic value) such as waste wool, nut wastes, tree barks, modified cotton, fruit peels and sawdust. Activated carbon produced from almond shell, sawdust based GAC, tree bark treated with formaldehyde and sulphuric acid, bone char, tea leaves, wood charcoal, coconut shell carbon, sulphurized activated carbon, ozonized activated carbon, chemically treated GAC rice hulls and rice bran, pine bark, treated sawdust and agricultural waste have been used with and without treatment for the removal of heavy metals [4]. Biosorption of lead (II), copper (II) and cadmium (II) ions from aqueous solutions onto olive leaves powder has been investigated by Akl M.Awwad et al. indicating that olive leaves powder is an effective adsorbent[5]. A Jafar Ahamed et al. studied adsorption using activated carbon prepared from Adathoda vasica stem to remove Cu^{2+} from an industrial wastewater showing that adsorption is one of the most effective techniques for removal of heavy metals [6].

II. EXPERIMENTAL

The aim of this study was to find out the effectiveness of orange peel as an adsorbent for the removal of Pb^{2+} ions from wastewater.

A. *Sample preparation*- Synthetic wastewater samples were prepared by using analytical grade lead nitrate by using double distilled water. A 1M stock solution was prepared having a lead concentration of 1000 mg/L. The solutions of various concentrations under study were made from stock solution by making appropriate dilutions.

B. *Adsorbent Preparation*- Orange peel was recovered and repeatedly washed with distilled water in order to remove soluble and coloured compounds. Then the solid was rinsed with distilled water and sun dried.

After that, it was crushed and sieved to a ground size into a fine powder.

C. *Method*- The batch experiments were conducted in 250 mL conical flasks. The volume of the test solution was maintained as 100 mL. All the samples were mechanically agitated in low speed. The experiments were conducted at room temperature. The duration of the experiments was 150 minutes. The amount of Pb(II) adsorbed on the raw adsorbent was recorded titrimetrically as per the standard method given in Vogel (1978) [7]. The experiments were carried out to study the effect of pH (2-6), effect of Adsorbent dose (0.4-1.2g/100 mL), effect of contact time (30-150 min) and effect of initial metal ion concentration (20-100 mg/L).

The amount of metal ion adsorbed was calculated as:

$$\% \text{ adsorption} = \frac{\quad}{\quad} \quad \text{--- (1)}$$

Where, $C_{\square}$ and $C_{\square}$ are the initial and final concentration of adsorbate, respectively.

The amount of metal adsorbed per Kilogram of the biomass was calculated as follows:

$$\frac{\quad}{\quad} \quad \text{--- (2)}$$

Where q_e is the adsorbed metal on the sorbent, m is the weight of sorbent, V is the volume of metal solution, C_o is the initial metal concentration, and C_e is the final metal concentration.

III. RESULTS AND DISCUSSION

A. *Effect of pH:*

Effect of pH on the adsorption characteristics of orange peel was determined in the pH range 2-6. As is apparent from fig.1, the system is pH dependent and shows maximum adsorption at pH 5. The sorption rate is lower in acidic ranges, because at low pH due to high positive charge density on the adsorbent surface, there is electrostatic repulsion resulting in lower rate of adsorption [8].
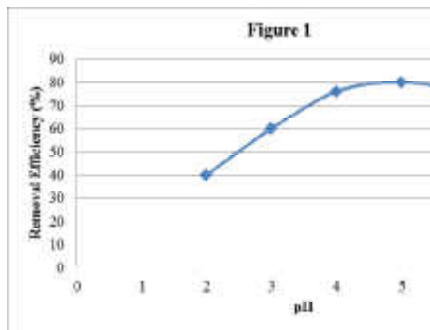
Fig. 1.

B. *Effect of adsorbent dose:*

The results for adsorptive removal of Pb(II) and Cd(II) with respect to adsorbent dose are shown in Fig. 2 over the
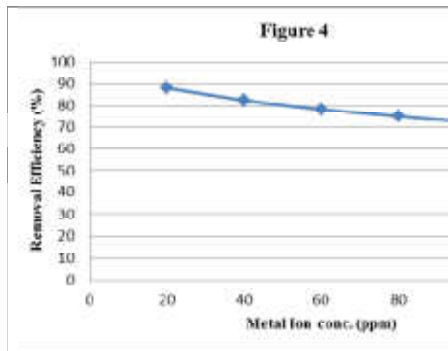
Fig. 4.

E. Adsorption isotherm studies:

The data for the uptake of Pb (II) by orange peel has been analyzed in the light of Freundlich and Langmuir isotherrms of adsorption. The isotherm is represented by

$$— \quad —— \quad —— \text{ --- (3)}$$

The linear plot of specific adsorption (C_e/q_e) against the equilibrium concentration (C_e) shows that the adsorption obeys the Langmuir model. The constants b and q_{max} relate to the energy of adsorption and maximum adsorption capacity, and their values are obtained from the slope and interception of the plot.

The Freundlich isotherm is introduced as an empirical model, where q_e represents the amount adsorbed per amount of adsorbent at the equilibrium (mg/g), C_e represents the equilibrium concentration (mg/L), and K and n are parameters that depend on the adsorbate and adsorbent.

Consider

$$— \text{ --- (4)}$$

The equation can be linearized and the temperature dependent constants K_f and 1/n found by linear regression:

$$— \text{ --------------------------------- (5)}$$

Where K_f and n are Freundlich constants which correspond to adsorption capacity and adsorption intensity respectively[9]. The n value indicates the degree of nonlinearity between solution concentration and adsorption and the values of n>1 represent favourable and good adsorption. The essential characteristics of Langmuir isotherm can be described by a separation factor or equilibrium constant R_L, indicates the isotherm shape and whether the adsorption is favourable or not, as per the criteria: 0<R_L< 1 Favourable adsorption [10].

be calculated by using these models. The adsorption capacity of orange peel for Pb (II) was 7.2 mg/g.

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Poozzolanic Potential of Sugarcane Bagasse Ash Verified Through TGA And XRD Techniques

Goyal Ajay
Dept. Civil Engineering
Baddi University of Emerging
Sciences & Technology
Baddi (H.P.), India
dean.rd@baddiuniv.ac.in

Jindal B.B
Dept. Civil Engineering
Baddi University of Emerging
Sciences & Technology
Baddi (H.P.), India

Sharma D
Dept. Civil Engineering
Baddi University of Emerging
Sciences & Technology
Baddi (H.P.), India

Ogata Hidehiko
Tottori University, Tottori,
680-8553, Japan
ogata@muses.tottori-u.ac.jp

Abstract— **Sugarcane bagasse ash (SCBA), a sugar-mill waste, has pozzoalanic properties if processed and obtained under controlled conditions. This paper discusses the reactivity of SCBA obtained by control burning of sugarcane bagasse procured from Punjab province of India. X-ray diffraction (XRD) and Thermo-gravimetric Analysis (TGA) techniques were employed to ascertain the amorphousness and morphology of the minerals ash particles. Ash-blended cement paste specimens were analyzed by XRD, thermal analysis, and SEM methods to evaluate the hydration reaction of SCBA with cement. Results showed that the SCBA processed at 600ºC for 5 hours was reactive; as ash-blended mortar specimens with up to 15% substitution of cement gave better strength than control specimens.**

Keywords— Bagasse as; Blended mortar; Pozzolanic Activity; X –ray diffraction; Thermal Analyses

I. INTRODUCTION

Sugarcane bagasse ash (SCBA) is an abundantly available waste of sugar-mills. Sugarcane is one of the major crops grown in over 110 countries and its total production is over 1500 million tons (FAO, 2006). After the extraction of all economical sugar from sugarcane, about 40-45% fibrous residue (Deepchand, 1986) is obtained, which is reused in the same industry as fuel in boilers for heat generation that leaves behind 8 -10 % ash as waste (Payá et al., 2002), known as SCBA. It contains high amounts of un-burnt matter, silica, aluminum and calcium oxides (Deepchand, 1986). It is a very valuable pozzolan material if carbon free and amorphous ash could be obtained by further combustion.

Sugarcane production in India is over 300 million tons/year. The processing of it in sugar-mills generates about 10 million tons of SCBA as waste material. Very few studies have been reported on use of bagasse ash directly obtained from the sugar-mills. A few studies (Baguant, 1995;

Hernández et al., 1998; Singh et al., 2000) have reported on the suitability of sugar cane bagasse ashes as partial cement replacement binders that are obtained directly from the sugar-mills. Present study was carried out to evaluate the SCBA processed and obtained by control burning of sugarcane bagasse which was procured from the Punjab province in India. After characterizing the SCBA with regards to its chemical and physical properties, hydration reaction of SCBA with cement was analyzed by X-ray diffraction (XRD) and thermal analyses (TGA) techniques.

II. EXPERIMENTAL PROGRAM

A. Ash Production from Sugar Cane Bagasse

In order to obtain amorphous SCBA, optimum burning with respect to time and temperature was evaluated by conducting trial burnings of sugarcane bagasse at 400, 500, 600, 700 and 800ºC for 3, 5, 6 and 8 hours (James and Rao, 1986; Chandrasekhar et al., 2006; Ajay et al., 2007). Biricik et al. (1999) on wheat straw and Patel (1987) on rice husk; have reported that burning time, temperature, cooling time, and grinding conditions effect the pozzolanic reactivity of the ashes. Carbon contents (%) were measured after each burning (Fig.1) which indicated that combustion was almost complete at 800ºC for 5 hours burning.

Visvesvaraya (1986) have reported that crystallization of minerals occurs at temperatures higher than 650ºC. Chopra et al. (1981) have also reported that at burning temperatures up to 700ºC, silica remains in amorphous form and silica crystals grow with increase in the time of

incineration. Hence considering the rate of burning, residence time and the carbon
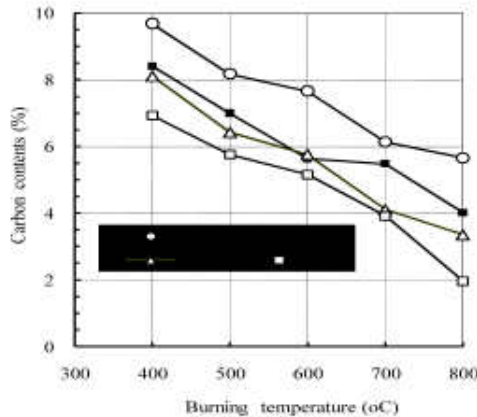
Fig. 1. Carbon contents in SCBA, as affected by burning temperature and residence time

consistency was also measured as shown in **Table I**. Effect of SCBA substitution on the setting time was evaluated directly by measuring the initial and final setting time. The pH values were also measured to check the effect of SCBA

TABLE I. WATER CONSISTENCYa, SETTING TIMEa, FLOWb AND pH VALUESb OF CTR AND ASH-BLENDED SPECIMENS

| Specimen | W.C. | IST | FST | pH | Mortar flow |
	(%)	(min)	(min)	value*	(mm)
CTR	33.0	125	230	12.5	178
SC-10	33.5	145	300	12.6	168
SC-15	33.8	155	310	12.6	165
SC-20	34.2	160	310	12.7	165
SC-25	34.5	170	315	12.7	160

W.C.: Water consistency, IST : initial setting time
FST : final setting time

TABLE II. PHYSICAL AND CHEMICAL PROPERTIES OF OPC AND SCBA

| | Chemical properties | | | | | | | | Physical properties | | | |
| | Chemical Composition (wt.%) | | | | | | | | Density | Blaine surface area | Particle size | color |
	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	K_2O	LOI	(g/cm³)	(cm²/g)	(μm)	
OPC	18.40	5.61	3.05	66.80	1.42	2.84	0.50	2.00	3.15	3,250	36.22	Dark grey
SCBA	62.43	4.38	6.98	11.81	2.51	1.48	3.53	4.73	2.52	5,140	28.92	Reddish grey

a: measured for paste specimens (average of 3 readings)
b: measured for mortar specimens (average of 6 readings)

contents, the carbon contents, the suitable burning condition was identified as 600°C for 5 hours. The temperature was raised at a rate of 5°C/minute with residence time of 3 hours. At this condition brownish white color indicated complete burning. Amorphous nature of the ash was further ascertained by XRD analysis.

To obtain SCBA for further tests, burning was carried out in two stages – open burning of sugarcane bagasse to reduce the volume of dry matter, followed by controlled burning at 600°C for 5 hours in a thermostatically controlled electronic furnace (KDFP-90). To achieve fineness comparable to OPC, the SCBA obtained after burning was grinded in a ball mill (25×35g – 30mm φ balls) for about 4 hours and subsequently screened through 53μm (No.270) sieve (Nair et al., 2006).

Pozzolanic reactivity of SCBA with OPC was evaluated by studying the mineralogy and morphology of hydrates present in the ash blended hydrated pastes, with XRD and TGA

B. *Preparation of Blended Paste Specimen*

To study the effect of ash substitution on hydration, mineralogical and morphological studies of hydrated pastes were conducted. For this, pastes were prepared, replacing OPC with 10, 15, 20 and 25% SCBA and water cementitious material ratio (*w/c*) as 0.35. Effect of SCBA on the water

substitution on the alkalinity of freshly prepared blended pastes. Micro-structural features and mineralogical composition of the hydration products formed in CTR and ash-blended pastes were ascertained and compared after 28 days and 91 days of curing by using XRD and thermo-gravimetric tests.

III. RESULTS AND DISCUSSION

A. *Physical and Chemical Properties*

Physical and chemical properties of SCBA in comparison to OPC are shown in Table II. SCBA has low density and higher surface area (Blaine surface area) as compared to OPC. The combined chemical composition: $SiO_2 + Al_2O_3 + Fe_2O_3$ (>70%) and CaO (>10%) testified the pozzolanic and cementitious nature of SCBA as per ASTM C 618-03specifications. Particle size distribution curve of SCBA samples (Fig.2) indicated that average size of the ash particles was 28.9μm and 90% particles were of size less than 45.3μm. Kraiwood et al. (2001) have reported that large surface area favors the pozzolanic reactivity of amorphous silica and other minerals.

B. *Analyses of Hydrates in SCBA-blended Cement Pastes*

Different hydrates formed in SCBA-blended cement pastes were examined and analyzed by XRD and thermal

analyses. Discussion is mainly based on the typical pozzolanic reaction of SiO_2 and alumina (Al_2O_3) present in SCBA with available calcium hydrates CH in the hydrated gel, forming additional calcium silicate hydrate (C-S-H) and calcium aluminate silicate hydrates (C-A-S-H).

1) X-ray Diffraction (XRD) Analyses

Comparison of XRD patterns (Fig.3) obtained for SCBA-blended and CTR paste specimens after 28 days and 91 days of curing showed that in 91 days cured specimens; the intensity of peaks 'C' representing CH was significantly reduced with corresponding increase in the C-S-H peaks represented by 'S'. Also the peaks 'Q' at $2\theta = 26.66°$, representing SiO_2 got diminished in 91 days cured specimens than as compared to 28 days specimens. It was a clear indication of the fact that the free CH available in 28 days cured specimens was gradually consumed by the excess amount of SiO_2 present in the SCBA. As shown in **Fig.3**, the intensity of CH peaks in the SCBA-blended specimens got diminished with the appearance of additional peaks. According to Pane and Hansen (2005), these peaks represent the formation of additional C-S-H and C-A-S-H. It

confirmed the pozzolanic reactivity of SCBA beyond any doubt. Appearance of peak representing C_4AH_x was also noticed in SC-20 and SC-25 specimens. Gengyiong and Xiaohua (2003) have reported that these products act as nucleating sites that hinder the further hydration reaction. This explained the reason for low strength development in specimens with higher percentages of SCBA. Higher peaks of SiO_2 were noticed in SC-20 and SC-25 paste specimens, both in 28 and 91 days patterns, which indicated that more amount of SCBA added more silica, and was left un-reacted. This could be another reason for low strength development in specimens with higher percentages of SCBA in SC-20 and SC-25 specimens.

2) Thermal Analyses

According to Langan et al. (2002); Pane and Hansen (2005), differential thermal analysis (DTA) combined with thermo-gravimetric analysis (TGA) is more suitable for studying the hydration or pozzolanic reaction that takes place at later stages of hydration. DTA locates the ranges
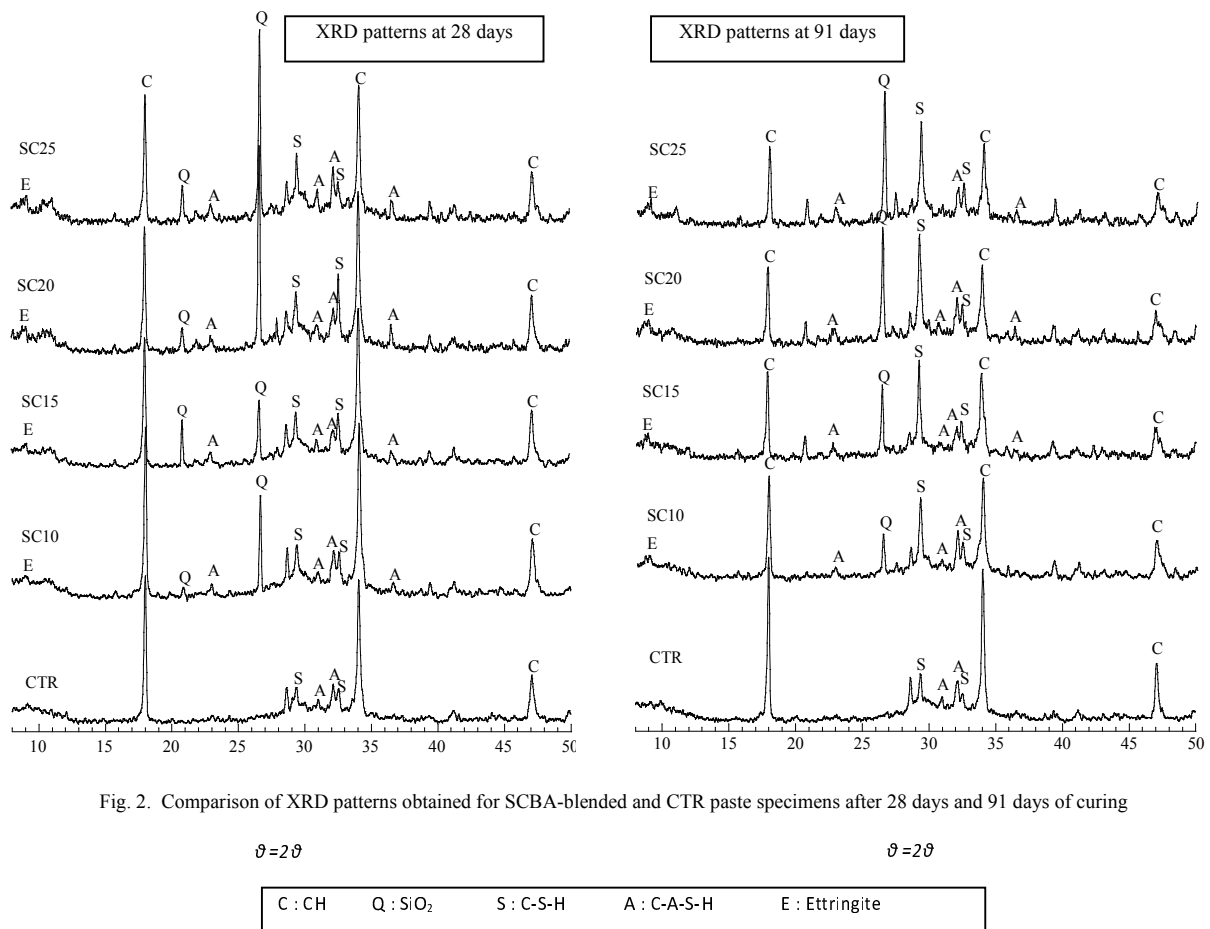
Fig. 2. Comparison of XRD patterns obtained for SCBA-blended and CTR paste specimens after 28 days and 91 days of curing

| C : CH | Q : SiO₂ | S : C-S-H | A : C-A-S-H | E : Ettringite |

corresponding to thermal decompositions of different phases in the hydrated paste, while TGA measures the simultaneous weight loss due to the thermal decomposition. In this study thermo-gravimetric tests were performed on Rigaku-TG810 ID Thermoflex TAS200 by gradually raising the temperature from $20^{\circ}C$ to $1,000^{\circ}C$ at a rate of $6^{\circ}C/min$. TGA and DTA diagrams for 91 days cured CTR and ash-blended specimens are shown in Fig. 3 and Fig. 4, respectively. DTA diagrams show two significant peaks for CTR and all ash-blended specimens hydrated at 91 days; (a) endothermic peak at 130 – $150^{\circ}C$ indicate the hydration of C-S-H (Mackenzie, 1972; El-Didamony et al., 1996) and (b) the peaks at temperatures between 420 - $480^{\circ}C$ correspond to CH decomposition (Oriol and Pera, 1995). As seen from the DTA curves, the endo-thermal effects in the temperature range of $100 – 150^{\circ}C$ was attributed to the loss of free water and dehydration of inter-layer water from the C-S-H phase (Mackenzie, 1972; El-Didamony et al., 1996). A small step obtained at temperatures close to $700^{\circ}C$ was probably due to the release of CO_2. It was through the decomposition of $CaCO_3$ formed by carbonation (Taylor, 1993).

As reported by Midgley (1979), the CH can be measured by the amount of water loss, which is very close to the water present in CH and therefore, is proportional to the amount of CH. Loss of water (%) measured for 91 days hydrated pastes, representing the amounts of CH at temperatures between $420 – 480^{\circ}C$ and corresponding amounts of C-S-H at temperatures between $70 – 400^{\circ}C$ is shown in Table 3.

In CTR, the amount of CH was higher (2.19) than that present in the SC-10 (2.00) and SC-15 (2.16). It indicated the presence of excess amount of CH available in the CTR. Corresponding amounts of C-S-H, in SC-10 and SC-15 were higher than that present in the CTR. It clearly indicated that excess amount of CH formed in the SCBA-blended specimens was consumed by the SiO_2 present in the SCBA with the formation of additional C-S-H. It was a typical pozzolanic reaction as explained by Ramachandran et al. (2003). Abrupt loss of weight between temperatures 420 –

$480^{\circ}C$ was also associated with the de-hydroxylization of CH (Orial and Pera 1995), and it was less in SC-10 and SC-15 (Table III). It further indicated that the amount of CH present in these samples at 91 days hydration was less as compared to the CTR and ash-blended specimens.
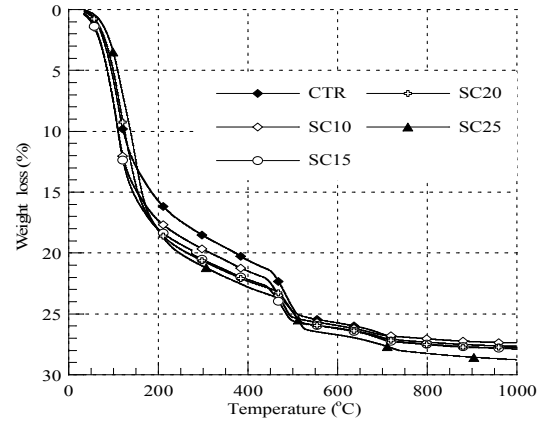
Fig.. 3. TGA diagram of CTR and SCBA-blended paste specimens tested at 91 days of hydration.
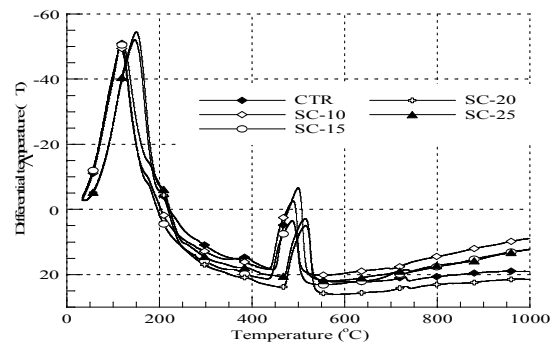
Fig. 4. DTA diagram of CTR and SCBA-blended paste specimens tested at 91 days of hydration

TABLE III. THERMAL ANALYSIS OF 91 DAYS HYDRATED CTR AND SCBA-BLENDED PASTE SPECIMENS

Specimen	Weight loss (%)		
	C-S-H* $70 – 400^{\circ}C$	CH** $420 – 480^{\circ}C$	Total $70 – 700^{\circ}C$
CTR	17.02	2.19	24.30
SC-10	17.92	2.00	23.83
SC-15	17.64	2.16	24.16
SC-20	16.95	2.27	27.17
SC-25	16.87	2.27	25.59

*C-S-H : Calcium silicate hydrate **CH : Calcium hydroxide

Formation of these hydrates indicated that pozzolanic reaction took place between the SiO_2 present in the SCBA and the free CH present in the cement. Up to 15% substitution of OPC with SCBA was enough to consume the excess CH present in the hydrates. With more than

15% substitution of OPC with SCBA, the amount of CH increased with corresponding decrease in the amount of C-S-H hydrates.

Overall analyses of TGA and DTA data proved that SC-10 and SC-15 reacted more than the other blends thus signifying 15% SCBA as optimum percentage of OPC substitution. This trend was also vindicated by the XRD analyses and mechanical strength test results as explained in earlier sections.

IV. CONCLUSION

Following conclusion can be drawn from the present study:

Controlled burning of bagasse at $600^{\circ}C$ for 5 hours produced amorphous bagasse ash with very low carbon contents in it. Processed SCBA possessed high specific surface area, high percentage of amorphous silica and calcium oxide which fulfilled the principal requirements of a pozzolanic material.

Thermal analyses (DTA/TGA) of hydrates, and interpretations of XRD diagrams and observations of the SCBA-blended pastes confirmed the pozzolanic reactivity of the SCBA.

V. ACKNOWLEDGEMENT

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Effect of Metakaolin clay, Silica Fume and Rice Husk Ash on strength characteristics of concrete

Vikas Kumar
Dept. of Civil Engineering
NIT JALANDHAR,
vikaskumarnitk@gmail.com

Anil Kumar Chhotu
Dept. of Civil Engineering
NIT JALANDHAR
akc.jucivil@gmail.com

AkashPriyadarshee
Dept. of Civil Engineering
NIT JALANDHAR
i.akashpriyadarshee1@gmail.com

Nishant Kumar
Dept. of Civil Engineering
NIT KURUKSHETRA
nishant.1947@gmail.com

ABSTRACT: Concrete is probably the most extensively used composite construction material in the world. Mineral admixtures also help in enhancing several properties of concrete. A study was carried out to investigate the strength and durability properties of concrete mixes after replacing cement partially by Rice Husk Ash (RHA), Metakaolin (MK) and Silica Fume (SF) in different concrete mixes. The compressive strength and tensile strength tests were conducted at the curing age of 3,7,28 and 60 days, whereas, water absorption tests were conducted on concrete specimens after 28 and 60 days of curing in potable water. It was concluded from the results that RHA decreases the compressive strength of concrete up to 28 days of curing but helps to develop the compressive strength at later ages of curing. Partial replacement of cement by MK, combination of MK and RHA; and combination of RHA and SF increases compressive as well as splitting tensile strength of concrete. After checking water absorption of all the mixes, it was found that replacing cement partially by RHA, MK and SF decreases the water absorption of the mixes.

Keywords: - Concrete; Admixture; RHA; Silica fume; Mata kaolin clay.

I. INTRODUCTION

Concrete is a composite construction material composed primarily of aggregate, cement and water. Concrete has relatively high compressive strength, but much lower tensile strength. The 28-day compressive strength is often considered as the sole criterion for approving a concrete mix by the construction industry. The other properties of concrete, such as water permeability and chloride diffusion, that influence its durability, are rarely evaluated due to the fact that their determination is costly, cumbersome and time consuming compared to assessing the compressive strength.

II. EXPERIMENTAL PROGRAMME

The objectives of the present investigation have been outlined in Chapter-1. To achieve the objectives, an experimental program was planned to investigate water absorption and strength properties of concrete containing mineral admixtures as partial replacement of cement. Mineral admixtures used were Silica fume (SF), Metakaolin (MK) and Rice husk ash (RHA).This chapter outlines the experimental programmed, planned for the present investigation, in detail. The basic properties of concrete constituent materials, concrete mix details along with method of casting and curing, workability of concrete, details of tests performed on hardened concrete are presented.

III. TEST PROGRAMME

- To obtain the physical properties of the concrete constituents i.e. Ordinary Portland Cement(PC), sand, coarse aggregate and mineral admixtures used i.e. SF, MK and RHA, as per relevant Indian Standard Codes of Practice.
- Development of various mix combinations for concrete.
- Casting and curing.
- Testing of specimens for Compressive strength, Splitting tensile strength and Water absorption test.
- Determining the effects of replacement of cement by SF, MK.

IV. MATERIALS

The properties of materials used in concrete are determined in laboratory as per relevant code of practice.

A. Cement

In the present investigation, Ordinary PortlandCement (OPC) of 43 Grade was used for allconcrete mixes.

B. Aggregates

The coarse aggregate is used primarily for the purpose of providing bulk to the concrete. The most important function of fine aggregates is to assist in producing a workable and a uniform concrete mix.

C. Fine Aggregate

IS383 – 1970defines the fine aggregate as the one passing through 4.75 mm IS sieve.

TABLE I. PHYSICAL PROPERTIES OF FINE AGGREGATE.

Characteristics	Result obtained
Fineness modulus	2.74
Specific gravity	2.67
Bulk density (loose) Kg/m3	1675

D. Coarse Aggregate

The coarse aggregate is defined, as that retained on 4.75 mm IS sieve. To increase the density of the resulting concrete mix, the coarse aggregate is frequently used in two or more sizes. Two types of aggregate with different sizes have been used in the present study.

1) CA – I aggregate passing 20 mm sieve and retained on 10 mm sieve.
2) CA – II Aggregate passing 10 mm sieve and retained on 4.75 mm sieve.

TABLE II. Physical properties of coarse aggregate.

Characteristics	Result obtained
Fineness modulus	7.54
Specific gravity	2.64
Bulk density Kg/m3	1600

E. Metakaolin

Metakaolin METACEM 85 C was used in the current investigation. It was procured from20 MICRONS Limited, Vadodara, India having specific gravity of 2.6,. Some of its chemical properties are given in Table V.

TABLE III. Chemical composition of Metakaolin

SiO_2	52.1
Al_2O_3	41.0
$CaCo_3$	-
Fe_2O_3	4.32
CaO	0.39

F. Silica Fume

Silica fume was first discovered in Norway in 1947 when the Environmental controls started the filtering of the exhaust gases furnaces. The main portion of these fumes was a finely composed of a high percentage of silicon dioxide.

TABLE IV. Physical properties of silica fume

Property	Value
Diameter of silica fume	0.1-0.2 micron
Surface area (m^3/kg)	30000
Density (kg/m^3)	150-170
Density(kg/m^3)(best suited as concrete	500

G. Rice Husk Ash

Rice husk ash (RHA) fillers are derived from rice husks, which are usually regarded as agricultural waste and an environmental hazard. Rice husk, when burnt in open air outside the rice mill, yields two types of ash that can serve as fillers in plastics materials. The upper layer of the RHA mound is subjected to open burning in air and yields black carbonized ash. The inner layer of the mound being subjected to a higher temperature profile results in the oxidation of the carbonized ash to yield white ash that consists predominantly of silica.

H. Water

As per IS: 456-2000 potable water is generally considered satisfactory for mixing and curing of concrete. Accordingly potable water was used for preparation of all concrete specimens.

I. Concrete Mix

Concrete mixes with binary and ternary blends of cement and mineral admixtures were prepared with constant mix proportion and water/binder ratio as shown in Table. Different binder combinations are given in Table-1.5.

TABLE V. Concrete mix proportion.

W/C	water	cement	F.A.	C.A
.46	225	490	750	928

V. RESULTS AND DISCUSSIONS

A. GENERAL

After the experiments were performed following results were obtained.

1) Compressive Strength
2) Tensile Strength
3) Water Absorption

B. COMPRESSIVE STRENGTH RESULTS

TABLE VI. Compressive Strength Results of all mixes at different curing ages.

Mix name	Mix description	Compressive strength			
		3 days	7 days	28 days	60 days
M1	100%PC	22.8	24.5	29.5	39.0
M2	90%PC +10% RHA	21.2	23	28.4	38.5
M3	80%PC +20% RHA	17.1	21.9	27.25	37.8
M4	90%PC + 10% MK	26.6	29.5	36.8	49.3
M5	90%PC+5%RHA + 5% MK	21.5	31.7	36.5	43.1
M6	80%PC+10% RHA + 10%MK	22.5	29.0	33.0	41.2
M7	90%PC+5%RHA +5% SF	24.5	37.7	39.0	41.0
M8	80% PC+10% RHA + 10%SF	20.2	25.8	38.0	44.0

As shown in the figure 1, there is decrease in compressive strength as we increase the percentage of RHA in the mixes M2 and M3 The effect of RHA decreases the compressive strength at earlier ages of curing but at later ages the compressive strength of the mixes comes closer to the strength of reference mix.
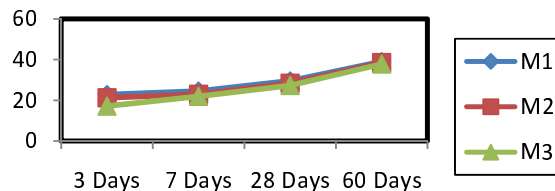
Fig. 1.   Compressive strength chart only for RHA

In case of mix containing only Metakaolin, replacing cement by 10%, the compressivestrength values show increasing trends at all ages of curing. This increase in strength of the mix M4 is 16.67% as compared to reference mix M1 at 3 days of curing and this increase is 26% at 60 days of curing.
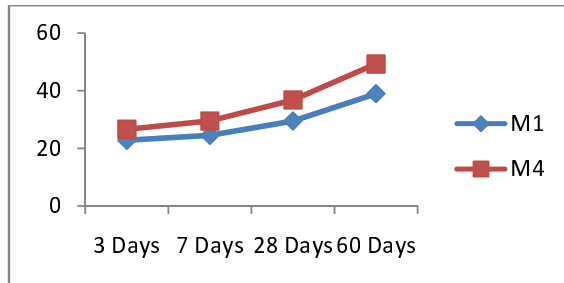
Fig. 2.   Compressive strength chart only for MK

As shown in the figure3, there is increase in compressive strength at all ages of curing for the mix M5, except at 3 days of curing. There is gradual increase in the compressive strength values at 7, 28 and 60 days of curing for mix M5. At 28 days of curing, compressive strength of mix M5 containing 5% RHA and 5% MK, is 24% as compared to reference mix M1. The compressive strength values of the mix M5 increase due to the addition of 5% Metakaolin.
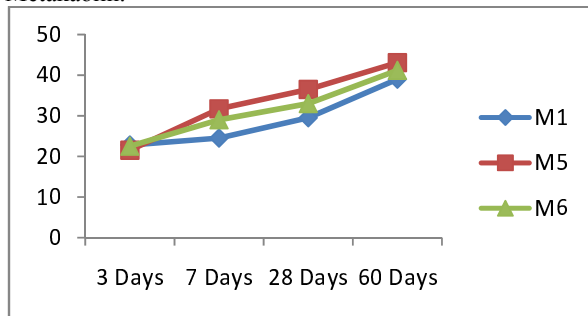
Fig. 3.   Compressive strength chart only for MK+RHA
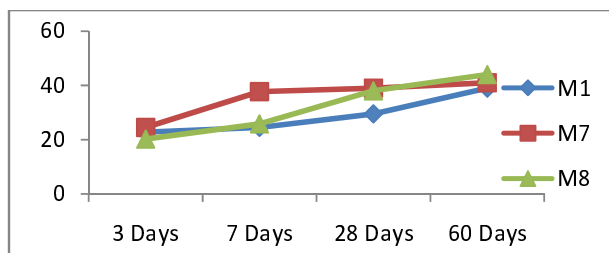
Fig. 4.   Compressive strength chart only for SF+RHA

As shown in figure4, compressive strength values of the mix M7 increase as we replace cement by 5% RHA and 5% silica fume in M7. This increase in strength is about 32% than reference mix M1 at 28 days of curing. Effect of 5% RHA and 5% SF increases the compressive strength in the mix. Mix M7 has the maximum compressive strength at 28 days of curing among all the other mixes.

C.   TENSILE STRENGTH RESULTS

TABLE VII. TENSILE STRENGTH RESULTS OF ALL MIXES AT DIFFERENT CURING AGES.

Mix name	Mix description	Compressive strength			
		3 days	7 days	28 days	60 days
M1	100%PC	2.01	3.2	7.0	8.05
M2	90%PC +10% RHA	2.31	3.6	7.9	8.10
M3	80%PC +20% RHA	3.06	6.1	8.1	8.28
M4	90%PC + 10% MK	2.93	7.1	8.5	9.49
M5	90%PC+5%RHA + 5% MK	2.10	5.5	8.0	9.87
M6	80%PC+10% RHA + 10%MK	4.91	6.6	8.2	10.61
M7	90%PC+5%RHA +5% SF	5.19	6.0	7.5	7.78
M8	80% PC+10% RHA+ 10%SF	5.27	6.3	7.5	7.99

As shown in the figure, the splitting tensile strength of the RHA mixes M2 and M3 is more than the reference mix M1. At 28 days of curing, splitting tensile strength of mix M2 is about 13% more than the reference mix M1 and of mix M3 is about 15% more. RHA helps in improving the splitting tensile strength of concrete.
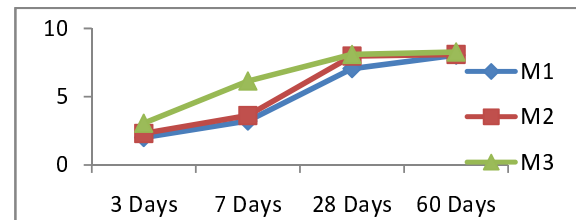
Fig. 5.   Tensile strength chart only for RHA

As from the figure, the splitting tensile strength values for the mix M3 containing 10% metakaolin increase as compared to reference mix M1. This increase in strength is about 21% at 28 days of curing
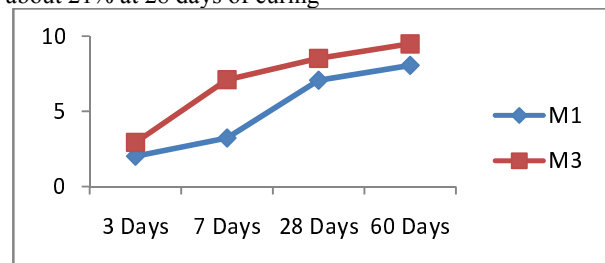
Fig. 6.   Tensile strength chart only for MK

D. WATER ABSORPTION RESULTS

TABLE VIII. WATER ABSORPTION RESULTS OF ALL MIXES AT DIFFERENT CURING AGES.

Mix name	Mix description	Water absorption	
		28 days	60 days
M1	100%PC	4.321	4.010
M2	90%PC +10% RHA	3.962	3.671
M3	80%PC +20% RHA	3.353	3.042
M4	90%PC + 10% MK	3.760	3.473
M5	90%PC+5%RHA + 5% MK	3.822	3.534
M6	80%PC+10% RHA + 10%MK	3.103	2.856
M7	90%PC+5%RHA +5% SF	3.740	3.465
M8	80% PC+10% RHA + 10%SF	3.071	2.802

As shown in the table VIII, the result values show that as we replace the cement partially by RHA, MK and SF, water absorption of concrete mixes decrease.

VI. Conclusion

- Rice husk ash (RHA) decreases the compressive strength of the concrete mixes up to 28 days of curing.
- Rice husk ash (RHA) helps to develop compressive strength of concrete mixes at later ages of curing.
- Rice husk ash (RHA) increases the splitting tensile strength of concrete mixes.
- Partial replacement of cement with Metakaolin increases both compressive and splitting tensile strength of the concrete mixes.
- Partial replacement of cement with combination of MK and RHA increases the compressive strength as well as the splitting tensile strength of the concrete.
- Partial replacement of cement with combination of Silica fume and Rice husk ash increases the compressive as well as splitting tensile strength of the concrete mixes.
- Partial replacement of cement with 5% MK and 5% RHA is more beneficial than 10% replacement levels of both mineral admixtures for increasing compressive strength of the concrete.
- Combination of Silica fume and RHA replacing cement partially is very much helpful in increasing the later age strength of concrete mixes.

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Influence of soil properties on strength of Fiber Reinforced Soil: A Review

Akash Priyadarshee
Dept. of Civil Engineering
NIT Jalandhar, India
i.akashpriyadarshee1@gmail.com

Anil Kumar Chhotu
Dept. of Civil Engineering
NIT Jalandhar, India
akc.jucivil@gmail.com

Vikas Kumar
Dept. of Civil Engineering
NIT Jalandhar,India
vikaskumarnitk@gmail.com

Abstract— In the field of soil reinforcement many techniques are showing their significant potential for strength improvement of soil. Use of randomly distributed fiber for reinforcement of soil is one of the new emerging soil reinforcement techniques. Reinforcement mechanism of fiber is similar to reinforcement provided by the roots of plants. Randomly distributed fibers provide interlocking and friction resistance to resist the movement of soil particles, which significantly increase the load carrying capacity. Major advantage of fiber reinforced soil over other form of reinforcement like; planar reinforcement or geocell reinforcement is absence of weak plane. Proper understanding of different parameters which effects behavior of fiber reinforced soil is required for efficient utilization of fiber reinforcement technique. In this paper brief review of the findings of different researchers, based upon the experiments is presented which shows the effect of different soil parameters on the strength behavior of fiber reinforced soil.

Keywords—planar reinforcement; load carrying capacity; stiffness

I. INTRODUCTION

Among all ground improvement technique soil reinforcement is most preferred technique by engineers. Major advantages of soil reinforcement are ease of construction and overall economy. Availability of many different materials and techniques is also increasing the utilization of the soil reinforcement for wide range of application. With development in the soil reinforcement area materials and methods both are changing. Initially metals were used for reinforcement purpose, but now materials prepared from the polymers have accelerate the utilization of soil reinforcement. Major advantages of polymer based materials are less degradation rate and overall cost. Similarly use of sheets, bars etc. are traditional form of reinforcement. But now different other forms like Geocell, fiber etc. are also available. Fiber reinforcement is one of the new techniques, in which fiber are randomly mixed in the soil. Fiber reinforced soil is also known as 'Ply soil' [1]. Fiber has been used from ancient time, but utilization as construction material is not frequent because of less understanding of potential benefit of fiber reinforcement. Absence of clear cut potential plane of weakness is major advantage of fiber reinforced soil, which is generally exist parallel to the soil and reinforcement interface in other form of reinforcement [2]. Properties of fiber reinforced soil depend upon the properties of fiber as well as soil properties. In this study effect of soil properties on the strength behavior of fiber reinforced soil is presented.

II. MECHANISM OF FIBER REINFORCEMENT

In fiber reinforcement technique, fibers which are randomly mixed in soil may be natural or synthetics type. Jute, coir etc. are example for natural fiber and polypropylene, glass fibers are example of synthetic fiber. The reinforcing mechanism fiber reinforcement is similar to the roots of plants. Plant roots bind soil particles and resist its movement [3]. Similar to that when stress applied on fiber reinforced soil, soil particles apply stress on the fiber, and then fiber deforms and thereby interlocks the soil. It also mobilizes frictional resistance at soil-fiber interface. These two factors are primarily responsible for resistance of movement of soil particles, which enhances the load carrying capacity of fiber reinforced soils [4]. so, there should be sufficient surface resistance for the improvement in load carrying capacity. Failure in fiber reinforced takes place due either by slippage or pull out of fiber due to inadequate friction between fiber and soil or because of breakage of fiber when friction resistance exceed tensile strength of fiber. Pull out failure take place at lower confining pressure and breakage of fiber take place at higher confining pressure. A critical confining pressure exist below which the fiber have tendency of pull out [2, 5].

III. PARAMETRIC STUDY

To understand the behavior of fiber reinforced soil different studies based upon model tests, case study and triaxial tests have done. Case studies on roads by Lindh [6], on embankment by [7], Santoni [8], on landfill liners by Refai [9] have shown the beneficial utilization of fiber reinforcement in different applications. Through model test on strip footing supported by fiber reinforced soil, improvement in the bearing capacity and stiffness have reported by Al-refai [10] and Wasti [11]. Gray [12], Maher [2], Al-refai [13], Michalowski [14], Ranjan [6], Michalowski [15] through triaxial test have shown that performance of fiber reinforcement depends upon the fiber properties like length of the fiber, fiber content, stiffness of fiber and surface properties of soil and soil properties like soil type, size of particles etc. To develop the understanding of behavior of fiber reinforced soil; in the following section the

influence of soil parameters obtained by different researchers are presented.

A. Soil Type

Performance of fiber reinforcement depends upon the type of soil. Soil with different size and shape of the particles has different performance with fiber reinforcement. Fig. 1 shows the failure envelope of two different soil Ottawa sand (OTW) and Valdosta blasting sand (VBS). Failure envelope of VBS have higher slope, which indicate greater friction angle of soil. It is due to angular shape of VBS particles. Effect of fiber with other types of soil like silt or clay is different with respect to sand. The influence of fiber reinforcement is better in case of sand. Reason of this is related to the mechanism of reinforcement of soil. Since strength improvement is related to friction resistance and interlock resistance, which is better in case of sand. Hence, fiber reinforcement performs better in case of sand. Even fibers have shown significant performance with fly ash (Fig. 2).
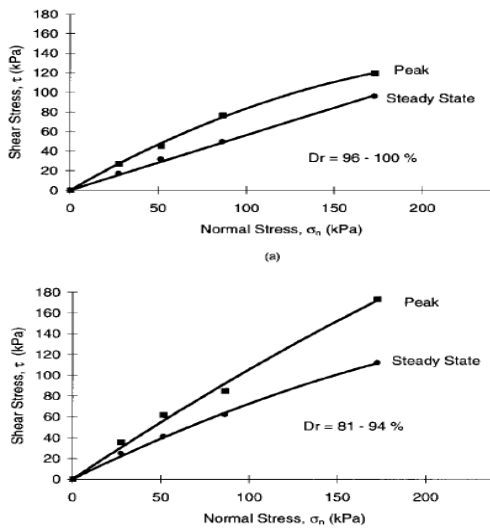
Fig. 1.   Peak and Steady-State Envelopes: (a) OTW-A; (b) VBS-A [17]
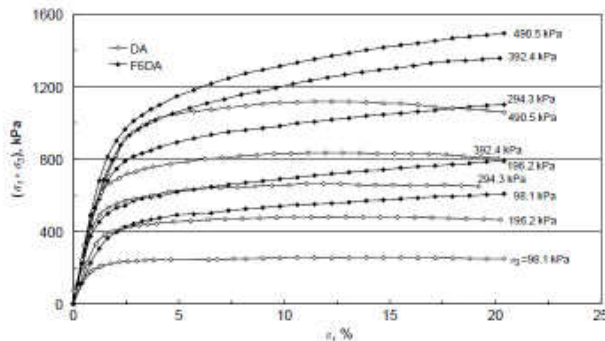
Fig. 2.   Behaviour of fly ash (DA) and fiber reinforced Fly Ash (F6DA) under triaxial condition [18]
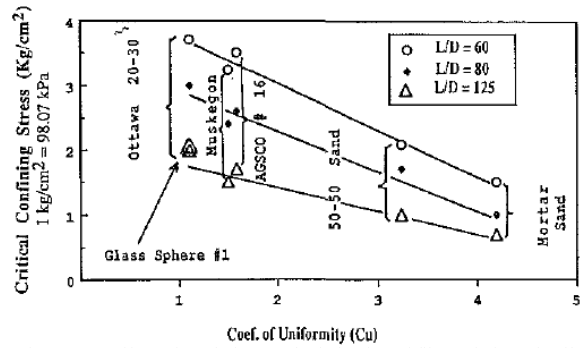
Fig. 3.   Effect of gradation on the behavior of fiber reinforced soil [2]

B. Gradation of soil

Gradation of soil indicates the range of particles present in the soil. If any soil is poorly graded then it has particles of same size. It is found that the well graded soil have better load carrying capacity than poorly graded soil. Since well graded soil have smaller to larger size of particles, interaction of soil and fiber will be greater. But surface interaction for poorly graded soil has lesser surface interaction (Maher and Gray 1990). Gradation of soil also influences the critical confining pressure (Fig. 3). With increase in the coefficient of uniformity (C_u), critical confining pressure below which fiber have tendency of pull out decreases.

C. Shape and size of soil particles

Shape of the soil particles of effects the performance of fiber reinforcement. Friction resistance is greater for the particles of angular shape than rounded soil particles. It is found that with increase in the angularity surface interaction increases (Al-Refai 1991). With angularity critical confining pressure decreases or with increase in sphericity index critical confining pressure increases (Fig. 4). Due to angularity of soil particles interlock resistance increases.

Reinforcing action of fiber also depends upon the size of the soil particles. For soil with smaller size particles have greater potential for strength improvement. Contact efficiency is greater in case of smaller size particle. Due to which surface resistance is greater because of greater surface area in case of smaller size particles (Fig. 5).
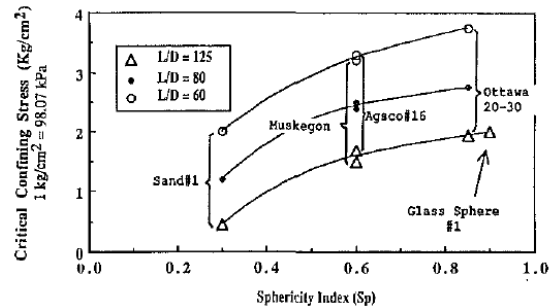
Fig. 4.   Effect of particle shape on the fiber reinforced soil [2]
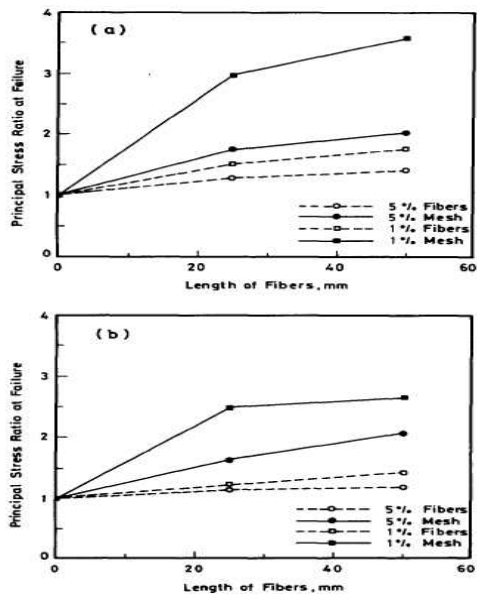
Fig. 5.   Effect of soil type on the principal stress ratio (a) fine sand (b) medium sand [13]

D. Density of soil

Behavior of soil depends upon the initial density of soil. Soil which is placed at higher density has greater load carrying capacity. Angle of friction of sand depends upon the relative density of soil. Soil compacted at higher relative density have greater angle of friction. Similarly fiber reinforced soil is also influenced by its density. Results of direct shear test have shown that the dense fiber reinforced soil have higher peak stress than loose soil (Fig. 6). Dense soils have stress-softening behavior. It shows the stress drop after peak stress. While in case of loose soil stress-deformation behavior is stress-hardening type of behavior. Stiffness of reinforced soil is also greater in case of dense. With dense soil interaction between the fiber and soil particle is greater because of greater surface contribution. While in case of loose soil surface contribution will be less because of less availability of soil particles.
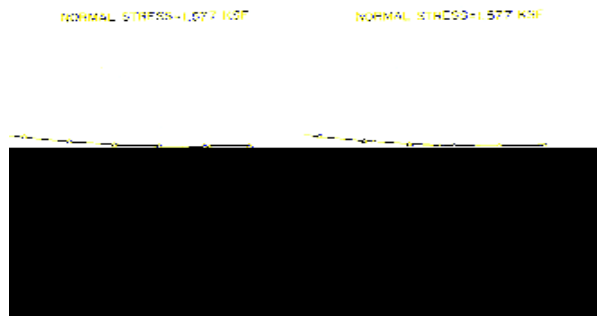
Fig. 6.   Effect of relative density of sand on stress-displacement behavior of soil [19]
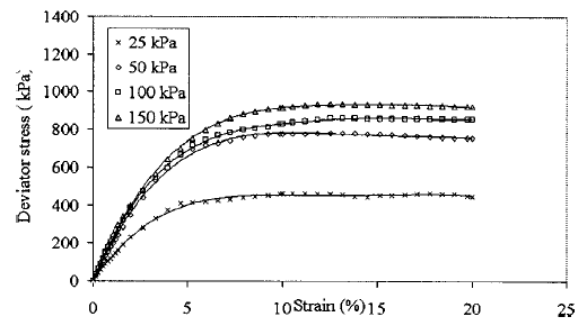
Fig. 7.   Effect of confining pressure on Stress-strain behavior of fiber reinforced soil [16]

E. Confining pressure

Confining pressure through soil is also a major parameter which affects the behavior of fiber reinforced soil. As discussed earlier that failure in case of fiber reinforced soil takes place due to the failure of fiber either through pull out of fiber or due to breakage of fiber. Pull out tendency or breakage tendency of fiber depends upon many factors. It also depends upon the confining pressure. If confining pressure is less, then pull out behavior will be greater. But if confining pressure is greater, then chances of breakage will be more. Confining pressure also affects the stress-stain behavior of soil (Fig. 7). Through experiments it is found that peak stress is suppressed by the confining pressure (Babu and Vasudevan 2008). Which indicates that higher confining pressure decrease the reinforcing action of fiber.

IV.   CONCLUSION

In this paper influence of Soil properties like type of soil, size and shape of soil, density of soil and confining pressure on behavior of fiber reinforced soil is briefly discussed. To get the maximum benefit from the performance of fiber-reinforced soil, one must consider all the influencing parameters and their working mechanism. Yet further research is required to understand the behavior and for proper design of fiber reinforced soil structure.

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Quality of Life Index Assessment for Kochi City

Aswathidas. N
Department of Civil Engineering
Sardar Vallabhbhai National Institute of Technology
Surat-395007 Gujarat, India
naswathidas38@gmail.com

Krupesh .A. Chauhan
Department of Civil Engineering
Sardar Vallabhbhai National Institute of Technology
Surat-395007 Gujarat, India

abstract>
Abstract— **The problem of the quality of life is a multidimensional and complex issue. It concerns the members of more than one profession such as planners, designers, economists, lawyers and design-makers. Quality of life has two main parameters, Social cohesion and sustainability and also two main components like subjective and objective quality of life. Social cohesion includes by reducing disparities and inequalities as well as by strengthening social connection and ties people's interaction can be increased. Sustainability includes to preserve the resources both natural as well as man-made means using them in a proper way as well as per need. The subjective quality of life represents the micro level quality of life of peoples. It reflects both the real status of quality of life or the conditions of life in general and the attitude of people toward these conditions. The objective quality of life measures are built on the basis of hard variables. ie, the data from the municipal or governmental institutions and organizations which may include financial accounts, civil state records, medical statistics, pollution levels and other pieces of factual information gathered by the institutions routinely.**

Keywords—Quality of life; Social cohesion; Sustainability

I. INTRODUCTION

The term quality of life (QOL) references the general well-being of individuals and societies. Quality of life index is the product of the interplay among social, health, economic and environmental conditions which affect human and social development. The term is used in a wide range of contexts, including the fields of international development, healthcare, and politics. Quality of life should not be confused with the concept of standard of living, which is based primarily on income. Instead, standard indicators of the quality of life include not only wealth and employment but also the built environment, physical and mental health, education, recreation and leisure time, and social belonging. There are two ways to assess how well people live. One is to consider to what extent the country provides conditions deemed essential for a good life. In this approach the emphasis is on societal input. Since there is little certainty about what people really need, called this 'presumed' quality-of-life. The other approach is to assess how well people thrive. In this approach the emphasis is on societal output, called this 'apparent' quality of life.

The definition by WHO is " The condition of life resulting from the combination of the effects of a complete range of factors such as those determining health, happiness, education, social and intellectual attainments, freedom of action, justice and freedom from oppression". Quality of life in nations can be measured by how long and happy people live. This is assessed by combining data on life expectancy drawn from civil registration with survey data on the subjective enjoyment of life as a whole. Bertrand Russell (1930) in his celebrated book the conquest of happiness elaborated the concept of happiness as a relative sense of joy that varied from one culture to another and also from one individual to another.

II. OBJECTIVES

- To study and conduct field studies about the coastal area beach development based on socio-economical survey.
- To identify the different parameters for improving the quality of life index.
- To analyses urban planning needs through socio economic analysis.
- To develop an urban planning proposal based on assessment.

III. METHADOLOGY

It is felt that the approach of this study should be semi-empirical and that the efforts are made to collect the data from the concern department as well as by directly talking to the local people. The inventory study approach has been adopted. Main aim is assessment Quality of Life Index for Kochi city. Each basic service is derived by giving them ranking according to city peoples' opinion. For better result and to make study easy the city is divided in various six zones. The peoples' opinions are to be taken by visiting all the zones one by one and data are to be collected. After collecting all data, making Mathematical model for Quality of Life Index measurement. Measure the quality of life index all zones are ranked. After that overall index for Kochi city is measured.

IV. DATA COLLECTION

The evolution of the QOL index was based on the model developed by Mr. Kenneth E. Hornback. The following values are required to be obtained in order to evolve the life index values.

- **S_{ij}** - The subjective, or satisfaction measure for all factors given by people to a normalized scale 1-10.
- **O_{ij}** - The objective measure for all the factors as given by experts also normalized to scale 1-10.
- **W_{ij}** - The importance weighting which the individual attaches to a particular factor, relative to all the other factors, on a rank order scale.

All the above mentioned three values were obtained from individual and experts who were permanent residents of this city. A special form was prepared based on the work of Mr. Hornback and a sample pilot survey was carried out for this city. The analysis was done for these forms in the following steps:

- The sample forms obtained were broadly classified into 5 different groups viz. Graduates, professionals, females, below S.S.C. and others.
- To obtain the S_{ij} values for different individuals for different factors was an important thing. The individuals were to read the statements corresponding to different factors and were to circle any one of the following code words.
- The S_{ij} value was to be obtained normalized to 1-10 scale. This was obtained by dividing the statements into two sections – one which would carry higher weightage if a person strongly agreed with it and the second which would carry higher weightage if a person strongly disagreed with the statement.
- To obtain the O_{ij} values, different experts in different fields were interviewed personally and were requested to give weightage normalized to a scale 1-10, depending on the objective indicators for a factor. The experts included ex-mayor, doctors, engineers, professors, etc.
- The individuals were also told to give weightage to all the factors relatives to all other factors, on a rank order scale. This was value of Wij.
- After obtaining the required values the analysis was done with the help of a computer. A computer program was developed and data was fed to the computer to give the QOL index.

V.   ANALYSIS AND RESULTS

In this study, an analysis is done and is compared with graphs. The graph shows the comparison between population and its factor in all 6 zones.

In this study, an attempt has been made to evaluate the 'Quality of Life Index' for Kochi city, by making use of the mathematical model developed by Kenneth E Hornback. The value of the index is measured on a scale normalized to 1-10. The value of index nearer to 10 indicates an excellent quality of life, whereas the value nearer to 1 indicates the worst quality of life.

The composite value of the index obtained on analysis is a result of the combination of the following factors: (I) Natural Environment (II) Physical Environment (III) Health (IV) Economic Sector (V) Social Sector and (VI) Political Sector (VII) Education Sector (VIII) Infrastructure Sector.

TABLE I. QUALITY OF LIFE INDEX

Sr. No.	Zone Name	QoLI	Rank
1	Zone – 2 (Palluruthy)	4.83	6
2	Zone – 1 (Fort Cochin)	4.93	5
3	Zone – 3 (Pachalam)	5.18	4
4	Zone – 4 (Cental Zone)	5.19	3
5	Zone – 5 (Edapally)	5.24	2
6	Zone – 6 (Vyttila)	5.28	1
	Kochi City	5.10	-

QoL index is an average value of the factor indices (F_j values) of different factors. Thus factor having low F_j value would tend to bring down the value of the overall index of quality of life. Depending on this, the factors can be grouped under various heads like poor factor indices, medium factor indices and better factor indices. In poor factor there are 5 sub-factor included. In medium factor there are 16 sub-factor included and in better factor there are 9 sub-factor included.

Table I shows that Study Zone - 6 is having the highest Quality of life Index i.e. 5.28 due to rapidly increasing that residential area, whereas Study Zone - 2 is having the lowest one i.e. 4.83 in Kochi . On the basis of analysis, it was found that QOLI for Kochi city is 5.10.

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Experimental Study for Selecting Cement Content in Porous Concrete

Deepinder Singh Aulakh
Dept. of Civil Engineering
COAE&T, PAU
Ludhiana, India

Sarvesh Kumar
Dept. of Civil Engineering
COAE&T, PAU
Ludhiana, India
sarveshfdk48@gmail.com

Jaspal Singh
Dept. of Civil Engineering
COAE&T, PAU
Ludhiana, India

N.K. Khullar
Dept. of Civil Engineering
COAE&T, PAU
Ludhiana, India

Abstract— **Porous concrete offers an attractive solution to the problem of excessive runoff. Porous concrete is an environment friendly material having multiple benefits like controlling storm water runoff, restoring groundwater and reducing water pollution. Although it have low strength as compare to conventional concrete but it can still be useful in construction of pavement and footpath for reducing surface runoff. The present laboratory study is to evaluate economical porous concrete with optimum strength and high permeability. The water content was kept constant for all the mixes. The water cement ratio was selected as 33%. Three different sizes of aggregates in same proportion in every mix were used to find economical results and best cement to aggregates ratio considering compressive strength, porosity and permeability characteristics. The maximum aggregate size used was 10mm, 20mm and 40mm with 1:1:2 proportions in each mix. Compressive strength test was conducted at 14 & 28 days water curing. Porosity and Permeability test was conducted at 28 days water curing. It was concluded that the mixes M_2 and M_3 gives nearly similar results as compared to mix M_1 and M_4.**

Keywords— *Compressive strength; Porosity; Permeability; Porous Concrete..*

I. INTRODUCTION

Concrete is an important material in construction. The main properties desired in concrete are that it should have high strength, low permeability and good workability etc. Due to urbanisation, large area is being converted from bare land to covered for the construction of buildings, roads, parking areas etc. This mean runoff occurs more quickly with greater peak flow which causes flooding, choking of sewerage line because drainage systems are generally not designed for such condition. Frequent flooding results in high maintenance cost of infrastructure. So there is need to have concrete with more porosity having adequate strength so that lesser runoff is generated from areas paved with concrete.

Porous concrete offers an attractive solution to the problem of excessive runoff. Porous concrete is also known as permeable concrete, pervious concrete, gap grade concrete and no fines concrete. Depending upon the void content, compressive strength of 3.5 to 28 MPa and flexural strength of 1 to 3.8 MPa have been reportedly [5]. Porous concrete is a concrete mixture comprised of cement (Ordinary Portland cement or blended cement), controlled amounts of water and uniformly graded coarse aggregate, little or no sand and sometimes other additives. The uniform coarse aggregate in

combination with low water cement ratio (0.25 to 0.35) makes concrete with void contents ranging from 11% to 35% [6].

The quantity of water in such concrete is critical as too much water in the mix causes the pores to collapse. Therefore, water content in such concrete needs to be controlled. The use of supplementary cementitious materials like fly ash, ground granulated blast furnace slag, calcined clay, pozzolana etc. is also found advantageous. Further depending on requirement, chemical admixtures like retarders, air entraining agents may also be used to achieve the desired result. With the use of porous concrete, property owners can reduce the cost of developing real estate as reduced runoff from built-up and paved areas minimize the need for separate storm water sewers.

The high permeability of porous concrete creates the ability to significantly reduce storm water runoff. Therefore, it had been considered as one of the best option for storm water Best Management Practice (BMP). More recently, porous concrete has the potential of being certified for construction projects by the US Green Building rating agency "Leadership in Energy and Environmental Design" because of its environmental benefits.

Urban areas tend to enclose large areas of impervious pavements [4], which add to the level of heat. The concentrated heat wave can be reduced by the open structure of porous concrete that allows air to flow through it. This had been exhibited in limited studies of porous concrete pavement applications. Footpath or walkways in some of the Indian metropolis and other big cities are usually paved with kota stone or interlocking tiles/blocks. These are similar as porous concrete pavements. The investigation was conducted to evaluate compressive strength of porous concrete at required porosity and to find best combination of aggregates size considering economy.

II. MATERIALS AND METHODS

No fine aggregates and sand had been used. The materials used for making concrete specimens were Ordinary Portland cement, coarse aggregates (10mm, 20mm and 40mm maximum size) and water. The characteristic of these materials are explained as:

A. Cement

Ordinary Portland cement from a single lot was used throughout the course of the investigation. The physical properties of the cement as determined from various tests

conforming to Indian Standard: 8112 – 1989 [1] are listed in Table I.

Sr. No.	Characteristic properties	Observed values	Codal requirements is: 8112 - 1989
1.	Fineness (m^2/kg)	310	225 Minimum
2.	Standard consistency (%)	32.8	
3.	Initial Setting time (minutes)	165	30 Minimum
4.	Final setting time (minutes)	294	600 Maximum
5.	Specific gravity	3.17	
6.	Compressive strength (MPa)		
	7-days	33.5	33 Minimum
	28-days	46	43 Minimum

B. Coarse Aggregate

Coarse aggregates from local market were used. The three different sizes (40mm, 20mm, and 10mm maximum size) of aggregates were selected for experimental work. The aggregates were separated by sieving through the sieves of different sizes. The IS Sieves [3] used to separate the three particular sizes were 40mm, 20mm and 10mm. Maximum size coarse aggregates were used. Physical properties of coarse aggregates are described in Table II.

TABLE II.   PROPERTIES OF COARSE AGGREGATES

Properties	Coarse Aggregates		
	10 mm	20 mm	40 mm
Colour	Grey	Grey	Grey
Shape	Angular	Angular	Angular
Specific Gravity	2.66	2.72	2.80
Water Absorption	0.65%	0.35%	0.35%
Bulk Density (kg/m^3)	1519	1556	1584

C. Water

Fresh and clean tap water was used for curing and to prepare the specimens in the present study. The water was relatively free from organic matter, silt, oil, sugar, chloride and acidic material as per Indian standard.

D. Concrete Mixes

Four batches of concrete were casted using different ratio of coarse aggregates with respect to constant water and cement values. No fine aggregates and sand was added to the mix. The proportion of concrete mixes taken are 1:4, 1:6, 1:8 and 1:10 (cement : coarse aggregates) by weight with W/C ratio as 0.35. Each batch comprised of 18 numbers of (150mm x 150mm x 150mm) cubes. The cubes were tested at curing age of 14 and 28-days. Quantity of Coarse aggregates ratio in all mixes will was remain same i.e. 1:1:2 (10mm: 20mm: 40mm) by weight with respect to cement. Proportion for each mix is listed in Table 3.

TABLE III.   PROPORTION OF MATERIALS IN DIFFERENT MIXES

Mix Samples	Cement : Coarse aggregates	Water Cement Ratio (%age)
M_1	1:4	33
M_2	1:6	33
M_3	1:8	33
M_4	1:10	33

E. Compressive Strength

Compressive strength test was conducted on concrete cubes of size 150mm x 150mm x 150mm of each mix sample after 14 and 28-days curing as per IS: 516-1959 [2]. The average of six samples was taken as the representative value of compressive strength.

F. Porosity

Porosity test was conducted on concrete cubes of size 150mm x 150mm x 150mm of each mix sample after 28-days curing. The average of six samples was taken as the representative value of Porosity.

G. Permeability

Permeability test was conducted on concrete cubes of size 150mm x 150mm x 150mm of each mix sample after 28-days curing. The average of six samples was taken as the representative value of permeability.

III.   RESULTS AND DISCUSSIONS

The Compressive strength, Porosity and Permeability test results were carried out on 150mm x 150mm x 150mm cube had been listed in Table IV.

TABLE IV.   COMPRESSIVE STRENGTH, POROSITY AND PERMEABILITY OF CONCRETE CUBES

Mix	Avg. Compressive strength (MPa)		28-days Porosity (%age)	28-days Permeability k (m/hr)
	14-days	28-days		
M_1	6.90	8.37	14.19	19.7
M_2	5.81	6.95	26.81	29.4

M₃	5.07	6.69	28.40	34.2
M₄	3.86	5.31	30.25	38.5

Fig. 1. show 14 and 28 days compressive strength of different concrete mixes. From figure 1, it is clear that strength increases with increase in curing age.

Suitable Curing Method for PPC Concrete

Sarvesh Kumar
Dept. of Civil Engineering
COAE&T, PAU
Ludhiana, India
sarveshfdk48@gmail.com

Ritesh Jain
Dept. of Civil Engineering
COAE&T, PAU
Ludhiana, India

Jaspal Singh
Dept. of Civil Engineering
COAE&T, PAU
Ludhiana, India

N.K Khullar
Dept. of Civil Engineering
COAE&T, PAU
Ludhiana, India

Abstract— **Concrete cubes were prepared with a water-cement ratio of 0.40 for testing the compressive strength at 7, 14 and 28 days of curing using three curing methods namely immersion, sprinkling and plastic sheeting until the day of testing as per IS-516 (1999). Test results indicate that water immersion curing is the best method of curing the concrete made from pozzolana portland cement (PPC). Sprinkling water curing also provided better results than Plastic Sheeting method of curing. The rate of drying was significant when the specimens were subjected to Plastic sheeting method of curing. This thus hampered the hydration process and thus affected the compressive strength of the hardened concrete. The overall finding of this study suggests that concrete made from PPC should be cured by water immersion curing method to achieve a better compressive strength.**

Keywords—Curing; compressive strength; pozzolana portland cement.

I. INTRODUCTION

Concrete curing is one of the most important step in concrete construction though it is also one of the most neglected and misunderstood procedures. It is the treatment of newly placed concrete during the period in which it is hardening and gaining strength so that it retains enough moisture to immunize shrinkage and resist cracking (Lambert Corporation, 1999) [5]. Curing of concrete is necessary for the hydration of the cement content. For a given concrete, the amount and rate of hydration and furthermore the physical make-up of the hydration products are dependent on the time-moisture-temperature history (Neil Jackson et al, 1996) [6].

The necessity for curing arises from the fact that hydration of cement can take place only in water-filled capillaries. This is why loose water must be prevented. Furthermore, water lost internally by self-dedication has to be replaced by water from outside (Neville,et al,1987)[7]. Thus, for complete and proper strength developments, the loss of water in concrete from evaporation should be prevented, and the water consumed in hydration should be replenished. This process of creation of an environment during a relatively short period after the placing and compaction of the concrete, favourable to the setting and the hardening of concrete is termed as curing (Gambir, 1986) [1].

A proper curing maintains a suitably warm and moist environment for the developments of hydration products, and thus reduces the porosity in the hydrated cements paste and increases the density of microstructure in concrete (Safiudeen et al, 2007) [8].

A proper curing greatly contributes to reduce the porosity and drying shrinkage of concrete, and thus to achieve higher strength. Therefore, a suitable curing method such as water ponding (immersion), spraying or sprinkling of water, or covering with polythene sheet material is essential us order to produce strong and durable concrete. This study presents the most suitable curing method of concrete made from PPC.

II. MATERIALS AND METHODS

Locally available fine and coarse aggregate were used for casting of concrete. Sieve analysis of the fine and coarse aggregates is listed in Table I and Table II respectively.

TABLE I. SIEVE ANALYSIS OF FINE AGGREGATES

IS Sieve designation	Weight retained (Grams)	Percentage weight retained (%)	Cumulative percentage weight retained (%)
4.75 mm	8	0.8	0.8
2.36 mm	172	17.2	18.0
1.18 mm	270	27.0	45.0
600 micron	272	27.2	72.2
300 micron	188	18.8	91.0
150 micron	77	7.7	98.7
Pan	13	1.3	100.0

Physical properties of fine aggregates are:
Fineness Modulus = 2.73
Specific gravity = 2.67
Average Absorption = 0.83%

TABLE II. SIEVE ANALYSIS OF COARSE AGGREGATES

IS Sieve designation	Weight retained (Grams)	Percentage weight retained (%)	Cumulative percentage weight retained (%)
40 mm	0	0	0
20 mm	0	0	0
10 mm	1120	56	56

4.75 mm	839	41.95	97.95
Pan	41	2.05	100

Physical properties of coarse aggregates are:
Fineness Modulus   = 6.91
Specific Gravity   = 2.67
Average Absorption   = 0.79 %

The physical properties and fineness modulus of coarse aggregate were determined as per standard procedures and were found to conform to IS:383-1970 (R2002)[2]. The fine aggregates lies in Grading Zone I as per Table-4 of IS:383-1970 (R2002)[2]. Portable water, fit for drinking was used for investigation. It was also used for curing purposes. It was free from injurious amounts of deleterious materials. Pozzolana Portland cement (ACC) from a single lot was used as the main binder in this investigation. The physical properties of the cement as determined from various tests conforming to Indian Standard IS: 1489-1991 [4] are listed in Table III.

TABLE III.   PHYSICAL PROPERTIES OF CEMENT

Characteristic Properties	Observed Value	Codal Requirements IS:1489-1991
Standard consistency (%)	33	------
Initial Setting time (minutes)	190	30 Minimum
Final setting time (minutes)	290	600 Maximum
Specific gravity	3.15	-------
Soundness by Le-Chat Expansion (mm)	1.0	10.0 Maximum
Compressive strength (MPa)		
3 days	21.8	16 Minimum
7-days	32.6	22 Minimum
28-days	54.3	33 Minimum

III.   PREPARATION OF TEST SPECIMENS

The proportions of the concrete mixes were kept 1:1.50:2.0 by weight with a water-cement ratio of 0.40. A total number of 54 cubes having dimensions 150mm x 150mm x 150mm each were casted for testing. The specimens were moulded in metallic moulds using three layers of filling and compaction was done with help of vibrating table to expel the entrapped air. Immediately after this, the specimens were kept in a cool place in the laboratory. The specimens were removed from the moulds at the age of 24 ± 2 hours.

IV.   CURING METHODS

The test specimens were cured under three types of curing until the day of testing. These were water immersion curing, sprinkling of water and wrapping with plastic sheeting. In water immersion curing, the specimens were weighed and immersed in water. Portable drinking water was used in immersion water curing. In sprinkling method, the specimens were also weighed and kept moist by sprinkling water on the

specimens 3 times daily until the date of testing. In plastic sheeting, the specimens were weighed and wrapped in flexible plastic sheets (polythene) until the testing date. Air tightened wrapping was done to prevent moisture movement from concrete surface. The curing temperature was maintained at 27 ± 2°C in all the curing methods.

V.   TESTING OF THE HARDENED CONCRETE

The compressive strength of the test cubes were determined by crushing the cubes using Universal Testing Machine. A total of 54 cubes in all were crushed, 18 of these cubes were for water immersion, 18 for sprinkling and 18 for Polythene Sheeting method. The length of curing dates considered was 7, 14 and28 days respectively counted from the time of casting. The compressive strength test was conducted as per guidelines laid in IS: 516-1959 (R1999)[3].

The results of compressive strength are given in Tables-IV.

TABLE IV.   COMPRESSIVE STRENGTH OF CONCRETE CUBES

Curing Method	Average Compressive Strength at 7 days	Average Compressive Strength at 14 days	Average Compressive Strength at 28 days
Water Immersion	20.90	32.08	44.24
Sprinkling	20.41	30.57	41.35
Plastic Sheeting	20.50	26.63	27.74

The graphical representation of average compressive strength versus curing age for different methods of curing was shown in figure1.
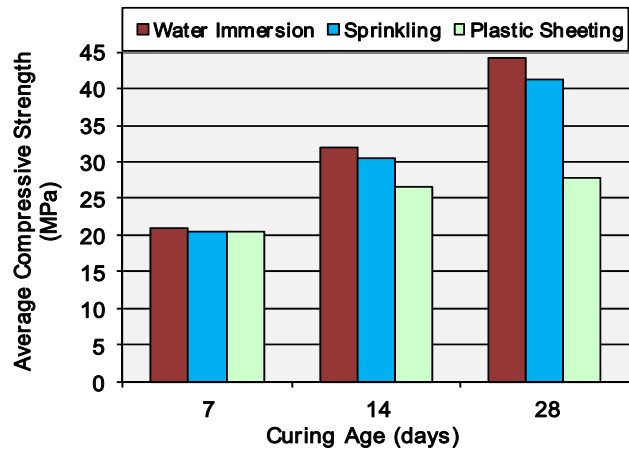
Fig. 1.   Graph of average compressive strength versus curing ages for different methods of curing.

In all curing methods, it is found the compressive strength of the concrete increases with age. The highest compressive strength at all ages was produced by water immersion curing

method. The average compressive strength of water immersion cured concrete was found to be 20.90 N/mm^2, 32.08 N/mm^2 and 44.24 N/mm^2 at 7, 14 and 28 days respectively. Sprinkling method produced results of compressive strength closer to water immersion curing method as 20.41 N/mm^2, 30.57 N/mm^2 and 41.35 N/mm^2 at 7, 14 and 28 days respectively. Results of Plastic sheeting method showed least compressive strength.

VI. CONCLUSIONS

- Water immersion curing was found to be the most effective method of curing. It produced the highest level of compressive strength. This is due to improved pore structure and lower porosity resulting from greater degree of cement hydration reaction without any loss of moisture from the concrete specimens.
- Sprinkling method of curing produces higher compressive strength than plastic sheeting. This is attributed reduce the moisture movement from concrete specimens leading to enhanced degree of cement hydration.
- Plastic sheeting method of curing produces lowest level of compressive strength. After utilisation of the mixed water in the hydration process completely at its early age of curing, no further water is available for reaction. Hence, hydration of cement was abated resulting less increase in compressive strength as we go from 14 to 28 days.
- Normal concrete should be cured by immersion water curing method in order to achieve good hardened properties. Water immersion curing (ponding) produces no loss of moisture, and therefore enhances cement hydration process. In case of water shortage, sprinkling curing can be adopted.

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Track 2
Electrical Engineering

Improvement in Voltage Profile Using Reconfiguration of Distribution Network

Dilsher Singh
Dept. Of Electrical Engineering
Guru Nanak Dev Engineering
College
Ludhiana,India
dlshrsngh@yahoo.com

Sarabjot Singh
Dept. Of Electrical Engineering
C.T. Institute of Engineering,
Management and Technology
Jalandhar
sarabjot2000@gmail.com

Harmeet Singh
Dept. Of Electrical Engineering
Guru Nanak Dev Engineering
College
Ludhiana, India

ABSTRACT: This article proposed a novel approach for reconfiguration of electric power distribution network under normal operating conditions to reduce the active losses on the network or to balance the load on the feeders. The idea behind reconfiguration is to recognize beneficial load transfers so that power losses are minimized and the prescribed voltage limits are satisfied. The proposed method determines the proper system topology that reduces the power loss according to a load pattern. The effectiveness of the proposed approach is tested on 11KV feeder which is bifurcated at the distribution end (consumer end) to 3 phase 440V and 1 phase 230V. The comparison of the proposed approach is presented in terms of improvement in voltage profile before and after bifurcation, balancing in load before and after bifurcation at the consumer end of the distribution network.

I. INTRODUCTION

Distribution network system is an important part of power system which connects distribution lines with the consumers. Nowadays, distribution networks are rapidly growing, therefore an efficient operation method is essential for reducing cost and increasing effective operation. Between 30 and 40 % of total investments in the electrical sector goes to distribution systems, but nevertheless, they have not received the technological impact in the same manner as the generation and transmission systems. Many of the distribution networks work with minimum monitoring systems, mainly with local and manual control of capacitors, sectionalizing switches and voltage regulators, and without adequate computation support for the system's operators. There are many losses in distribution system such as voltage drop, poor power factor, theft of energy, failure of distribution system, poor reliability of the supply etc.

Merlin et al.[1] using a discrete branch & bound technique in order to increase the efficiency of the distribution electrical network considering feeder reconfiguration. In this method all the network switches are closed to form a meshed system, &then the switches are opened successively to restore to the radial configuration. However, this method involves approximations. Shirmohammadi et al. [2] proposed an algorithm to overcome these approximations. In this method switches are opened one by one, based on an optimal flow pattern. Peponis et al. [3] have developed a methodology for the optimal operation of distribution network. In this method loss minimization is obtained by installation of shunt capacitors & reconfiguration of network. Schmidt et al. [4] have formulated the problem as the mixed integer nonlinear optimization problem. The integer variables represent the status of the switches, & continue variables represent current flowing through the branches. Broadwater et al.[5] have considered the time varying load demand, obtained through load estimation, to reduce the loss. Mortom et al. [6] have proposed method based on an exhaustive search algorithm for obtaining a minimum loss radial configuration of distribution system.

How we can reduce these types of losses:-

•Reconfiguration of the network.

•HVDS

The network is reconfigured to reduce the. Under conditions of permanent failure, the network is reconfigured to restore the service, minimizing the zones without interruption of supply. This can be achieved by networks reconfiguration. Several approaches are used to find the optimal configuration with the following subjects:

-Reducing power system losses.

-Improving service restoring for the isolated portion of a distribution system.

-Enhancing system reliability by introducing an analytical mathematical model.

-Improving load factors to facilitate load aggregation in distribution networks.

Benefits of reconfiguration of distribution network

- Excellent voltage profile.

- System power factor improves causing easy reactive power control.

- Considerable reduction in line losses and consequent savings in power purchase cost.

A. Bifurcation & its need

Bifurcation mean two, when a fully over loaded 11KV distribution feeder is divided into two parts, or when one feeder is obtained from two or more fully overloaded feeder. The process become a new feeder under light load from the heavy load feeder is called bifurcation of the feeder.

In fig 1.1 show bifurcation of two 11KV overloaded network. Some part of the load these overload network put on the new feeder & improve the voltage profile.
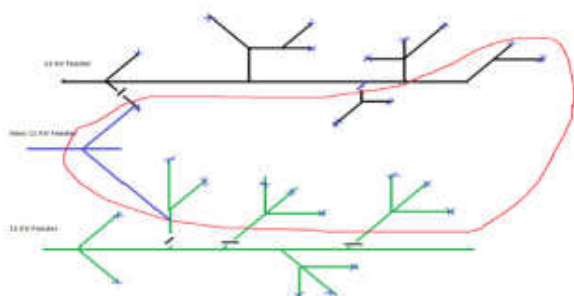
Fig. 1. Bifurcation of network

B. Previous behaviour of feeder existing

At earlier stages when the feeder start feeding load to consumers there was no information how larger feeder feeds the load to the consumers. As population increases the load increases abruptly. At that stage there was no knowledge that how much rating of the feeder should be increased depending upon load. This point comes into Knowledge when it was seen that feeder feeding the system begins to overload. At this stage various problems like poor voltage profile at the end of feeder, larger losses in the feeder, large fault frequency, difficult fault location, difficult feeder maintenance etc.

At starting stage the route of the feeder feeding to consumer was zigzag. The population was less and feeder feeds the small consumer but cover large area.

II. PROBLEMS DESCRIPTION

In case of ordinary system, the feeder runs according to the load and mostly the feeders run along the roads. In this case length of the feeder sometimes increase to large extends. Therefore, the system gets complex and level of voltage at the end point of feeder is reduced to permissible level, So the quality of voltage is decreased.

With the help of reconfiguration of network technique, the quality of voltage level can be improved. The paper further presents the case study for two villages which are reconfigured to improve the voltage profile of distribution line.

A. Problem Formulation

Case Study 1

HISTORY

Under Phagwara Division Punjab Sub-Station installed at Daulatpur is feeding the following villages:

1) Ucha village
2) Darvesh village

Before bifurcation the load on the Ucha village feeder 3001.9 KVA and maximum demand is 185A. Voltage regulation of the Ucha feeder before bifurcation was 11.06% which was calculated. After bifurcation the voltage regulation of the Ucha feeder was estimated at 5.28% which was earlier 11.06% and Ucha village load after bifurcation was 2276.9 KVA. This is also lead to advantage as it will decrease number of transformer from 61 to 45. Also Darvesh village load before bifurcation was 2286.8 KVA and its maximum demand was 185A. Voltage regulation of the Darvesh village before bifurcation was 4.76% which was calculated. After bifurcation the voltage regulation of the Darvesh village was estimated at 2.89% which was 4.76% earlier. Darvesh village load after bifurcation was 1496.8 KVA. This is also lead to advantage as it will decrease number of transformer from 55 to 40. After bifurcation Ucha & Darvesh village feeder new 11KV feeder was installed & putt on the load 1514.3 KVA. The voltage regulation of the new feeder is 1.54%. The total money expenditure on new 11 KV feeder is Rs1377385. All these result show in the map & table calculation.
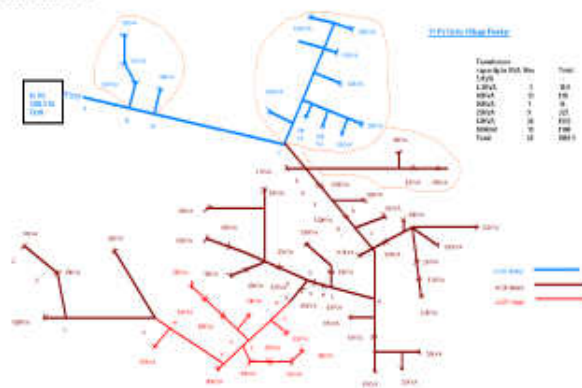
Fig1 11 KV Ucha Village shaded Bificuration

Fig.3 11 KV Ucha Village after Bificuration portion

B. **Feeder voltage drop:** - Feeder voltage drop is the total drop in the line which feed to load centre from substation mainly. This drop occurs in the line due to resistivity.

C. **Total conductor drop:** - Total conductor drop is the drop in the conductor mainly due to resistivity of the material used for conductor.

Let the conductor used in the system of various types (acc to size).

A1, A2, A3, A4……………An (length of various size of conductor)

F1, F2, F3, F4…………......Fn (voltage drop factor of various size of conductor)

According to voltage drop of various conductor

A1*F1 + A2*F2 + A3*F3 ……………… + An*Fn

Total voltage drop = ∑ An*Fn   (1)

Feeder voltage drop = Total conductor drop * 100/System Voltage – Total conductor drop

TABLE 1 VOLTAGE DROP FACTOR OF VARIOUS CONDUCTORS: -

S no.	ACSR Conductor mm^2	Voltage drop factor
1	48	0.0442
2	30	0.0662
3	20	0.0992
4	13	0.1439

TABLE 2 MAXIMUM DEMAND OF CONDUCTOR WITH MAXIMUM KVA: -

S no.	ACSR Conductor mm^2	Maximum demand(A)	Maximum KVA
1	13	70	1333
2	20	100	1905
3	30	148	2819

4	48	197	3753
5	65	254	4839

Voltage drop before Bifurcation of the Ucha village Feeder or network

Voltage drop before Bifurcation = 11.06%

Voltage drop = 11.06%

Applied voltage = 220V

Voltage drop = Applied voltage * Voltage drop\100

Voltage drop = 220*11.06\100 = 24.33V

Voltage at the load end = Applied voltage – voltage drop in volt = 220 – 24.33 = 195.67V

Voltage drop After Bifurcation of the Ucha Village Feeder or network

Voltage drop after Bifurcation = 5.28%

Voltage drop = 5.28%

Applied voltage = 220V

Voltage drop = Applied voltage * Voltage drop\100

Voltage drop = 220*5.28\100 = 11.61V

Voltage at the load end = Applied voltage – voltage drop = 220 – 11.61 = 208.39V

After bifurcation voltage increase at the load end.

Voltage increase at the load end in volt = 208.39 -195.67 = 12.72V

The voltage at the load increased by 12.72 volts i.e. 6.5% increases in voltage.

TABLE 3 SHOW 11 KV UCHA VILLAGE BEFORE BIFURCATION VOLTAGE DROP

Portion	Length in KM	KVA	ACSR 13mm2	ACSR 20mm2	ACSR30mm2
A-B	0.340	3000.9	-	-	1020.64
B-B'	0.100	2918.9	-	-	291.89
B'-C	2.862	2908.9	-	-	8325.27
C-C'	0.049	2412.9	-	118.23	-
C'-D	0.050	2276.9	-	113.84	-
D-E	0.135	2276.9	-	307.38	-
E-F	0.141	2176.9	-	306.94	-
F-G	0.122	2113.9	-	257.89	-
G-H	0.154	2013.9	-	310.14	-
H-I	0.100	2013.9	-	201.39	-

I-J	0.300	1950.9	-	585.27	-
J-K	0.443	1618	-	716.77	-
K-L	0.096	1379	-	132.38	-
L-M	0.297	1216	-	361.15	-
M-N	0.058	1153	-	66.87	-
N-O	0.050	1053	-	52.65	-
O-P	0.147	809	-	118.92	-
P-Q	0.186	809	-	150.47	-
Q-R	0.099	809	80.09	-	-
R-S	0.181	709	128.32	-	-
S-T	0.200	646	129.2	-	-
T-U	0.098	485	47.53	-	-
U-V	0.144	308	44.35	-	-
V-W	0.396	208	82.36	-	-
W-X	0.073	145	10.58	-	-
X-Y	0.434	120		52.08	-
Y-Z	0.306	20		6.12	-
Z-Z'	0.150	10		1.5	-
			522.83	3859.99	9637.8

Table 3 show 11 KV Ucha village feeder portion, Length in km, KVA rating & various size of conductor.

Total voltage drop = $\sum$ An*Fn

522.83*0.1439+3859.99*0.0992+9637.8*0.066275.23+382.91+638.02=1096.16

Feeder voltage drop = Total voltage drop * 100/(System Voltage – Total voltage drop)

1096.16*100\(11000-1096.16) = 11.06%

TABLE 4 SHOW 11 KV UCHA VILLAGE KVA RATING AFTER BIFURCATION VOLTAGE DROP

Portion	Length in KM	KVA	ACSR 13mm²	ACSR 20mm²	ACSR 30mm²	ACSR 48mm²
A-B	0.340	2276.9	-	-	-	774.44
B-B'	0.100	2276.9	-	-	-	227.69
B'-C	2.862	2276.9	-	-	-	6516.48
C-C'	0.049	2276.9	-	-	-	111.56
C'-D	0.050	2276.9	-	-	-	113.84
D-E	0.135	2276.9	-	-	-	307.38
E-F	0.141	2176.9	-	-	-	306.94
F-G	0.122	2113.9	-	-	-	257.89

G-H	0.154	2013.9	-	-	-	310.14
H-I	0.100	2013.9	-	-	-	201.39
I-J	0.300	1950.9	-	-	-	885.27
J-K	0.443	1618	-	-	-	716.77
K-L	0.096	1379	-	-	-	132.38
L-M	0.297	1216	-	-	-	361.15
M-N	0.058	1153	-	-	-	66.87
N-O	0.050	1053	-	-	-	52.65
O-P	0.147	809	-	-	-	118.92
P-Q	0.186	809	-	-	-	150.47
Q-R	0.099	809	-	-	-	80.09
R-S	0.181	709	-	-	128.32	-
S-T	0.200	646	-	-	129.2	-
T-U	0.098	485	-	-	47.53	-
U-V	0.144	308	-	-	44.35	-
V-W	0.396	208	-	-	82.36	-
W-X	0.073	145	-	-	10.58	-
X-Y	0.434	120	-	52.08	-	-
Y-Z	0.306	20	-	6012	-	-
Z-Z'	0.150	10	-	1.5	-	-
				59.7	442.34	11692.32

Table 4 show 11 KV Ucha village feeder portion, Length in km, KVA rating & various size of conductor

From equation (1)

Total voltage drop = $\sum$ An*Fn

59.7*0.0992+442.34*0.0662+11692.32*0.0442 5.92+29.28+516.80=552.00

Feeder voltage drop = Total voltage drop * 100/System Voltage – Total voltage drop

552*100\11000-552=55200\10448=5.28%
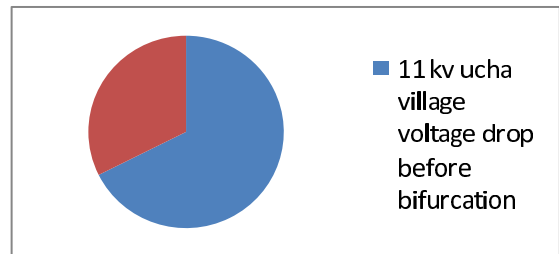
Fig. 4 Graph of Ucha village before & after bifurcation
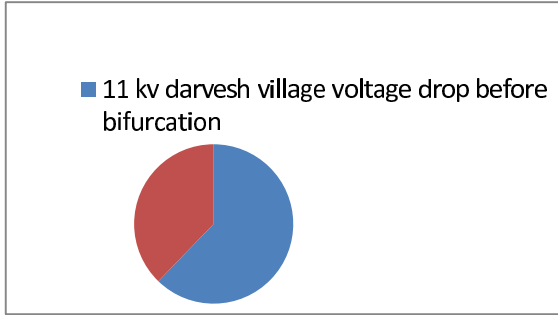
Fig. 7 Graph of darvesh village voltage drop before and after bifurcation

Similarly Voltage drop before Bifurcation of the Darvesh village Feeder or network

Voltage drop before Bifurcation = 4.76%

Voltage drop after Bifurcation = 2.89%   The voltage at the load increased by 4.17 volts i.e. 2% increases in voltage
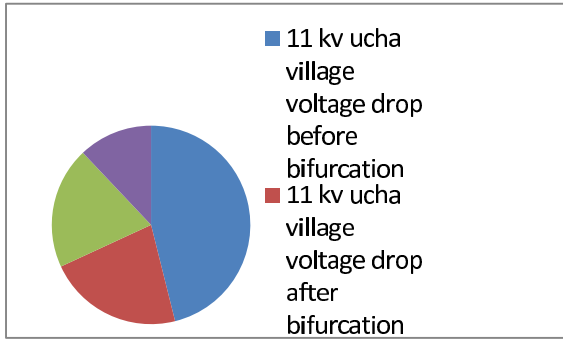
Fig. 8 Comparison of Ucha & Darvesh village voltage drop before & after
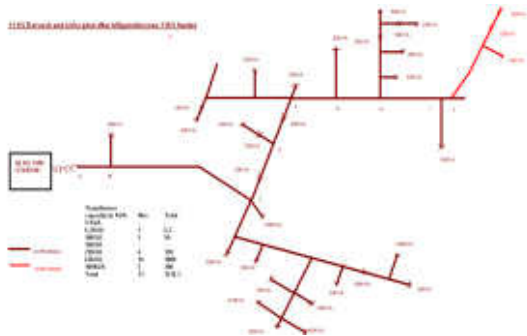
Fig. 9 11 KV new feeder after bifurcation

TABLE 7 COMPARISON OF UCHA & DARVESH VILLAGE VOLTAGE DROP BEFORE & AFTER BIFURCATION

S. No.	Village	Voltage drop before bifurcation in %	Voltage drop after bifurcation in %

| 1 | Ucha | 11.06 | 5.28 |
| 2 | Darvesh | 4.76 | 2.89 |

11 KV Darvesh and Ucha village feeder after bifurcations new 11 KV Feeder voltage drop

New 11 KV feeder voltage drop is 1.54%

Voltage drop = 1.54%

Applied voltage = 220V

Voltage drop = Applied voltage * Voltage drop\100 voltage drop in volt = 220*1.54\100 = 3.38volt

TABLE 8 11 KV UCHA & DARVESH VILLAGE FEEDER AFTER BIFURCATION NEW 11 KV FEEDER VOLTAGE DROP

Position	Length in km.	KVA	ACSR 20 mm sq.	ACSR 30 mm sq.	ACSR 48 mm sq.
A-B	0.340	1514.3		-----	514.86
B-C	1.660	1451.3		-----	2409.15
C-D	0.200	935		-----	187
D-E	0.150	809		-----	121.35
E-F	0.160	784		-----	125.44
F-G	0.116	548		-----	63.56
G-H	0.117	485		-----	56.74
H-I	0.119	236		-----	28.08
I-J	0.243	136		-----	33.04
J-K	0.885	136	120.36	-----	
K-L	0.235	126	29.61	-----	
L-M	0.207	63	13.04	-----	
Total		=		163.01	3539.07

.Total voltage drop = ∑ An*Fn

10.79+156.42=167.21 Feeder voltage drop =1.54%

III. CONCLUSION

This topic addresses the problem of feeder reconfiguration in the context of feeder loss reduction. The network reconfiguration of distribution system is to recognize beneficial load transfer so that objective function composed of power losses in minimized & prescribed voltage limits are satisfied. The proposed method determines the proper system topology

that reduces the power loss according to a load pattern. After bifurcation as the feeder becomes new & fault finding are easy. It reduces the shutdown time. When there is addition of load at the load centre then power transformer & other equipments can be easily augmented

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Multiple Phase Power Transmission System (6-Phase)

Vijay H Agrawal
Dept. of Electrical Engg
Babaria Institute Of Technology
avijayagrawal@gmail.com

Parth M Patel
Dept. of Electrical Engg.
Babaria Institute Of Technology.
spr_4560@yahoo.com

Dipesh. M. patel
Dept.of Electrical Engg
Babaria Institute Of Technology.
dipesh_ee@yahoo.co.in

Abstract:-High phase order transmission system is being considered a viable alternative for increasing the power transmission capability of overhead electric power transmission over existing right-of-way. This paper presents is analysis of six-phase transmission system.

Keywords :- Six Phase Transmission System

I.   INTRODUCTION:

The concept of six phase transmission lines was introduced by Barns & Barthold during 1972. Six phase power system is a part of multiphase power system. Due to harmonics effect and various other reasons, six phase systems and six phase machines are not popular but six phase transmission lines are more popular due to its increased power transfer capability by $\sqrt{3}$ [(or)1.732] times, maintaining the same conductor configuration, rights of way.

This increase in power may be coupled with a decrease in electric and magnetic field strengths for certain configurations and reduction in radio and audible noise levels. For the HPO Demonstration Project, a 6-phase system was selected since it represents an optimum between the proportional increase in loading and the proportional increase in surge impedance obtained by increasing the number of phases with the increase in power transfer capability[3]. In 1978 the U.S. Department of energy sponsored a project for the construction and testing of experimental 6 and 12 phase lines. As a part of this project, new high phase order tower, insulators and insulator spacer designs were developed. Test lines have successfully shown practical and simple constructions for 6-phase transmission and proved all advantages predicted before[4]

Method of obtaining 6ϕ supply from 3ϕ s Phase and line voltage relations:

Figure 1 shows three phase to six phase conversion

Consider V line between V_a and $V_{c'}$ then from fig 2

$$V_{line} = V_a - V_c' = \left|V_a\right| = \left|V_l'\right| = V_{ph}$$

From equilateral triangle M N K

Since MN = KN = V_{ph} and the line voltage

$$V_{line} = V_L = Vph$$
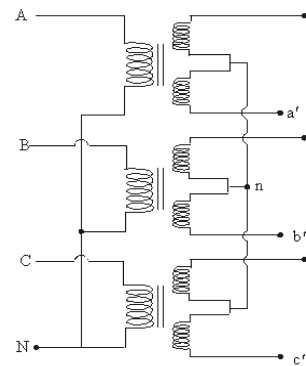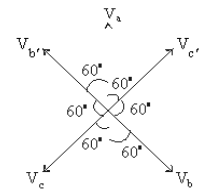
Fig1. Three to Six Phase Connections
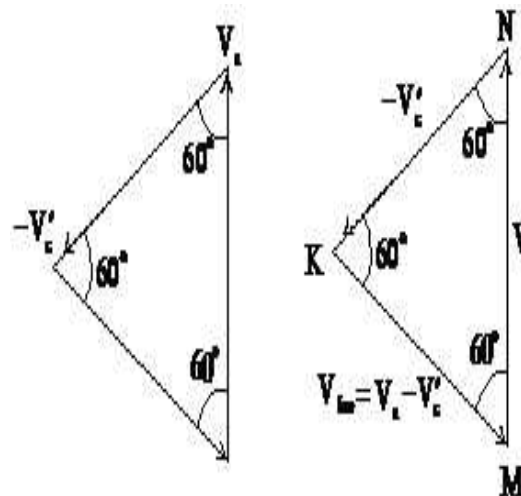
Fig 2. Phasor Diagram

II.   PHASE TRANSMISSION TOWER & TRANSFORMER CONNECTION

The 6-phase line was modeled as double circuit 138kV line that had been up rated to 138kV 6-phase to provide additional transmission capability. The construction of the tower is shown

in the above figure. The figure below that represents the connection of two transformer banks consisting of six single phase transformers that are used for the three- to six-phase .

A. Power transfer capability:

Consider 3 practical cases as follows:

1.   : 138 KV, 3 phase double circuit line configuration

2.   : 230 KV, 3ph transmission line configuration

3.   : 138 KV, 6 phase transmission line configuration

To convert the existing 3phase double circuit line to 6phase transmission line with little modification of the terminal equipment in the substations to provide 3phase / 6phase transformer etc., without changing the transmission towers, without additional rights of way etc,. Then power transferred is

givenby

$$P_C = 6 \times 138 \times I_{ph} \cos\phi \qquad \ldots\ldots\ldots(1)$$

$$\therefore \quad \frac{P_B}{P_A} = \frac{230}{138} = 1.67 \qquad \ldots\ldots\ldots(2)$$

$$\text{and} \quad \frac{P_C}{P_A} = \sqrt{3} = 1.732 \qquad \ldots\ldots\ldots(3)$$

Thus from the above equations (2) & (3) it is clear that 6 phase option not only includes less expenditure but also improves the power transfer capability to 1.732 times i.e., 73.2 % more power can be transferred. On the other hand 230KV, upgraded option not only involves more expenditure due to the change in tower design and increased conductor spacing, but also improves the power transfer capability by 1.67 times only from eq. (2). Thus 6 phase line will have more power transfer capability at reduced cost.

B. Surge impedance loading (SIL) :

It is the power delivered by a transmission line to a purely resistance load equal in value to the surge impedance (Z_s) of the line.

$$Z_s = \sqrt{\frac{L}{C}}$$

Since the inductance of 6 phase line is about 90% of that of the 3 phase double circuit line Z_s is reduced for 6 phase line.

$$SIL = \sqrt{3} \cdot \frac{|V_R|}{\sqrt{3}Z_s} \cdot |V_R| \times 1000KW \qquad \ldots\ldots (4)$$

138 KV 6ϕ TRANSMISSION LINE TOWER

TRANSFORMER CONNECTION
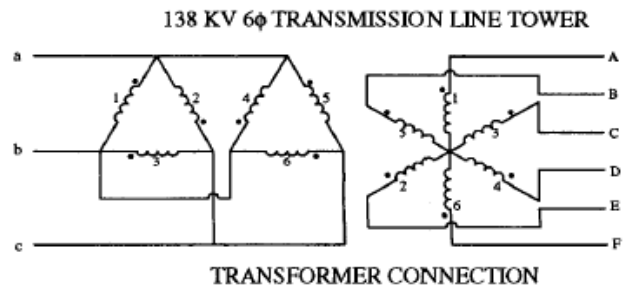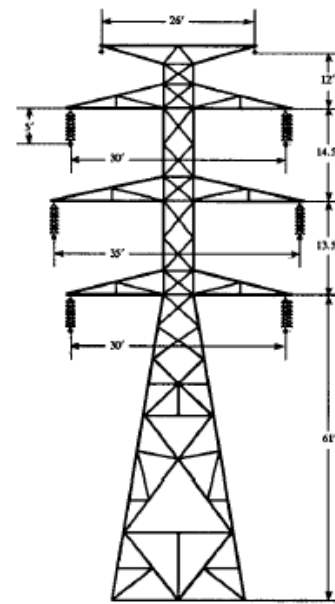
Fig 3 EHV Tower Configuration/transformer Connection

Where V_R = Receiving end line voltage

From eq. (4) since Z_s is less for 6 phase the surge impedance loading is more for 6 phase which is an advantage.

1. Thermal loading :

Thermal loading follows a straight line relationship with phase order. Thus if thermal loading is the criterion for circuit rating, the capacity increase is proportional to number of phases. Thus 6 phase systems will have more thermal loading which is an advantage.

2. Electric fields :

The electric field which is maximum at the conductor surface decreases with phase order whereas the ground electric field will be more since line voltage is equal to the phase voltage for enhanced power. For the same power transfer since the line voltage can be reduced the electric field between the two conductors will be less.

3. Radio & Audible noise :

It is proved that 6 phase transmission system will have less radio & audible noise compared to the 3 phase double circuit line.

4. Lightning performance

Number of lightning strokes to the line is reduced by 20% .
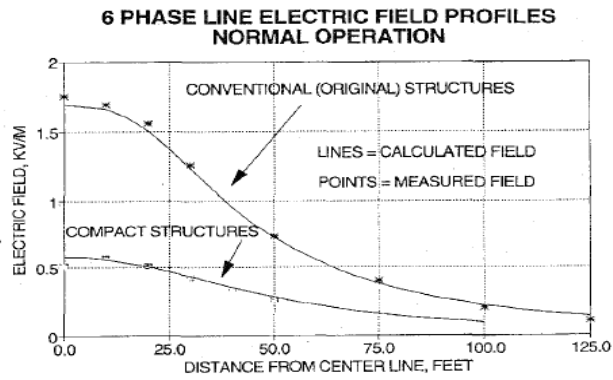
Fig 4 Electric Field Profile
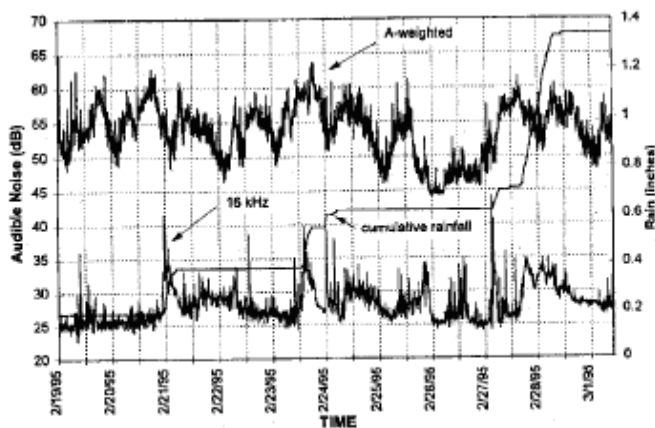
Fig 5 Audible Noise as the function of Time

5. Reliability Aspect: 6 phase line is said to have more reliability due to the   following reasons.

1. More power demand can be met at the load point since power transfer capability is more in 6 phase systems.

1.   Voltage regulation and efficiency are better.

6. Terminal Insulation Level :

Terminal insulation level will be slightly higher for six phase systems for enhanced power supply.

III. CONSTRUCTION OF 6-PHASE TRANSMISSION LINE

The diagram below shows the construction of Six-phase transmission , accomplished by installing transformers at either end of a double circuit transmission line which shifts one of the three-phase line. This results in a 6-phase line with each phase 60 degrees apart. Also the phase to ground voltage equals the phase to phase voltage.
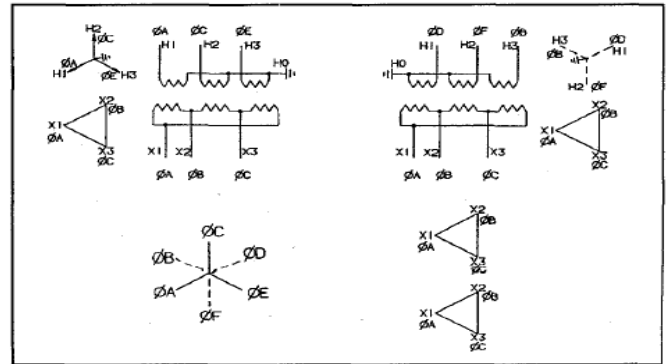
Fig 6 Transformer Connection For Six Phase Operation

Advantages:

1. For the same power flow capability, the phase to phase voltage is reduced by $\sqrt{3}$ times, allowing the towers to be built smaller and more compact

2. For the same phase to phase voltage the power flow capability could be increased by 73%.

3   Magnetic fields can be reduced.

IV. CONCLUSION

Six phase transmission technology provides a technique for reducing physical space requirements for transmission lines while providing a means for increasing power transfer capacity of a new or existing transmission corridor. The cost for constructing a new six-phase line versus a three phase line of the same voltage level is not excessive, particularly if physical constraints exist. In India, the 6-phase transmission system does not exist because there is no technical knowledge over the operation of the 6-phase systems.

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Solar Energy Scanning System

Vijayh. Agarwal
Electrical Engg Department
Babaria Institute Of Technology
avijayagrawal@gmail.com

Parth M.Patel
Electrical Engg Department
Babaria Institute Of Technology
spr_4560@yahoo.com

Dipesh M Patel
Electrical Engg Department
Babaria Institute Of Technology
dipesh_ee@yahoo.co.in

Abstract:- **Global Warming is the most serious effect on the environment as a result of rapid industrial growth and development to reach the energy demand. Solar energy is rapidly gaining notoriety as an important means of expanding renewable energy resources. As in industrial and domestic power more and more fossil fuel are burnt in a power plant which gives global warming, pollution and much other adverse effect on the environment.**

The project is about tracking, the solar raise to its optimum extent and utilizing them to maximum. Our project will include the design and construction of solar tracking system with an additional protective device named Anemometer

Keywords: **Solar Energy Tracking System, sustainable energy, Renewable energy**.

I. INTRODUCTION

In last two decades, environmental concerns, energy security and socio-economic benefits have brought clean energy to forefront. Clean energy's share in Indian energy mix is relatively small when compared to energy from fossil fuels. Central and federal governments are keen to promote use of clean energy and have formulated policies and incentives to attract investments from private and public sector companies.

The challenge however lies in just how much energy solar power would have to displace if it were to become the dominant source of energy in the world in 2006 according to the international energy agency 80.3% of the world energycame from Fossil fuel: oil (34.3%); Coal (25.1%) and Gas(20.9%). Fully 90.9% of the world's energy came from combustion; because alongside these fossil fuels in 4th place are "Combustible Renewable", mostly wood (10.6%). Include Nuclear power (6.5%) and hydro-electric power (2.2%) and you have accounted for 99.5% of the world's Most of this last half-percent of one percent of the world's energy, 41% is provided from geothermal sources. The energy that is available free and pollution free like, wind and solar, currently provides only 0.064% and 0.039% of the world's power requirements. Put another way, for solar energy achieve its potential and replace all other energy in the world, this 0.039% would have to increase to 2500 times.

Fig 1. Air pollution due to thermal power plant

II. LITERATURE RESEARCH

A. Technology of Solar Panel

Solar panels are devices that convert light into electricity. They are called solar after the sun or "Sol" because the sun is the most powerful source of the light available for use. They are sometimes called photovoltaic which means "light-electricity". Solar cells or PV cells rely on the photovoltaic effect to absorb the energy of the sun and cause current to flow between two oppositely charge layers [1].

A solar panel is a collection of solar cells. Although each solar cell provides a relatively small amount of power, many solar cells spread over a large area can provide enough power to be useful.[2] To get the most power, solar panels have to be pointed directly at the Sun.

The development of solar cell technology begins with 1839 research of French physicist Antoine-Cesar Becquerel. He observed the photovoltaic effect while experimenting with a solid electrode in an electrolyte solution. After that he saw a voltage developed when light fell upon the electrode.

According to Encyclopedia Britannica the first genuine for solar panel was built around 1883 by Charles Fritts. He used junctions formed by coating selenium (a semiconductor) with an extremely thin layer of gold.

Crystalline silicon and gallium arsenide are typical choices of materials for solar panels. Gallium arsenide crystals are grown especially for photovoltaic use, but silicon crystals are

available in less-expensive standard ingots, which are produced mainly for consumption in the microelectronics industry[4]

1.   Evolution of Solar Tracker

A solar tracker is a device onto which solar panels are fitted which tracks the motion of the sun across the sky ensuring that the maximum amount of sunlight strikes the panels throughout the day. When compare to the price of the PV solar panels, the cost of a solar tracker is relatively low.

Most photovoltaic (PV) solar panels are fitted in a fixed location- for example on the sloping roof of a house, or on framework fixed to the ground. Since the sun moves across the sky though the day, this is far from an ideal solution.

Solar panels are usually set up to be in full direct sunshine at the middle of the day facing South in the Northern Hemisphere, or North in the Southern Hemisphere. Therefore morning and evening sunlight hits the panels at an acute angle reducing the total amount of electricity which can be generated each day.
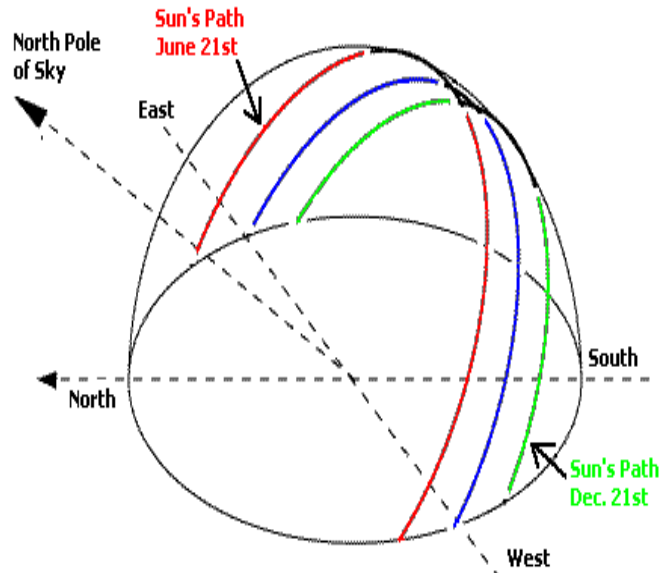
Fig.2: Sun's Apparent Motion

During the day the sun appears to move across the sky from left to right and up and down above the horizon from sunrise to noon to sunset. Figure shows the schematic above of the Sun's apparent motion as seen from the Northern Hemisphere.

The end-user will prefer the tracking solution rather than a fixed ground system to increase their earnings because:

1   The efficiency increases by 30-40%

2   The space requirement for a solar park is reduced, and they keep the same output

3   The return of the investment timeline is reduce

4   The tracking system amortizes itself within 4 years (on average)

B.   Energy Scenario in India

The major source of energy is coal and oil as specified in Figure 2: Energy Source & Uses**.** Coal, Oil, Gas, Hydro, Nuclear are the different fuel sources contributing to energy mix in India. As mentioned in fig 50.9% of power generated by coal, 34.4% of power generated by petroleum, 6.5% of power by Natural gas, and 1.7% of power is generated by nuclear energy. These types of resources create tremendous pollution and also these resources are limited to some extent also day by day the power demand is increasing. At this stage we have two options:

1. Use nuclear resources

2. Use solar and wind energy to produce electrical energy.

Fig.3 India's fuel share energy consumption, 2001

If we are concentrating towards Nuclear energy, it is dangerous and need more skilled persons to operate nuclear power plant. There are another big problem is that United Nations has not yet given permission for more use of nuclear resources.

So we have to concentrate on solar and wind. The geographical position of India is such a great factor to use solar energy and wind energy. Therefore Indian government is taking steps for use of the solar energy and wind energy. There is one

policy of govt in which huge factories have to install wind farms or solar farms. Also govt. gives subsidies for solar equipments.

C. Where does solar fit into the equation?

The challenge however lies in just how much energy solar power would have to displace if it were to become the dominant source of energy in the world in 2006 according to the international energy agency 80.3% of the world energy came from fossil fuel: oil (34.3%); coal(25.1%) and gas(20.9%). Fully 90.9% of the world's energy came from combustion; because alongside these fossil fuels in 4th place are "Combustible Renewable", mostly wood (10.6%). Include nuclear power (6.5%) and hydro-electric power (2.2%) and you have accounted for 99.5% of the world's energy!

Most of this last half-percent of one percent of the world's energy, 41% is provided from geothermal sources. The energy that is available free and pollution free like, wind and solar, currently provides only 0.064% and 0.039% of the world's power requirements. Put another way, for solar energy achieve its potential and replace all other energy in the world, this 0.039% would have to increase to 2500 times.

With the fluctuating high cost petroleum minimizing dependence on importing conventional energy resource, stewardship to protect the planet and providing affordable energy to all, countries including India have stepped up their energy path for harnessing indigenous renewable resources. To tap the infinite energy and transform as well as transmit it to each household, the Indian government has accelerated promotion of the use of universally available solar energy.
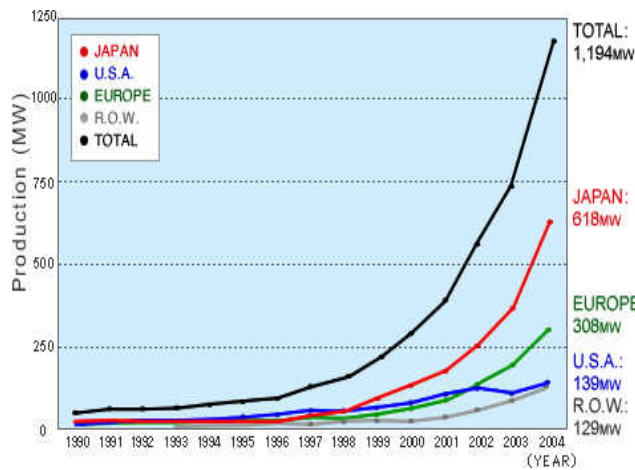
Fig 4: Country wise solar cell production vs. year

India due to its geophysical location receives solar energy equivalent to nearly, 5000 trillion KWH/Year, which is far more than the total energy compensation of the country today.

However India produces a very negligible amount of solar energy-a mere 0.2% compared to other energy resources. Power generation from solar thermal energy is still in experimental stages in India. Until now, India's energy base has been more on conventional energy like coal and oil. However, India has now attained 7th place world-wide in solar photovoltaic cell production and 9th place in solar thermal system. Grid interactive renewable power installed capacity as on 31/10/2006 aggregated 9013MW corresponding to around 7% of the total power installed capacity, which equates to over 2% of the total electricity.

The figure4 shows that the Japan is the leading country in the application of solar cell panels and they generate about 618MW followed by Europe who generates about 308MW, china about 200MW and USA about 139MW.

However the problem with solar power is that it is directly dependent on light intensity. To produce the maximum amount of energy, a solar panel must be perpendicular to the light source. Because the sun moves both throughout the day as well as throughout the year, a solar panel must be able to follow the sun's movement to produce the maximum possible power. The solution is to use a tracking system that maintains the panel's orthogonal position with the light source. There are many tracking system designs available including passive and active systems with one or two axes of freedom.
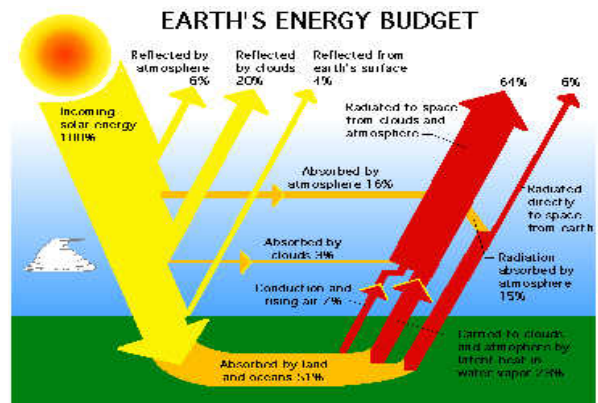
Fig 5: Earth's energy budget

D. What is Solar Tracker?

A solar tracker is a generic term used to describe devices that orient various payloads toward the sun. Payloads can be photovoltaic panels, reflectors, lenses or other optical devices.

Solar Tracking System is a device for orienting a solar panel or concentrating a solar reflector or lens towards the sun. Concentrators, especially in solar cell applications, require a high degree of accuracy to ensure that the concentrated sunlight

is directed precisely to the powered device. Precise tracking of the sun is achieved through systems with single or dual axis tracking.

In flat-panel photovoltaic (PV) applications trackers are used to minimize the angle of incidence between the incoming light and a photovoltaic panel. This increases the amount of energy produced from a fixed amount of installed power generating capacity. In standard photovoltaic applications, it is estimated that trackers are used in at least 85% of commercial installations greater than 1MW from 2009 to 2012.

Figure 7: Solar tracker

In concentrated photovoltaic (CPV) and concentrated solar thermal (CSP) applications trackers are used to enable the optical components in the CPV and CSP systems. The optics in concentrated solar applications accepts the direct component of sunlight light and therefore must be oriented appropriately to collect energy.

There are mainly two types of solar tracker on the basis of its movement.

1 Single axis solar tracker

2 Dual axis solar tracker

E. Single Axis Solar Tracking System

Single axis trackers have one degree of freedom that acts as an axis of rotation. The axis of rotation of single axis trackers is typically aligned along a true North meridian. It is possible to align them in any cardinal direction with advanced tracking algorithms.

Types of single axis solar trackers are as listed below:

 1. Horizontal single axis trackers (HSAT)

 2. Vertical single axis trackers (VSAT)

 3. Tilted single axis trackers (TSAT)

 4. Polar aligned single axis trackers (PSAT).

F. DUAL AXIS SOLAR TRACKER

Dual axis trackers have two degrees of freedom that act as axes of rotation. These axes are typically normal to one another. The axis that is fixed with respect to the ground can be considered a primary axis. The axis that is referenced to the primary axis can be considered a secondary axis.Dual axis trackers allow for optimum solar energy levels due to their ability to follow the sun vertically and horizontally. No matter where the sun is in the sky, dual axis trackers are able to angle themselves to be in direct contact with the sun.

Types of dual axis solar trackers are listed below:

1.   Tip-tilt dual axis trackers (TTDAT)

2.   Azimuth-altitude dual axis tracker (AADAT)

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Electrical Fault Diagnostics Using Thermal Imaging

Satnam Singh Matharu

CT Institute of Engg,Mgt & Technology

ssmatharu2002@yahoo.com

Abstract: - The integrity of a power system is of paramount importance when it supplies electricity throughout, especially during peak time. Overloading, load imbalance, corrosion and loose connection of electrical components can produce a thermal abnormality or hot spot resulting in   component temperature reaching beyond its limits. Early prevention is required to avoid future faults and increase the reliability of the electrical components.

Above Kelvin zero, all objects radiates infrared rays, which can be detected by IR camera. Thermograph is based on the detection of infrared radiation (IR) which is emitted by a body at temperature above zero Kelvin. Thermography converts infrared radiation into visible light in form of a thermal image which is map of the temperature field around the object's surface. The power of radiation depends on the radiant property of body. Thermo graphic cameras are used to perform these tests. The thermal image of the object can be easily seen on the screen because all temperatures are assigned by different colours. The paper focuses the fault diagnostic technique in electrical networks, transformers, substations or transmission lines using thermogaphy technique.

Keywords - .Thermography, Infrared radiation

I.   INTRODUCTION

The important objective for every power company is to provide proper maintenance for all electrical equipment under them. The maintenance can be classified under three different categories: when equipment malfunctions, time–based, and condition-based maintenance [1]. The most popular one is condition-based maintenance, i.e preventive maintenance. Infrared thermography technique is widely used in preventive maintenance for the advantage of carrying out quick, accurate, and wide area inspections by telemetry. It uses infrared sensors and optical lenses in a constructed electrical circuitry to capture images of thermal objects based on temperature variations. Infrared thermal camera stores the infrared pictures of the objects as thermal images that the human cannot see with naked eye in order to understand the inside conditions of the objects. With the thermographic images, inspectors can analyze the temperature variations of any objects to look for defective parts.

 The Infrared thermography technology is a non-destructive inspection technique [2]. The inspection can be conducted efficiently by keeping a distance from the inspected equipment. There is no need to halt equipment operation while an inspection is going on. Since the collection of information for inspection is by telemetry, hazardous operations can be avoided [3]. It can examine the damaged condition of the joint connectors, insulators, lightening arresters & cross arms etc.

For these reasons, Infrared thermography can be widely implemented for many applications involving preventive maintenance [4]. The new technique presented in this paper prevents damage of power transmission lines, transformers, substations & distribution networks to avoid any blackouts before it occurs resulting in huge saving of revenue.

II.   BASIC IDEA OF THERMAL IMAGING

Infrared radiation is electromagnetic radiation of a wavelength longer than visible light wavelength, but shorter than that microwaves. It's name means "below red", because of red being the colour of visible light with the longest wavelength. Infrared radiation has wavelengths between about 750 nm and 1 mm, spanning five orders of magnitude. Thermographic cameras detect radiation in the infrared range of the electromagnetic spectrum(roughly 900–14,000 nano-metres   and produce images of that radiation.

According to black body radiation law, infrared radiation is emitted by all objects based on their temperatures & emissivity (Which is expressed as Ratio of radiation emitted by object at certain temperature, to the radiation emitted by black body at same temperature). More   the emissivity, more the material radiate infrared energy. Thermography makes it possible to see environment with or without visible illumination.
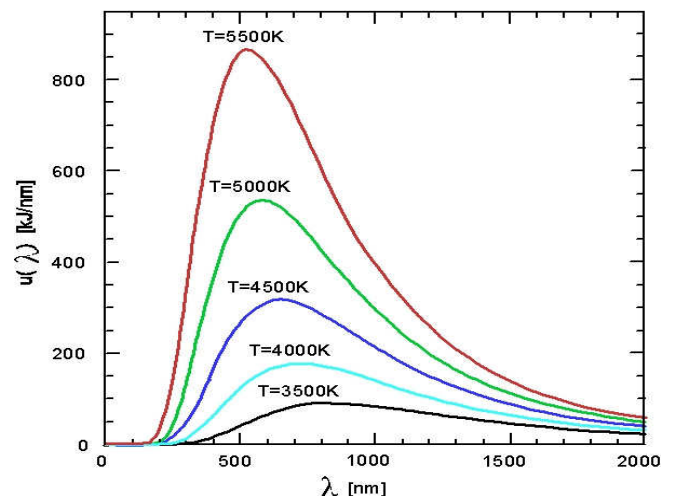
.Fig 1. The wavelength corresponding to the peak emission in various blackbody spectra as a function of temperature

The amount of radiation emitted by an object increases with temperature, therefore thermography allows one to see variations in temperature. When viewed by thermographic camera, warm objects stand out well against cooler backgrounds; humans and

other warm blooded animals become easily visible against the environment, day or night. For inspection, the diagnosis system needs to be first find a hotspot & to choose a reference point from neighbourhood of the connecting point i.e. on same structure & similar feathers, then pinpoint the actual fault location.

Thermographic Camera

A thermographic camera, also called as FLIR (Forward Looking Infrared), or an infrared camera, is a device that forms an image using infrared radiation (IR), similar to a common camera that forms an image using visible light. (Instead of the 450–750 nanometre range of the visible light camera), infrared cameras operate in wavelengths as long as 14,000 nm (14 μm) as shown in Fig.1. Cameras create a thermal image of observed target, generally in scale from black (coolest) through red to white (hottest), and also provide on the image a reference scale. Thermographic cameras can be broadly divided into two types: those with cooled infrared image detectors and those with uncooled detectors.
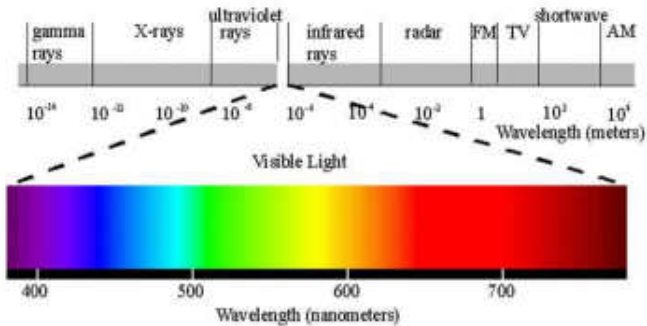
Fig II. Light spectrum.

The thermal images of all electrical panels and other high load connection points such as drives, disconnections, controls & loose connections is to be collected with the help of IR Cameras. Wherever you discover higher temperatures, follow that circuit and examine associate branches and loads. Compare all three phases' side-by-side and check for temperature differences. More heavily loaded phases will appear warmer. The reason, hot conductors may be undersized or overloaded.

However, unbalanced Objects that have high emissivity emit thermal energy well and are not usually very reflective. Materials that have low emissivity are usually fairly reflective and do not emit thermal energy well. This can cause confusion and incorrect analysis of the situation if you are not careful.

A thermal imager can only accurately calculate the surface temperature of an object if the emissivity of the material is relatively high, and/or the emissivity level on the imager is set close to the emissivity of the object. Look for connections that have higher temperatures than

other similar connections under similar loads. That could indicate a loose, over tightened, or corroded connection with increased resistance.

Connection-related hot spots usually, but not always, appear warmest at the spot of resistance, cooling with distance from that spot. In some cases a cold component is abnormal due to the current being shunted away from the high-resistance connection.

III. CASE STUDY THREE PHASE UNBALANCED LOAD

From the distribution board, the image was collected with the help of thermographic camera as shown in figures below.

Fig III Image capturing with IR camera
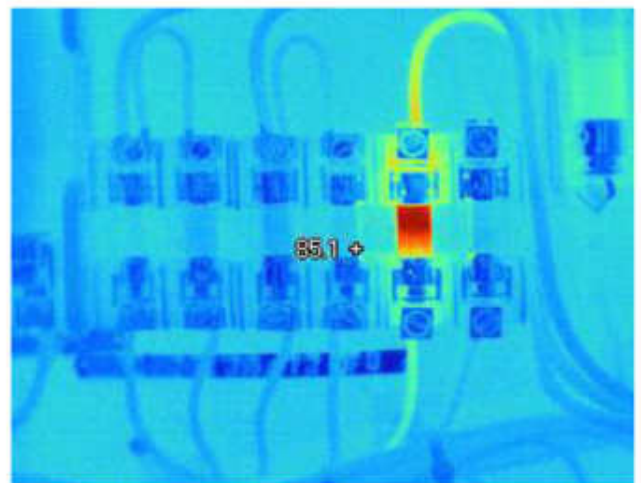
Fig IV Captured Image of Fuse Box.

The captured image in Fig IV above clearly shows that one of fuse along with connecting cable shows hot spots When evaluating an electrical hot spot, notice whether the

heat continues back along the wire toward the load or is isolated to the connection.

You may also find broken or undersized wires or defective insulation. The NETA (InterNational Electrical Testing Association) guidelines say that when the difference in temperature (DT) between similar components under similar loads exceeds 15 °C (~25 °F), immediate repairs should be undertaken.

The similar images were collected from the string insulator connected to transmission line poles. The faults likely to be arising in future can be easily avoided with this type of preventive inspection which are required to be carried out at certain interval of times regularly.
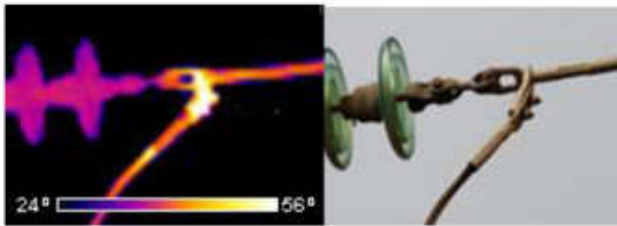
Fig V Insulator Thermal/original image
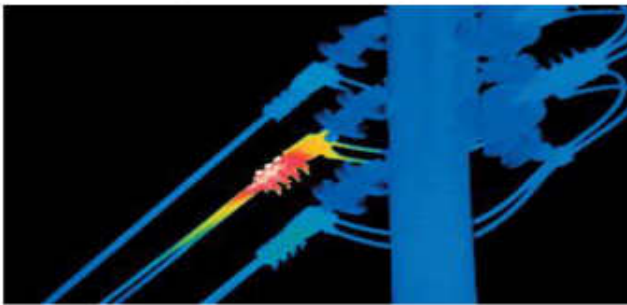
Fig. VI Thermal Image of Transmission line Pole

Fig. VII Transmission Line Pole Image

IV. PROPOSED AUTOMATIC PROTECTION CIRCUIT

A color sensor is used to pick up different colors from the thermal image of thermographic camera and if a hotspot is detected it will automatically generate alarm. Fig. below shows thePictorial view of automatic hotspot protection system which uses a thermal image camera to generate thermal image, programmable color sensor to detect color which can be programmed to detect hotspot color i.e. yellow bright color.

Fig.VIII Pictorial Diagram of proposed circuit

A microcontroller (8051) to program the system for detecting hotspot from thermal image on camera and a PLC system whose input is a signal from microcontroller and PLC output is used to energized the contactor or circuit breaker, which further cut off the power supply to the system in case Pre condition of fault,resulting in to save the costly equipment/Installations.

V. CONCLUSION

Enhancing and preserving system reliability and reducing maintenance costs are top priorities for electric utilities today. The thermal image camera to inspect the system deficiencies for overhead transmission lines / distribution systems or any electrical installation helps to save costly equipments by detecting the high temperature normally caused by the heat due to bad contacts or high resistance of connection points, which can be cured easily. Concluding, infrared inspections of electrical systems are beneficial to reduce the number of costly equipment failures and unscheduled plant shutdowns leading to the improvement of system efficiency and power quality.

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Wireless Power Transmission using Magnetic Resonance

Karan V. Bhavsar
Dept.Electrical Engineering
Babaria Institute of Technology
karan.bhavsar@hotmail.com

Rudresh S. Chauhan
Dept.Electrical Engineering
Babaria Institute of Technology
rudresh1893@gmail.com

D. M. PATEL
Dept.Electrical Engineering
Babaria Institute of Technology
dipesh_ee@yahoo.co.in

Abstract :- Wireless electricity transmission is based on strong coupling between electromagnetic resonant objects to transfer energy wirelessly between them. This differs from other methods like simple induction, microwaves, or air ionization. The system consists of transmitters and receivers that contain magnetic loop antennas critically tuned to the same frequency. Due to operating in the electromagnetic near field, the receiving devices must be no more than about a quarter wavelengths from the transmitter.

Unlike the far field wireless power transmission systems based on travelling electro-magnetic waves, Wireless Electricity employs near field inductive coupling through magnetic fields similar to those found in transformers except that the primary coil and secondary winding are physically separated, and tuned to resonate . This paper deals with possibility of power transmission for smaller distances, without having any physical connection among generating station & receiving load ends.

Keywords— Wireless Electricity Device, Oscillating magnetic Field, Resonant Magnetic Coupling, Magnetic Resonance Imaging .

I. INTRODUCTION

Wireless power transfer technology enables various electronic devices, such as mobile phones, game controllers, laptop computers, mobile robots, and implantable devices, to be charged without connectors or cables, which is more convenient and environment friendly [1,2]. Inductive coupling and resonant coupling have been two main methods for wireless power transfer [3].An inductively coupled power transfer system has a pair of coupled coils. At the transmitting side, an alternating current flows through a coil, generating a

magnetic field. A receiving coil, which is close enough to the primary coil, picks up the field and generates a current to save power. According to previous studies, the effective operating range is usually less than 30 % of the diameter of coils [4].

To communicate between power transmitters and power receivers, the systems generally use load modulation because they are constructed on the same principle as inductive coupling [5]. A magnetic resonant coupling system uses a pair of coupled coils with additional capacitance, which makes the transmitter and the receiver have the same resonant frequency. It enables a highly efficient energy transmission over a longer distance compared to inductively coupled schemes [2].

In addition, an expanded operating range from centimetres to several meters allows more than two devices to be charged at the same time. Therefore these systems require a

communication protocol not only for identifying devices but for networfcking and control. Communication protocols in wireless power transfer systems, however, have hardly been discussed in previous studies [6-8]. In this work, we propose a wireless communication and wireless power transceiver system based on magnetic resonant coupling. The same frequency band and loop antenna is shared for power transmission

II. SYSTEM ARCHITECTURE

With all the necessary background research completed, it became clear what basic design components the entire system would require. The block diagram of the proposed system is shown below. First we needed a method to design an oscillator, which would provide the carrier signal with which to transmit the power. Oscillators are not generally designed to deliver power, thus it was necessary to create a power amplifier to amplify the oscillating signal. The power amplifier would then transfer the output power to the transmission coil. Next, a receiver coil would be constructed to receive the transmitted power. However, the received power would have an alternating current, which is undesirable for powering a DC load. Thus, a rectifier would be needed to rectify the AC voltage to output a clean DC voltage. Finally, an electric load would be added to complete the circuit design
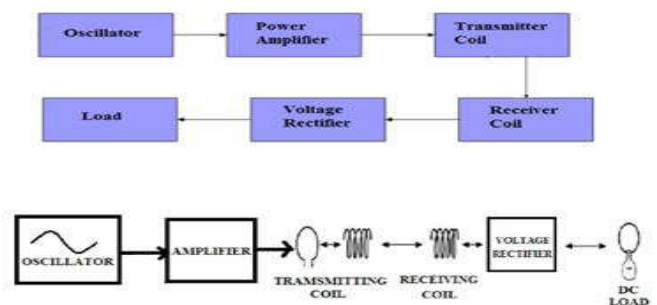
Fig 1 Block Diagram of System
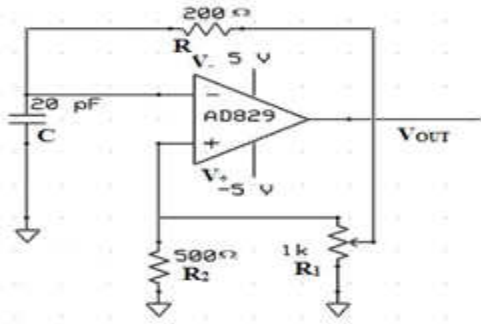
Fig 2 Oscillator
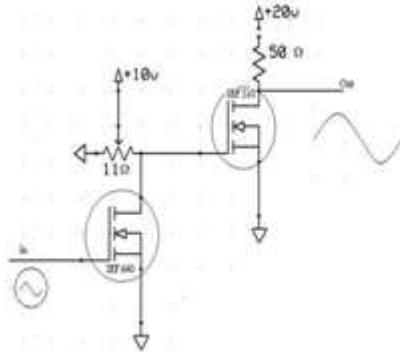
Fig 3. Power Amplifier
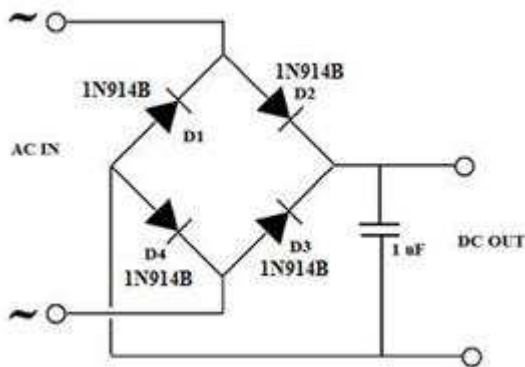
Fig. 4 Rectifier Circuit

Fig. 5 Resonant Coils

III. RESULTS AND MEASUREMENTS:

At a distance of 0.18 cm between the two coils, we were able to transmit enough power to power a 40 W light bulb. As the distance of separation between the coils was increased, the bulb got dimmer. It was evident from this simple experiment itself that the power transmitted was related to the distance of separation between the coils. To demonstrate the presence of evanescent waves being produced which transferred power from the transmitter coil to the receiver coil, we measured the voltage across the 40 Watt light bulb at varying distances and orientations. We took measurements starting at a distance of 0.5 m between the coils in 10 cm increments up to a distance of 2 m of separation. We found that the resonant frequency changed with distance due to the imperfect match in the resonant frequencies of our coils. The frequency was then adjusted to find the maximum output voltage at every measurement.

IV. VARIOUS CONFIGURATIONS & THEIR REPRESENTATIONS

Fig.6. Parrallel Resonance Configuration
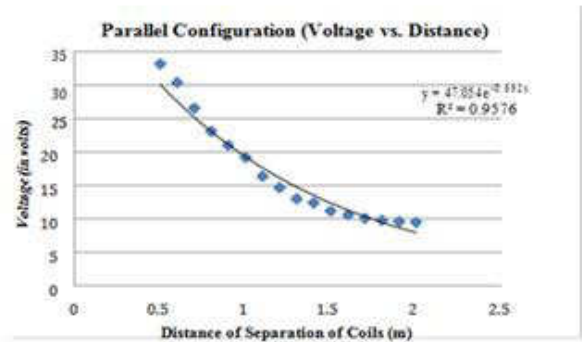
Fig 7 Voltage Verses Distance

As the distance between two coils increasing the voltage induced correspondingly decreasing. Since the coefficient of determination (R^2) has a value close to 1 for the exponential fit, the data points were strongly exponentially correlated. In other words, the voltage decayed exponentially as the distance of separation between the coils was increased. This illustrates the theory of power transmitted through evanescent waves that decay exponentially as the distance between the coils was increased.

Fig 8. Perpendicular Configuration
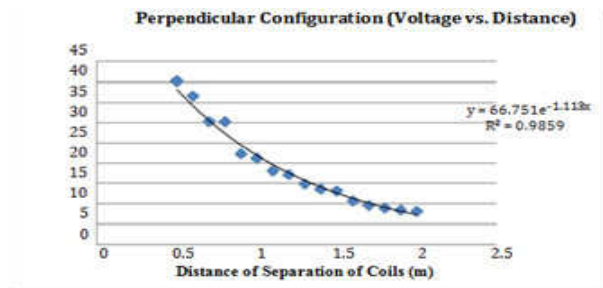
Fig.9 Voltage verses distance graph for Perpendicular configuration

In this case, the value of the coefficient of determination (R^2) is closer to 1 than when the coils were placed parallel to each other. The strong exponential correlation in this case also illustrates the exponential decay of evanescent waves propagating from the transmitting coil to the receiving coil.

V. Conclusions

At the end of the research, we were able to design a system for transmitting watts of power wirelessly from the transmitting coil to the receiving coil that was enough to light We were able to design discrete components such as the relaxation oscillator, switch mode-power amplifier and a full bridge voltage rectifier for the system design process. We also managed to demonstrate evanescent waves by measuring exponential decay of voltage as an increase in distance between the transmitter and the receiver coils.

VI. Acknowledgment

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Wake Up Call For Dopey Grids

(Smart Grids are no more a Luxury)

Anil Kumar Uppal
State Power Utility
Punjab, India.

Abstract— Traditional Electric Grids are suffering from obsolete technologies. They are neither reliable nor efficient. Their Electromechanical base mainly requires manual operations. They generally depend upon one-way communication. Recent power failures of very long durations in the Regional Grids have raised alarm. Today is the era of Smart Devices and Smart Processes. Power Sector can no more afford laxity. With the growing hunger for quality electric supply, It is now impossible to manage loads and congestions manually. Almost all State Utilities are struggling hard to reduce Aggregate Technical and Commercial Losses. Revenue leakages are draining the Utilities. The Consumers are suffering and raising great hue and cry. Traditional Thermal Plants are being constantly blamed for increased environmental pollutions. The most viable solution for all this chaos is undoubtedly advent of Smart Grids.

Keywords—Smart Distribution Management System, Advanced Metering Infrastructure, Smart Demand Control, Demand Response, Business Intelligence, Renewable Energy Integration, Smart Grid Standards.

I. INTRODUCTION

'Blackout" or power failure for longer duration dreads the most. Life gets jammed due to jammed Electricity Grids. Existing conventional grids are fast aging. They are suffering from insufficient capacity. They are neither reliable nor secure. They depend upon Centralized Power Generation which may not be friendly to our environment. Their pure electromechanical operational features do not allow fully automatic restorations. Their sensing mechanisms are crude and not sufficiently dependable. They lack required interaction among various grids and consumers as they use one way communication only. Their passive behavior makes them highly prone to failures. High **AT&C Losses** (Aggregate Technical and Commercial Losses) are making them unaffordable.

Today we use and talk of smart phones, smart TVs, smart cards, smart classes, smart cars, smart homes and what not. There is now absolute need of replacing the existing dull and drowsy interconnected electric network with intelligent and ever active network. We need automation to measure as well as control to and fro flow of power from one grid to another as well as consumers on real time basis. It is now almost impossible to manage loads and congestions manually. Quality and reliability of electric supply can no more be compromised. Uncalled-for outages of electric supply have to be minimized. Revenue leakages are to be plugged. Polluting generating plants are to be substituted as well as supplemented with green sustainable energy sources which may be of smaller capacities.

To achieve all this and reap many more benefits Smart grids are now cry of the day.

S.M.A.R.T. originally stands for Self Monitoring, Analysis and Reporting Techniques but now it is commonly used for intelligent automated digital net connectable devices and processes. The interconnected network to deliver power can be a local grid, state grid, regional grid or national grid. Grids when made smart can have all the features one can think and name. Thus broadly smart grid is the result of integration of Electrical Technology - Information Technology - Communication Technology (**ICT**).
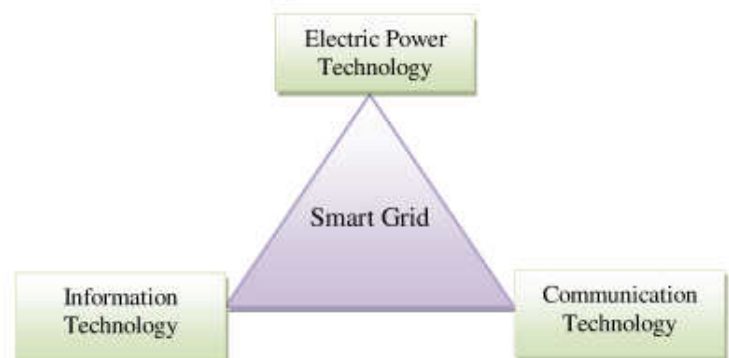
Fig 1 Block Diagram Of IET based smart grid

List of the features of smart grids is becoming lengthy day by day. Smart devices boast less and do more so it is also important to know the popular abbreviations used frequently in the case of smart grids.

A smart grid can have more or less the following packs:

1. SDMS (Smart Distribution Management System)
2. AMI (Automated or Advanced Metering Infra structure)
3. SDC (Smart Demand Control)
4. SCC (Smart Control Center)
5. STS (Smart Transmission system)
6. SSS (Smart Substation System)
7. BI (Business Intelligence)
8. REI (Renewable Energy Integration)
9. MISC.(Miscellaneous)

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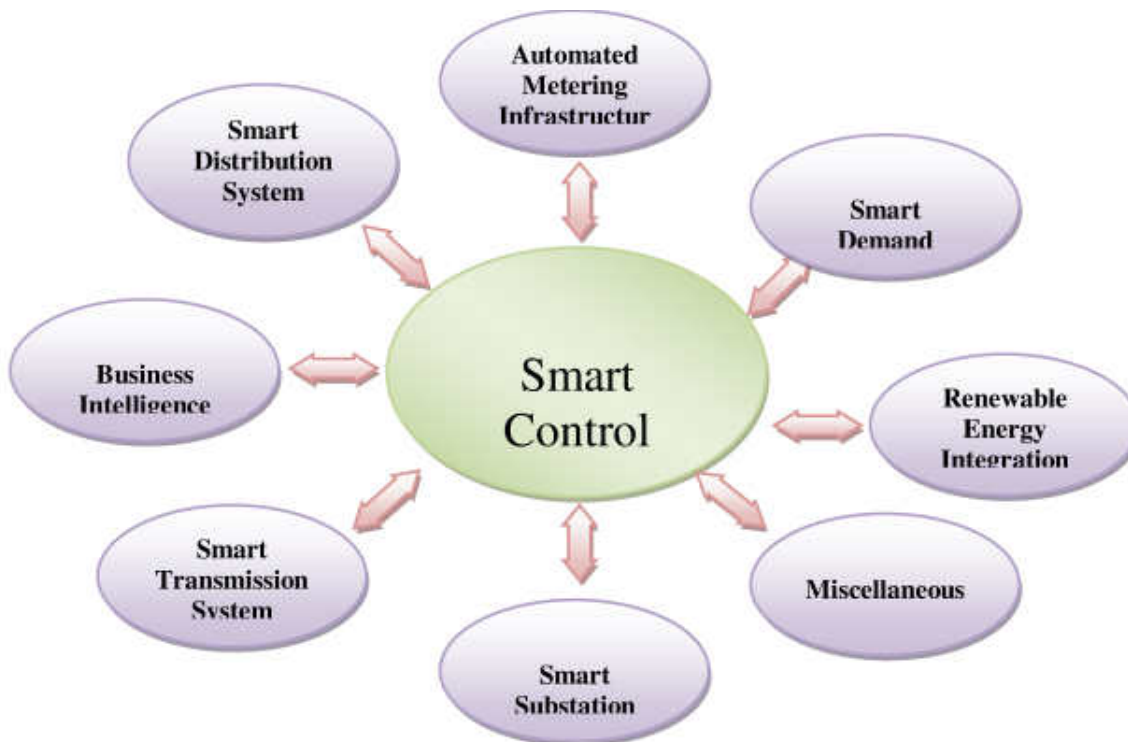
Fig.2 Feature Of Smart Grid

Smart Distribution Management System (SDMS) consists of all management tools namely **LMS** (Load Monitoring System), **NMS** (Network Monitoring System), **PLM** (Peak Load Management), **PQM** (Power Quality Management), **MDMS** (Meter Data Management System), **OMS** (Outage Management System). PLM is highly useful for increased available energy during peak times. PQM takes care of unbalanced voltage, flickering of voltage, harmonics, VAR etc. OMS deals with unscheduled outages of lines and distribution transformers so it comprises of FPI (Fault Passage Indicator), FLISR (Fault Location Isolation & System Restoration) and DMIU (Distribution Transformer Monitoring Unit). This pack essentially aims at reduction of AT&C losses. Another useful feature of this pack enables prompt action as per Short Term Load Forecast (**STLF**) say festivals, social events, brisk seasonal changes etc.

Advanced Metering Infrastructure (AMI) is the most important and most talked about feature of smart grids. High quality end- power meters are installed at high voltage lines for acquiring quality metering data at remote ends via **MDAS** (Meter Data Acquisition System). It may also deal with intelligent net meters for industrial, commercial, domestic and agricultural consumers. **GIS** (Geographical Information Sys) is used to have customer data at the remote end. Consumer Insight Unit (**CIU**) helps the customer to monitor his each appliance. Intelligent Home Displays (**IHD**) are used to develop reliable messaging system. This device can provide relevant and timely power related information to the consumers. Customer Web Portal (**CWP**) provides all

customer related information. Thus, monitoring of consumption pattern becomes easy. Spot recording and instant billing reduces travel and cost of payment collection. This smart system helps in using **Dynamic Tariff.**Hence, Tariffs like **ABT** (Availability Based Tariff), **TOUP** (Time of Use Pricing), **TODP** (Time of Day Pricing), **RTP** (Real Time Pricing) and **CPP** (Critical Peak Pricing) can yield better system control and revenue. Features like tamper detection can curb theft of electricity. In this way, commercial losses arising due to manual errors and short assessment can be reduced.

Smart demand control (SDC) consists of modules like **DR** (Demand Response) and **DS** (Demand Supply). Thus both supplier as well as customers remains transparent about their respective demands. This feature also empowers remote disconnection and connection of supply as per mutually agreed upon stipulations. Both customer and supplier are given choice to remain connected or disconnected through remote commands. This can help in load curtailment and control over bills.

Smart Control Center (SCC) is must for monitoring and governing the vast network of Smart Generating Stations (**SGS**), Smart Transmission System (**STS**), Smart Substation System (**SSS**) and Smart Distribution System (**SDS**). Main responsibility in this regard is generally taken by Load Dispatch Center on area basis (**ALDC**), state basis (**SLDC**), region basis (**RLDC**) and national basis (**NLDC**).

Business intelligence (BI) provides complete analysis to devise strategies and arrive at functional decisions. Metric or measurable Key Performance Indicators (**KPI**) is part of this intelligence.

Thermal plants are often blamed for pollution. Smart grids enable integration of Distributed Energy Resources (**DER**) i.e. small generators. This gives added benefit of using **Renewable Sources of Energy** (**RES-E**) namely solar power plants, wind power plants, tide energy power plants, geo energy power plants, micro hydro power plants etc. These green power plants can be tied with smart grids through **DESI** (Distributed Energy Source Integration) while controlling the injected harmonics.

Smart grids can have number of **Miscellaneous Add-ons**. Energy Accounting and Energy Audit can be conveniently done in smart grids. Maintenance schedules can be efficiently drafted and executed. Mobile gangs can be easily managed to attend faults in smart system. Asset management is very easy in smart grids and early warning of health of assets can be obtained. Smart grids are must for **RAPDRP** (Restructured Accelerated Power Development and Reforms Program).

Concept of smart grid is going to revolutionize the way electric power is generated, wheeled and consumed in India. Bureau of Indian Standards (**BIS**) is already developing Smart Grid Standards (**SGS**). Smart grids are sure to give huge boom to electronics, communication, IT and allied industries as well.

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Electrical Power Generation using Mixing Entropy Battery

Rajkumar Laxman Kodnani
Dept. Electrical Engineering
Babaria Institute of Technology
rajkodnani09@gmail.com

D. M. PATEL
Dept. Electrical Engineering
Babaria Institute of Technology
dipesh_ee@yahoo.co.in

Abstract— The salinity difference between seawater and river water is a renewable source of enormous entropic energy, but extracting it efficiently as a form of useful energy remains a challenge. Hence, a device called "mixing entropy battery", which can extract and store it as useful electrochemical energy is proposed. The battery, containing a Na2−x Mn5O10 nano rod electrode, was shown to extract energy from real seawater and river water and can be applied to a variety of salt waters. Energy extraction efficiencies of up to 74% were recorded. Considering the flow rate of river water into oceans as the limiting factor, the renewable energy production could potentially reach 2 TW, or 13% of the current world energy consumption. The mixing entropy battery is simple to fabricate and could contribute significantly to renewable energy in the future. In this paper, a novel electrochemical cell named a "mixing entropy battery", is investigated.

Keywords: Salinity-gradient power; mixing entropy; sodium intercalation; energy harvesting

I. INTRODUCTION

To date, this significant and completely renewable energy source has not been fully harnessed. Several types of technologies have been proposed in order to take advantage of this renewable energy source. Past suggestions for capturing energy from the mixing of seawater and freshwater include:

- Hydroelectric pile based on acidic and basic membranes;

- Pressure-retarded osmosis based on semi permeable membranes;

- Reverse electro dialysis based on ion selective membranes;

- Concentration electrochemical cells and devices exploiting differences in vapor pressures.

Nowadays, the most reliable methods use membranes as separator between the seawater and the freshwater, to prevent the mixing of the two streams. Therefore, the application of these technologies is strongly based on the energy efficiency, cost, and lifetime of the membranes themselves.

Solar energy drives this cycle, creating a significant salinity difference between seawater and freshwater. The entropic energy created by the difference in water salinities is normally dissipated when river water flows into the sea. This reduction in free energy due to the mixing is estimated at 2.2 kJ of free energy per liter of freshwater.

In this paper, a novel electrochemical cell named a "mixing entropy battery", which extracts energy from the difference in concentration of two solutions and stores it as chemical energy inside the electrode material's bulk crystal structure. This approach allows us to overcome the challenges of super capacitor electrodes based on activated carbon. This device consists of a reversible electrochemical system where the salts in the electrolyte are the reactants and the electrode stores ions. We employed two different electrodes: an anionic electrode, which interacts with Cl− ions selectively; and a cationic electrode, which interacts with Na+ ions selectively.

II. WORKING OF SYSTEM

These electrodes are initially submerged in a low ionic strength solution (river water) in their discharged states, when the electrode materials contain the respective ions incorporated in their structures. In this dilute solution, a small electric current is passed and the battery is charged by removing the Na+ and Cl− ions from the respective electrodes as shown in (Figure1).

Successively, the dilute electrolyte is exchanged for a concentrated solution (seawater), which is accompanied by an increase in the potential difference between the electrodes. At this higher potential difference, the battery is discharged, as the anions and cations are reincorporated into their respective electrodes (Figure3, step 3). The concentrated solution is then removed and substituted by the dilute electrolyte (river water), which results in a decrease in potential difference between the electrodes (Figure3, step 4). We note that the exchange of solution could also be carried out via a flow process, which could be attractive for large scale energy extraction.
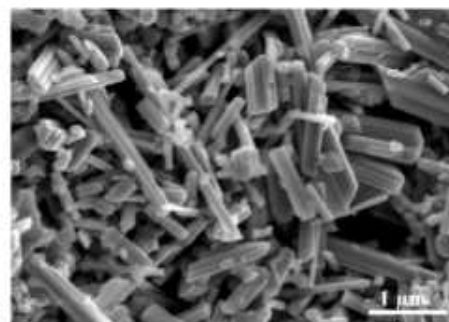
Fig1. Nanorods which are used as electrodes to increase the surface area of the electrodes.
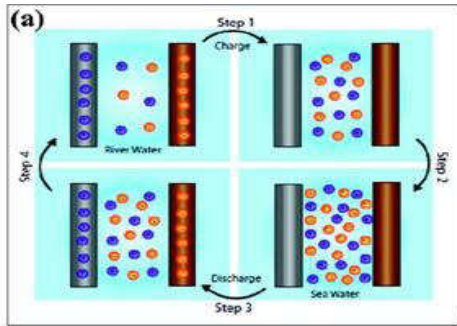
Figure 2 Proposed Battery
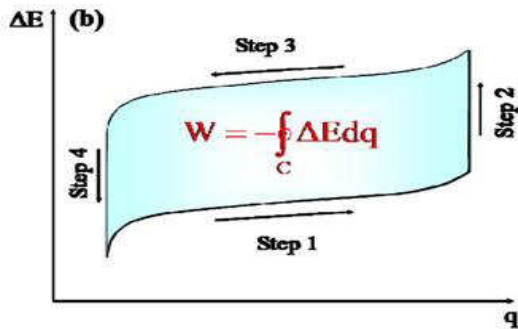
Figure 3.Entropy Diagram Working Principle

Typical form of a cycle of battery cell voltage (ΔE) vs. charge (q) in a mixing entropy battery, demonstrating the extractable energy.

This closed cycle produces energy, as shown by a schematic of the expected shape of the battery cell voltage (ΔE) versus charge (q) during one cycle is shown in figure 3. From entropy diagram it is observed that during steps 2 and 4 no energy is produced or consumed. During step 1, the battery requires energy to drive the ions out of the crystal structure, while during step 3 the battery produces energy by incorporation of the ions.

III. MATHEMATIC EQUATIONS

The energy gain is due to the fact that the same amount of charge is released in step 3 at a higher voltage than consumed in step 1. The energy gain is given by the integral along the cycle of the voltage with respect to the charge.

$$ W = - \oint_C \Delta E \, dq $$

The diagram below shows the pictorial view of the enrgy generated across the various parts of the globe
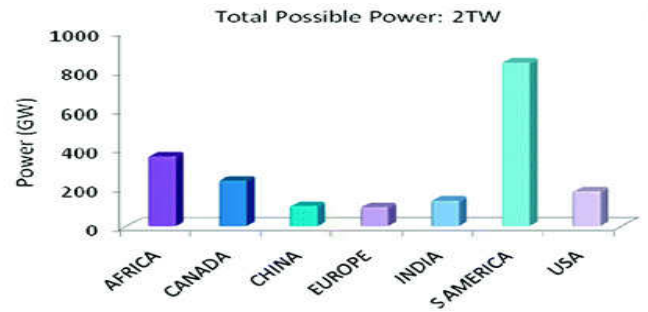
Figure IV. Power Generation across world

The extractable power from the difference of salinity of river and seawater that could be obtained in many different countries around the world is summarized in above figure. If the energy from mixing entropy was harnessed from all these rivers, the power obtained could reach up to 2 TW, which is 13% of the current total global energy requirement. This energy can also be easily harvested at low temperatures, and is completely renewable, since the ultimate source is the solar energy which powers the water cycle.

IV. SITE SELECTION

Anywhere freshwater enters the sea, such as river mouths or estuaries, could be potential sites for a power plant using such a battery. The theoretical limiting factor is the amount of freshwater available. We actually have an infinite amount of ocean water unfortunately we don't have an infinite amount of freshwater.

The mouth of the Amazon River, where the world's largest drainage basin flows into the Atlantic Ocean. A location such as this, where fresh and sea water mix, is a good spot for generating electricity with this battery. This can be implemented at Afsluitdijk in Netherlands. It is a fundamental part of the larger Zuiderzee Works. the Zuiderzee, a salt water inlet of the North Sea, and turning it into the fresh water lake of the Ijsselmeer.

V. CONCLUSION

In this paper, the energy from salt water and fresh water is harnessed to generate electrical power which is a very useful source of power generation and has no effect on environment. The power generated is of sufficient amount which can be used for various applications & the running cost of the generating plant is minimum.

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Feasibility of Standalone PV/DG/Battery Hybrid System

Vivek Panwar
Dept. of Electrical Engineering
PEC University of Technology
Chandigarh-160012, India
vivekp257@gmail.com

Tarlochan Kaur
Dept. of Electrical Engineering
PEC University of Technology
Chandigarh-160012, India
tarlochan.kaur@gmail.com

Ravikant pandey
Dept. of Electrical Engineering
PEC University of Technology
Chandigarh-160012, India
ravikantpandey91@rediffmail.com

Abstract — With the advancement in the technology all over the world energy demand has been increasing day by day. The report given by International Energy Outlook 2013 suggests that world energy consumption of energy will grow by 56 % between 2010 and 2040. It remained only limited amount of fossil fuel available on earth to meet the energy demand. We are returning back to renewable energy sources due to problem caused by increase in price of fossil fuels simultaneously with the environmental problems associated with it. In this regard, a study to investigate the feasibility of renewable hybrid system compromising of photovoltaic (PV), diesel and battery has been carried out for the site Additional Town Hall (ATH) building in Sector 17C of Chandigarh, India. This paper determines the optimal cost of energy of the standalone hybrid system with the help of HOMER software.

Keywords — Homer, Stand-alone, PV array, diesel generator, battery.

I. INTRODUCTION

In the recent time there has been seen improvement of technology in every sector from agriculture to defense. With the improvement in technology every field is being utilized in the best possible manner. This utilization of fields has led to significant increase in consumption of energy all over the world. The International Energy Outlook 2013 projects that world energy consumption will grow by 56 percent between 2010 and 2040. Total world energy use rises from 524 quadrillion British thermal units (Btu) in 2010 to 630 quadrillion Btu in 2020 and to 820 quadrillion Btu in 2040 [1]. The Indian power sector has made remarkable progress since Independence. The total installed capacity has gone up from 1,362 MW in 1947 to more than 234 GW till March 2014 [2, 3]. Current centralized energy planning of India is dependent on coal and fossil fuel sources. The main concern arises on how to protect the fossil fuel for our coming generation with simultaneously utilizing the different resources of energy for high and sustained economic growth. Pressure to increase its energy supplies and the consequent negative environmental impact of fossil fuels has led India to a conscious policy toward renewable sources.

Renewable energy and nuclear power are the world's fastest-growing energy sources. Recent research and development of Renewable energy sources have shown excellent potential as a form of contribution to conventional power generation systems. There is huge amount of potential available in renewable energy sources such as solar, wind, hydro, bio-fuel, tidal etc. which can be harnessed to fulfill the gap between generation and demand. For Indian climate, one of the most alternative solution of renewable energy sources is standalone solar-diesel Hybrid Energy System. The use of the standalone PV- diesel hybrid system with battery used as the back-up source when solar energy is inadequate to meet the demand looks economically attractive.

This paper gives the design idea of a standalone PV-diesel hybrid power system with battery backup for ATH building in Chandigarh (Latitude 30° 45' N, Longitude 76° 47' E) [4]. National Renewable Energy Laboratory (NREL)'s, Hybrid Optimization Model for Electric Renewables (HOMER version 2.68 beta) has been used as the sizing and optimization software tool. It contains a number of energy component models and evaluates suitable technology options based on cost and availability of resources [5].

Source: International Energy Outlook 2013
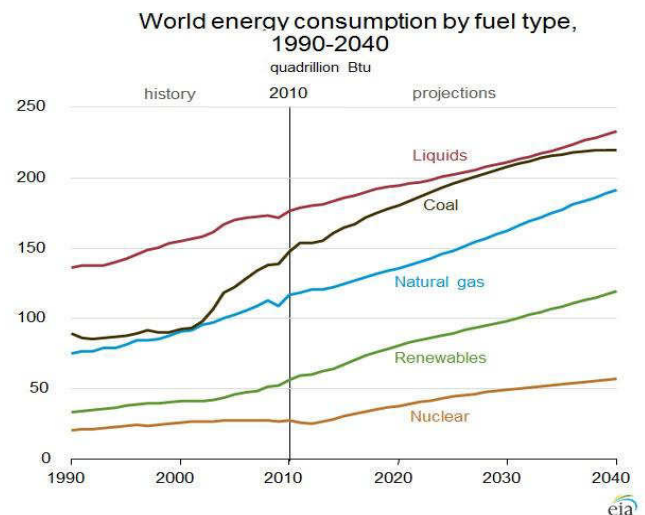
II. SYSTEM DESCRIPTION

The hybrid renewable system is designed based upon the certain important sensitivity variables to optimize the cost & size effectively. Hence, before designing the model, certain parameters like solar irradiation and load profile must be

evaluated. General scheme of the proposed hybrid system is shown in the fig. 1.
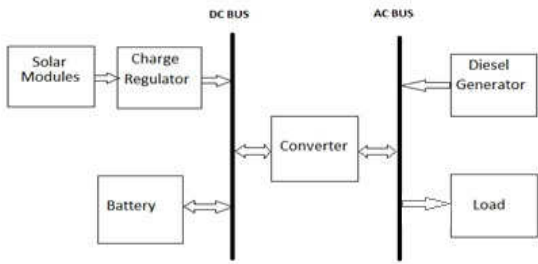
Fig. 1: schematic diagram for the standalone hybrid power supply system

A. Solar Radiation Data

First of all for the estimation of solar potential we need reading of solar radiation for our site. There are two sources, from where solar radiation data can be obtained: Indian Meteorological Department, Pune (branch office in Chandigarh), and NREL website that provide satellite data. The data collected is analyzed for designing the hybrid power system (which includes PV/Diesel/Battery) which has to meet the load requirement which in our case is 260 kWh/d. Fig. 2 shows the monthly average daily solar radiation ranges from 3.574 to 7.067 (kWh/m^2/d).
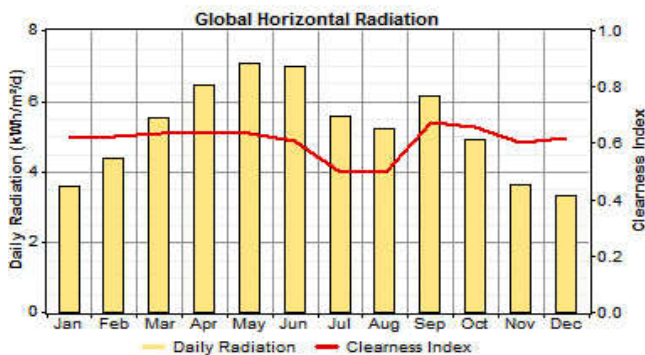
Fig. 2: Monthly average daily solar radiation
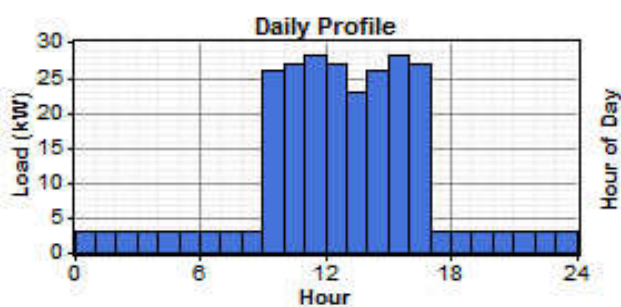
Fig. 3: Daily Load Profile

B. Load Profile

In this study, an Additional Town Hall (ATH) building in Sector 17C of Chandigarh is considered. The main input to the software is the load. After carefully determining the hourly electric load of the building the monthly average of the daily load is supplied to the software. It has been observed that the monthly electricity consumption of the building is about 3000 kWh. The daily and monthly load profiles are shown in fig. 3 and fig. 4 respectively.
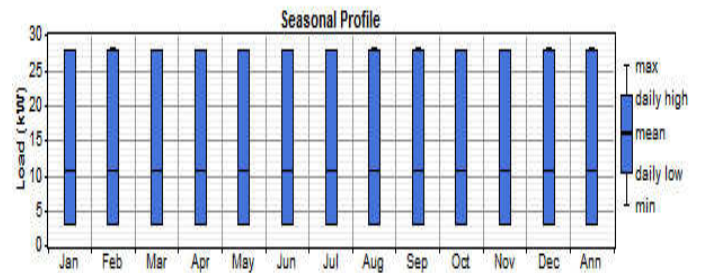
Fig. 4: Monthly average loads (KW) for complete year

III. HOMER SIMULATION MODEL

In the present work, the selection and sizing of components of hybrid power system has been done using HOMER software. HOMER is a computer based software which simulates the hybrid renewable system and calculates all feasible and non-feasible solution. HOMER can simulate a wide variety of micro power system configurations, comprising any combination of PV array, wind turbines, run-of-river hydro- turbine and generator, battery bank, ac-dc converter etc. [6]. It firstly assesses the technical feasibility of the system (i.e. whether the system can adequately serve the electrical and thermal loads and any other constraints imposed by the user). Secondly, it estimates the net present cost of the system [5]. Fig. 5 shows the proposed scheme as implemented in the HOMER simulation tool.
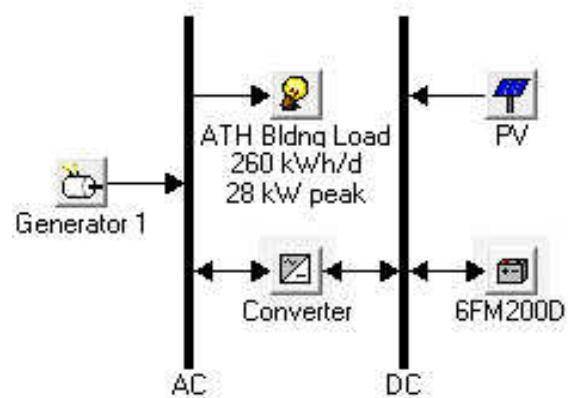
Fig. 5: HOMER implementation of the hybrid energy system

It consists of Photovoltaic array, diesel generator, converter, load and battery. The simulation process first of all determines the feasibility of the system based on the constraints imposed and on the fact that it can adequately supply the electric load. And then the life cycle cost of the

system is determined which is the total cost of installing and operating the system over its lifetime.

IV. SYSTEM DESCRIPTION AND SPECIFICATION

TABLE I. TECHNICAL PARAMETER OF PV KIT (1 KW)

Price of PV Panels	$952.81
Price PV mountings	$112.07
Price of Charger Regulator	$99.17
Installation Cost	$148.76
Balance of system (cables etc.)	$82.64
Total Panel Cost/kW	$1396
O & M Cost (1%)	$14
Efficiency	16.1%
Replacement Cost	$1047
Lifetime	25 years

TABLE II. TECHNICAL PARAMETERS OF INVERTER (1kW)

Capital Cost	$388.76
Replacement Cost	$292
O & M Cost/yr (1%)	$4
Lifetime	10 years
Efficiency	95.5

TABLE III. TECHNICAL PARAMETERS OF DIESEL (1kVA)

Capital Cost	$521
Replacement Cost	$391
O & M Cost/hr (1%)	0.12
Lifetime	10000 hours

TABLE IV. TECHNICAL PARAMETERS OF BATTERY

Capital Cost	$270.74
Replacement Cost	$204
Nominal Voltage	12V
Nominal Capacity	200Ah

V. OPTIMIZATION RESULTS

Simulation has been done by considering different sizes of PV, diesel generator, inverter and battery systems. HOMER performs the simulation for a number of prospective designed configurations. After examining every design, it selects the one that meets the load with the system constraints, at the least life cycle cost. The arrangement of the result is done in terms of the most cost effective to least cost effective. The optimization is done for every sensitivity variables and each and every feasible solution is displayed [7]. Cost curves for different sizes of the diesel generator, PV cell and battery are shown in fig. 6, fig. 7 and fig. 8 respectively.
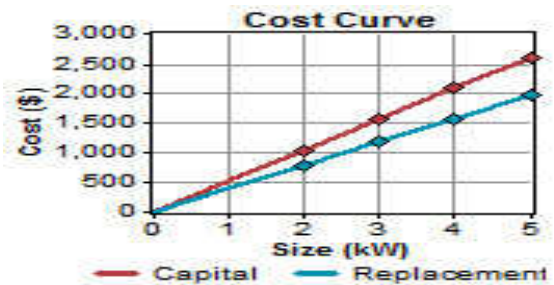
Fig. 6: Cost curve for Diesel Generator
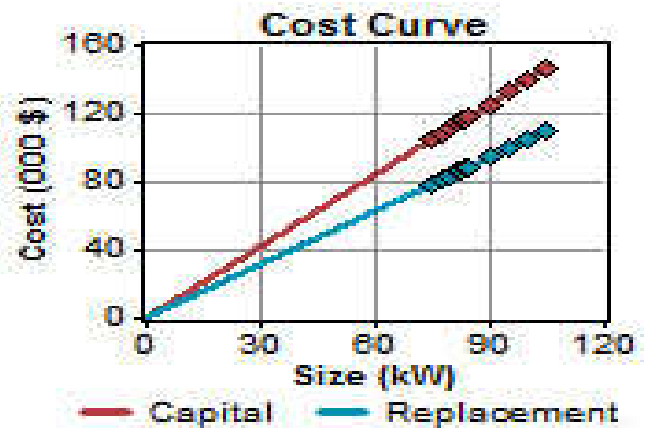
Fig. 7: Cost curve of PV
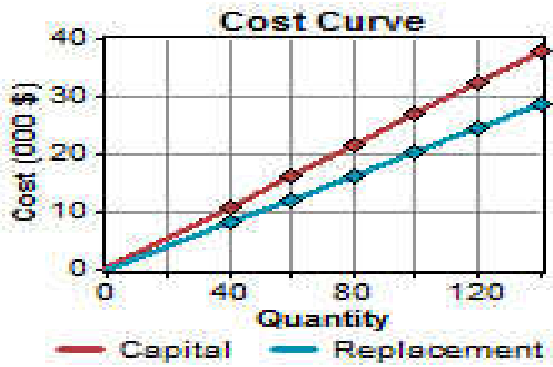
Fig. 8: Cost curve of Battery

Without Consideration of Sensitivity Variables

Results obtained in our case of ATH building is shown in the fig. 9. In the result shown, though Cost of Energy (COE $/kWh) of system with PV size of 78 kW looks equal to the PV with size 80 kW, the Operating Cost of the system and Total Net Present Cost (TNPC) of the system is less for 78 kW PV system. Therefore in the optimization process the most cost effective result is shown at first place i.e. system with 78 kW PV and corresponding COE of the system with 78 kW PV is $0.157

Fig. 9: Optimization results without sensitivity analysis

A. With Consideration of Sensitivity Variables

The sensitivity variable selected in our study is PV Slope. Different values of PV Slope is specified in the HOMER software. HOMER calculates the optimized results in each case of the PV Slope and displays best optimized result for each case. Results calculated are shown in fig.10. It can be noticed from these results that TNPC of system is least in case of system with PV Slope of 26 degree compared to the previous result of without sensitivity analysis. The COE is $0.156 with consideration of sensitivity variables whereas COE without consideration of sensitivity variable came out to be $0.157.The monthly average electric production and cash flow energy with PV Slope is shown in fig. 11 and fig. 12 respectively.

Fig. 10: Optimization results with sensitivity analysis
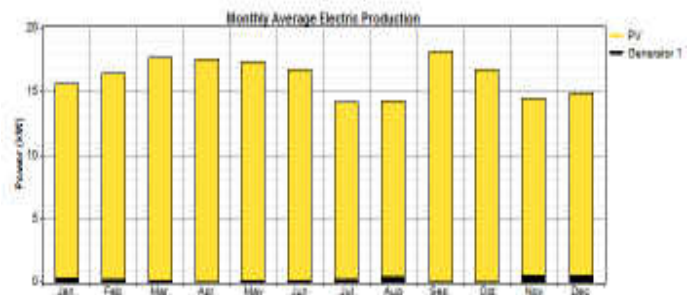
Fig. 11: Monthly average electric production
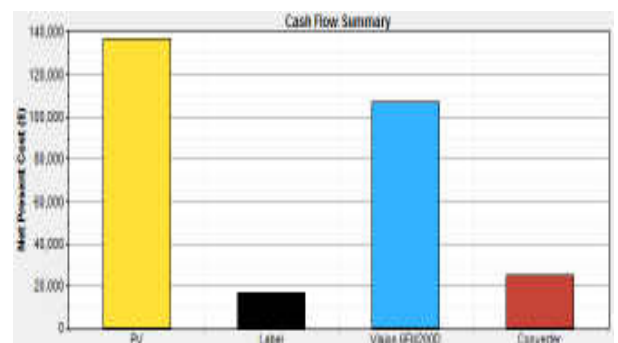
Fig. 12: Cash flow energy with PV slope of 26 (deg)

VI. CONCLUSION

This paper investigates on the feasibility of a stand-alone power system focusing on photovoltaic-diesel generator energy systems. In the day, the PV array produces much more power than needed by the load and stores the surplus power in the battery. When sun is not available or PV array is insufficient to feed the load, battery together with the diesel generator (if necessary) supply the load. The paper has discussed the optimization results and effective cost analysis of PV-diesel generator. The optimal cost of energy for our hybrid system has been come out to be $0.157. In the sensitivity analysis PV slope has been chosen and with sensitivity analysis optimal cost of energy come out to be $0.156. It can be inferred from the results that there has not been much difference of COE when sensitivity variable is used. The standalone PV/DG/battery hybrid power system offers several benefits such as greatly reduction in the greenhouse gases, independent supply of electricity (not dependent upon Grid), reliable power supply etc. The only factor for concern is initial cost of the system. However the initial cost disadvantage can be virtually offset by almost negligible operating and maintenance cost of the system.

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Economic Load Dispatch and Short Term Unit Commitment Problem Formulation of Thermal Electric Power System

Vikram Singh
CTIEMT
Jalandhar

Vikram Kumar
Kamboj
Dept. of Electrical
Engineering, DAV
University, Jalandhar,
Punjab

Satnam Singh Matharu
Dept. of Electrical
Engineering,CT Institute of
Engineering Management &
Technology,
Jalandha

Abstract-Economic Load Dispatch and Short-Term Unit Commitment (STUC) are important research challenges and vital optimization task in the daily operational planning of modern power system. The electrical unit commitment problem is the problem of deciding which electricity generation units should be running in each period so as to satisfy a predictably time varying load demand for electricity. This research paper aims to present the mathematical formulation of Economic load dispatch and short-term unit commitment problem of thermal electric power system considering various system and physical constraints.

Index Terms- Economic Load Dispatch (ELD), Short-Term Unit Commitment (STUC), Unit Commitment Problem(UCP).

I. INTRODUCTION

In the modern power system systems, there are various generating units e.g. thermal, hydro, nuclear etc. Also, the load demand varies during a day and attains different peak values. Thus, it is required to decide which generating unit to turn on and at what time it is needed in the power system network and also the sequence in which the units must be shut down keeping in mind the cost effectiveness of turning on and shutting down of respective units. The entire process of computing and making these decisions is known as unit commitment (UC). The unit which is decided or scheduled to be connected to the power system network, as and when required, is known to be committed unit. Unit commitment in power systems refers to the problem of determining the on/off states of generating units that minimize the operating cost for a given time horizon[7]. Economic dispatch is the short-term determination of the optimal output of a number of electricity generation facilities, to meet the system load, at the lowest possible cost, subject to transmission and operational constraints. The economic load dispatch means that the generator's real and reactive power are allowed to vary within certain limits so as to meet a particular load demand within minimum fuel cost.

II. ECONOMIC LOAD DISPATCH

The scheduling of the units together with the allocation of the generation quantities which must be scheduled to meet the demand for a specific period represents the Unit Commitment Problem[7]. Economic Load Dispatch (ELD) seeks the best generation schedule for the generating plants to supply the required demand plus transmission loss with the minimum generation cost. Significant economical benefits can be achieved by finding a better solution to the ELD problem. The economic dispatch problem is defined so as to minimize the total operating cost of a power system while meeting the total load plus transmission losses within generator limits [1].

III. ECONOMIC LOAD DISPATCH-PROBLEM FORMULATION

The objective of economic load dispatch of electric power generation is to schedule the committed generating unit outputs so as to meet the load demand at minimum operating cost while satisfying all units and operational constraints of the power system. The economic dispatch problem is a constrained optimization problem and it can be mathematically expressed as follows [1-5]:

Minimize

$$F(P_i) = \sum_{i=1}^{NG} (a_i P_i^2 + b_i P_i + c_i) \qquad \$/h \tag{1}$$

subject to (i) the energy balance equation

$$\sum_{i=1}^{NG} P_i = P_D + P_L \tag{2}$$

(ii) The inequality constraints

$$P_i^{min} \le P_i \le P_i^{max} \qquad i = 1,2,3,\ldots\ldots\ldots,NG \tag{3}$$

where, a_i, b_i and c_i are cost coefficients

P_D is Load Demand.

P_L is power transmission Loss.

NG is the number of generation buses.

P_i is real power generation and will act as decision variable.

The most simple and approximate method of expressing power transmission loss, P_L as a function of generator powers is through George's Formula using B-coefficients and mathematically can be expressed as:

$$P_L = \sum_{i=1}^{NG_i} \sum_{j=1}^{NG} P_{g_i} B_{ij} P_{g_j} \quad \text{MW}$$

(4)

where, P_{g_i} and P_{g_j} are the real power generations at the ith and j^{th} buses, respectively.

B_{ij} are the loss coefficients which are constant under certain assumed conditions.

NG is the number of generation buses.

IV. SHORT-TERM UNIT COMMITMENT

The unit commitment problem determines both the hourly start-up and shut down schedule as well as the power output for the generating units over a certain time period. the resultant schedule minimizes the total operational cost while satisfying the system demand as well as generating units constraints. In a Unit Commitment Problem (UCP), the objective is to achieve the minimum total operating cost by a precise scheduling of the ON/OFF status of the generating units subject to the system and physical constraints.

V. SHORT TERM UNIT COMMITMENT-PROBLEM FORMULATION

Unit commitment is a complex decision making process because of the multiple constraints that must not be violated when finding optimal or near optimal commitment schedules. Mathematically, the Unit Commitment Problem is a non-linear, mixed-integer combinatorial optimization problem. The optimal solution to the above complex combinatorial optimization problem in power system can be obtained by global search techniques.The objective function of the short term thermal Unit Commitment Problem is composed of the fuel cost, start-up cost and shut-down cost of the generating units and mathematically can be expressed as[8]:

$$Cost_{NH} = \sum_{h=1}^{H} \sum_{i=1}^{SG} [FC_i(P_{ih}) * U_{ih} + STUC_{ih} * (1 - U_{i(h-1)}) * U_{ih} + SDC_{ih} * (1 - U_{ih}) * U_{i(h-1)}]$$

(5)

Where, $Cost_{NH}$ is the total operating cost over the scheduled horizon

$FC_i(P_{ih})$ is the fuel cost function

$U_{i(h-1)}$ is the ON/OFF status of of ith unit at $(h-1)^{th}$ hour.

U_{ih} is the ON/OFF status of ith unit at h^{th} hour.

U is the decision matrix of the U_{ih} variable. for i=1,2,3,........NG.

P_{ih} is the generation output of ith unit at h^{th} hour.

$STUC_{ih}$ is the start-up cost of the ith generating unit at h^{th} hour.

SDC_{ih} is the shut-down cost of the ith generating unit at the hth hour.

NG is the number of thermal generating units

$U_{ih} \in \{0,1\}$ and $U_{i(h-1)} \in \{0,1\}$

H is the number of hours in the study horizon.

(for Short-Term unit Commitment, H is generally taken as 8-12 Hours. For general unit commitment scheduling H is taken as 24 hours (i.e. one day) and for long term unit commitment, H may be taken as one week , one month, three month, six month or one year duration.

A. Fuel Cost, $FC_i(P_{ih})$

The fuel cost function of the thermal unit $FC_i(P_{ih})$ is expressed as a quadratic equation:

$$FC(P_{ih}) = \sum_{i=1}^{NG} (a_i P_{ih}^2 + b_i P_{ih} + c_i) \quad \$/\text{Hour}$$

(6)

Where, a_i ($\$/MW^2h$), b_i ($\$/MWh$) and c_i ($\$/h$) are fuel consumption coefficients of ith unit.

B. Start up cost, $STUC_{ih}$

Start up cost is warmth-dependent. Start up cost is the cost involved in bringing the thermal unit online. Start up cost is expressed as a function of the number of hours the units has been shut down. Mathematically, the start-up cost can be represented as a step function:

$$STUC_{ih} = \begin{cases} HSC_i, & \text{if} \quad MDT_i \leq DT_i < (MDT_i + CSH_i) \\ CSC_i, & \text{if } DT_i > (MDT_i + CSH_i) \end{cases}$$

(7)

where, DTi is shut down duration, MDTi is Minimum down time, HSCi is Hot start up cost, CSCi is Cold start up cost and CSHi is Cold start hour of ith unit.

C. Shut down cost , SDC_{ih}

Shut down costs are defined as a fixed amount for each unit/shutdown. The typical value of the shut down cost is zero in the standard systems. This cost is considered as a fixed cost.

VI. THERMAL CONSTRAINTS

A thermal generation unit needs to undergo gradual temperature changes and thus it takes some period of time to bring a thermal unit online. Also, the operation of a thermal unit is manually controlled. So a crew is required to perform the operation and maintenance of any thermal unit. This leads to many restrictions in the operation of thermal unit and thus it gives rise to many constraints.

1. Generation Constraints

In order to satisfy the forecasted system load demand, the sum of all of the generating units on-line must equal the system load over the time horizon.

$$\sum_{i=1}^{NG} P_{ih} U_{ih} = D_h$$

(8)

Where, D_h is the system load demand at h^{th} hour.

P_{ih} is the power output of ith unit at hth hour

U_{ih} is the On/Off status of the ith unit at the hth hour.

NG is the number of thermal generating units

2. Unit Generation Limitations

The output generated by the individual units must be within the maximum and minimum generation limits i.e.

$$P_{i(min)} \leq P_{ih} \leq P_{i(max)} \tag{9}$$

Where, $P_{i(min)}$ and $P_{i(max)}$ is the minimum and maximum power output of the ith unit.

3. Minimum up Time

Once the unit is started up, it should not be shut down before a minimum up-time i.e.

$$T_i^{on} \geq MU_i \tag{10}$$

Where, T_i^{on} is the up-time of the ith unit

MU_i is the minimum-up time of the ith unit

4. Minimum Down Time

once the unit is shut-down, there is a minimum downtime before it can be started up i.e.

$$T_i^{off} \geq MDT_i \tag{11}$$

Where, T_i^{off} is the down-time of the ith unit

MDT_i is the minimum down time of the ith unit.

VII. STANDARD TEST SYSTEM FOR ECONOMIC LOAD DISPATCH PROBLEM

Test System-I

Table-I: Generator characteristics of 3-Unit Test System [6]

No. of Generating Units	Real Powers(MW)		Cost Coefficients		
	Pmax	Pmin	A	B	C
1	210	35	1243.531	38.30533	0.003546
2	325	130	1658.57	36.32782	0.0211
3	315	125	1356.659	38.27041	0.01799

The loss coefficient matrix for 3-unit system:

$$B = \begin{bmatrix} 0.000071 & 0.000030 & 0.000025 \\ 0.000030 & 0.000069 & 0.000032 \\ 0.000025 & 0.000032 & 0.000080 \end{bmatrix}$$

Test System-II

Table-III: Generator characteristics of 4-Unit Test System [6]

No. of Generating Units	Real Powers(MW)		Cost Coefficients		
	P_{max}	P_{min}	A	B	C
1	300	50	40.0	1.8	0.0015
2	125	20	60.0	1.8	0.0030
3	175	30	100.0	2.1	0.0012
4	250	40	120.0	2.0	0.001

The loss coefficient matrix for 4-unit system:

$$B = \begin{bmatrix} 0.000140 & 0.000010 & 0.000015 & 0.000015 \\ 0.000010 & 0.000060 & 0.000010 & 0.000013 \\ 0.000015 & 0.000010 & 0.000068 & 0.000065 \\ 0.000015 & 0.000013 & 0.000065 & 0.000070 \end{bmatrix}$$

Test System-III

Table-IV: Generator characteristics of 6-Unit test System [6]

No. of Generating Units	Real Powers(MW)		Cost Coefficients		
	Pmax	Pmin	A	B	C
1	125	10	756.7989	38.53	0.15240
2	150	10	451.3251	46.15916	0.10587
3	225	35	1049.998	40.39655	0.02803
4	210	35	1243.531	38.30553	0.03546
5	325	130	1658.57	36.32782	0.02111
6	315	125	1356.659	38.27041	0.01799

The loss coefficient matrix for 6-unit system:

$$B = \begin{bmatrix} 0.000022 & 0.000020 & 0.000019 & 0.000025 & 0.000032 & 0.000085 \\ 0.000026 & 0.000015 & 0.000024 & 0.000030 & 0.000069 & 0.000032 \\ 0.000019 & 0.000016 & 0.000017 & 0.000071 & 0.000030 & 0.000025 \\ 0.000015 & 0.000013 & 0.000065 & 0.000017 & 0.000024 & 0.000019 \\ 0.000017 & 0.000060 & 0.000013 & 0.000016 & 0.000015 & 0.000020 \\ 0.00014 & 0.000017 & 0.000015 & 0.000019 & 0.000026 & 0.000022 \end{bmatrix}$$

Test System-IV

Table-V: Generator characteristics of 10-Unit test System [3]

No. of Generating Units	Real Powers(MW)		Cost Coefficients		
	Pmax	Pmin	A	B	C
1	470	150	958.2	21.6	0.00043
2	460	135	1313.6	21.05	0.00063
3	340	73	604.97	20.81	0.00039
4	200	60	471.6	23.9	0.0007
5	243	73	480.29	21.62	0.00079
6	160	57	601.75	17.87	0.00056
7	130	20	502.7	16.51	0.00211
8	120	47	639.4	23.23	0.0048
9	80	20	455.6	19.58	0.10908
10	55	55	692.4	22.54	0.00951

The loss coefficient matrix for 10-unit system:

D.

$$B = 1 \times 10^{-5} \times \begin{bmatrix} 8.700 & 0.430 & -4.61 & 0.360 & 0.320 & -0.66 & 0.960 & -1.60 & 0.800 & -0.10 \\ 0.430 & 8.300 & -0.97 & 0.22 & 0.750 & -0.28 & 5.040 & 1.700 & 0.540 & 7.200 \\ -4.61 & -0.97 & 9.000 & -2.0 & 0.630 & 3.00 & 1.700 & -4.30 & 3.100 & -2.00 \\ 0.360 & 0.220 & 200 & -5.300 & 0.470 & 2.600 & -1.96 & 2.100 & 0.670 & 1.800 \\ 0.320 & 0.750 & 0.630 & 0.470 & 8.600 & -0.80 & 0.370 & 0.720 & -0.90 & 0.670 \\ -0.66 & -0.28 & 3.000 & 2.620 & -0.80 & 11.80 & -4.90 & 0.300 & 3.000 & -3.00 \\ 0.960 & 5.040 & 1.700 & -1.96 & 0.370 & -4.90 & 8.240 & -0.90 & 5.900 & -0.60 \\ -1.60 & 1.700 & -4.30 & 2.100 & 0.720 & 0.300 & -0.90 & 1.200 & -0.96 & 0.560 \\ 0.800 & 0.540 & 3.100 & 0.670 & -0.90 & 3.000 & 5.900 & -0.96 & 0.930 & -0.30 \\ -0.10 & 7.200 & -2.00 & 1.800 & 0.690 & -3.00 & -0.60 & 0.560 & -0.30 & 0.990 \end{bmatrix}$$

VII. CONCLUSION

In this paper, researchers have presented the mathematical formulation of economic load dispatch problem and short-term unit commitment problem. Standard test data for Economic Load Dispatch Problem for IEEE 3, 4, 6 and 10-unit generating model using B-coefficient is also presented at the last, which can be used as the quick reference by other researchers working in the similar area.

VIII. ACKNOWLEDGEMENT

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An Effective Dynamic Programming Approach for Single Area Unit Commitment

Maninder Kaur
DAV Institute of
Engineering and
Technology,
Jalandhar

Vikram Kumar Kamboj
Dept. of Electrical
Engineering,
DAV University,
Jalandhar,
Punjab

Sushil Pracher
Dept. of Electrical
Engineering
DAV. Institute of
Engineering and
Technology,
Jalandhar (Pb.)

Abstract- Unit Commitment is the important research challenge and vital optimization task in the daily operational planning of modern power system. Dynamic programming is the one of the successful approaches to unit commitment problem. Dynamic Programming has many advantages over the enumeration scheme, the chief advantage being a reduction in the dimentionality of the problem. It is one of the refined algorithm design standards and is powerful tool which yields definitive algorithm for various types of optimization problems. This research paper presents Single Area Unit Commitment Problem solution for IEEE 14-Bus System using Dynamic programming approach.

Keywords- Dynamic Programming (DP), Economic Load Dispatch(ELD), Unit Commitment Problem (UCP)

I. INTRODUCTION

In the modern power system, there are various generating resources like thermal, hydro, nuclear etc. Also, the load demand varies during a day and attains different peak values. Thus, it is required to decide which generating unit to turn on and at what time it is needed in the power system network and also the sequence in which the units must be shut down keeping in mind the cost effectiveness of turning on and shutting down of respective units. The entire process of computing and making these decisions is known as unit commitment (UC). The unit which is decided or scheduled to be connected to the power system network, as and when required, is known to be committed unit. Unit commitment in power systems refers to the problem of determining the on/off states of generating units that minimize the operating cost for a given time horizon [2].

Generators cannot be immediately turned on to meet the load demand. So it is required that the planning of unit commitment (UC) must be so done that there is enough generation available to fulfil the load demand along with an ample reserve generation to avoid failures and malfunctions under adverse conditions. Unit commitment handles the unit generation schedule in a power system for minimizing operating cost and satisfying prevailing constraints such as load demand and system reserve requirements over a set of time periods [3].The unit commitment problem (UCP) is basically about finding the most suitable schedule to turn- on or turn- off the generating units to meet the load demand and at the same time keep the cost of generation as much minimum as possible. UCP is a non- linear, large scale, mixed integer constrained optimization problem [2] and happens to belong to combinatorial optimization problems. There are many constraints involved in UCP and hence it is quite a complex and tedious task to compute or find the optimal solution to unit commitment problem.

II. UNIT COMMITMENT PROBLEM

The scheduling of the units together with the allocation of the generation quantities which must be scheduled to meet the demand for a specific period represents the Unit Commitment Problem (UCP). The Unit Commitment Problem is to determine a minimal cost turn-on and turn-off schedule of a set of electrical power generating units to meet a load demand while satisfying a set of operational constraints. The production cost includes fuel, startup, shutdown, and no load costs. The operational constraints that must be taken into account include, 1. The total power generated must meet the load demand plus system losses. 2.There must be enough spinning reserve to cover any shortfalls in generation. 3. The loading of each unit must be within its minimum and maximum allowable rating. 4.The minimum up and down times of each unit must be observed. The unit commitment is aimed at devising a proper generator commitment schedule for a power system over a period of one day to one week. The main objective of unit commitment is to minimize the total production cost over the study period & to satisfy the constraints imposed on the system such as power generation-load balance, spinning reserve, operating constraints, minimum up time & minimum down time, etc. Several conventional methods are available to solve the unit commitment problem. But all these methods need the exact mathematical model of the system & there may be a chance of getting stuck at the local optimum.

III. PROBLEM FORMULATION FOR SINGLE AREA UNIT COMMITMENT

Unit commitment is a complex decision making process because of the multiple constraints that must not be violated when finding optimal or near optimal commitment schedules. Mathematically, the Unit Commitment Problem is a non-linear, mixed-integer combinatorial optimization problem. The optimal solution to the above complex combinatorial optimization problem in power system can be obtained by global search techniques.

The objective function of the short term thermal Unit Commitment Problem is composed of the fuel cost, start-up cost and shut-down cost of the generating units and mathematically can be expressed as[8]:

$$Cost_{NH} = \sum_{t=1}^{H}\sum_{i=1}^{NG}[FC_i(P_{it})*U_{it} + STUC_{it}*(I-U_{i(t-1)})*U_{it} + SDC_{it}*(I-U_{it})*U_{i(t-1)}]$$

(1)

Where, Cost_{tot} is the total operating cost over the scheduled horizon

$FC_i(P_{ih})$ is the fuel cost function

$U_{i(h-1)}$ is the ON/OFF status of of ith unit at $(h-1)^{th}$ hour.

U_{ih} is the ON/OFF status of ith unit at h^{th} hour.

U is the decision matrix of the U_{ih} variable. for i=1,2,3,........NG.

P_{ih} is the generation output of ith unit at h^{th} hour.

$STUC_{ih}$ is the start-up cost of the ith generating unit at h^{th} hour.

SDC_{ih} is the shut-down cost of the ith generating unit at the hth hour.

NG is the number of thermal generating units

$U_{ih} \in \{0,1\}$ and $U_{i(h-1)} \in \{0,1\}$

H is the number of hours in the study horizon.

(a) Fuel Cost, $FC_i(P_{ih})$

The fuel cost function of the thermal unit $FC_i(P_{ih})$ is expressed as a quadratic equation:

$$FC(P_{ih}) = \sum_{i=1}^{NG}(a_i P_{ih}^2 + b_i P_{ih} + c_i) \qquad \$ / \text{Hour}$$

(2)

Where, a_i ($\$/MW^2h$), b_i ($\$/MWh$) and c_i ($\$/h$) are fuel consumption coefficients of ith unit.

(b) Start up cost, $STUC_{ih}$

Start up cost is warmth-dependent. Start up cost is the cost involved in bringing the thermal unit online. Start up cost is expressed as a function of the number of hours the units has been shut down. Mathematically, the start-up cost can be represented as a step function:

$$STUC_{ih} = \begin{cases} HSC_i, & \text{if} \quad MDT_i \le DT_i < (MDT_i + CSH_i) \\ CSC_i, & \text{if } DT_i > (MDT_i + CSH_i) \end{cases}$$

(3)

where, DTi is shut down duration, MDTi is Minimum down time, HSCi is Hot start up cost, CSCi is Cold start up cost and CSHi is Cold start hour of ith unit.

(c) Shut down cost , SDC_{ih}

Shut down costs are defined as a fixed amount for each unit/shutdown. The typical value of the shut down cost is zero in the standard systems. This cost is considered as a fixed cost.

IV. SINGLE AREA UNIT COMMITMENT CONSTRAINTS

A Single Area thermal generation unit needs to undergo gradual temperature changes and thus it takes some period of time to bring a thermal unit online. Also, the operation of a thermal unit is manually controlled. So a crew is required to perform the operation and maintenance of any thermal unit. This leads to many restrictions in the operation of thermal unit and thus it gives rise to many constraints.

1. Generation Constraints

In order to satisfy the forecasted system load demand, the sum of all of the generating units on-line must equal the system load over the time horizon.

$$\sum_{i=1}^{NG} P_{ih} U_{ih} = D_h$$

(4)

Where, D_h is the system load demand at h^{th} hour.

P_{ih} is the power output of ith unit at hth hour

U_{ih} is the On/Off status of the ith unit at the hth hour.

NG is the number of thermal generating units

2. Unit Generation Limitations

The output generated by the individual units must be within the maximum and minimum generation limits i.e.

$$P_{i(min)} \le P_{ih} \le P_{i(max)}$$

(5)

Where, $P_{i(min)}$ and $P_{i(max)}$ is the minimum and maximum power output of the ith unit.

3. Minimum up Time

Once the unit is started up, it should not be shut down before a minimum up-time i.e.

$$T_i^{on} \ge MU_i$$

(6)

Where, T_i^{on} is the up-time of the ith unit

MU_i is the minimum-up time of the ith unit

Minimum Down Time

once the unit is shut-down, there is a minimum downtime before it can be started up i.e.

$$T_i^{off} \ge MDT_i$$

(7)

Where, T_i^{off} is the down-time of the ith unit

MDT_i is the minimum down time of the ith unit.

V. SINGLE AREA UNIT COMMITMENT USING DYNAMIC PROGRAMMING

Dynamic programming (DP) is effectively employed to solve the problem of unit commitment for a system having larger number of units. This is mainly because dynamic programming constitutes the enumeration of viable schedules or solutions to the unit commitment problem which becomes tedious and difficult to do manually and it has to be done using a digital computer to make it fast and easier. Dynamic programming approach hourly evaluates possible unit commitment schedules associated with

decision made in the proceeding step by considering all constraints before searching for a schedule that yields the minimum cost [8-9]. There are certain data requirements while using dynamic programming. These data include cost characteristic of the units under consideration along with the maximum and minimum load limits and various other constraints. In contrast to the priority listing method for solving the same type of problem, dynamic programming proves to be a better approach. If the listing method is used for an n unit system, then 2 n − 1 combinations would be produced. The dynamic programming technique follows absolute enumeration of feasible alternatives of schedule and their comparison on the basis of operating costs. The main advantage of dynamic programming approach is that once the operating schedule of n units is evaluated, the optimal schedule for n+1 unit can be easily determined. Thus DP reduces the dimensionality of the considered problem.

Test System: The standard IEEE 14-Bus System (having 5-generating units) as shown in Figure-2 and load demand of 24-hours as shown in Figure-3 has been taken into consideration to obtain the corresponding results. The generating characteristics of IEEE-14 Bus system are shown in Table-I. The Dynamic Programming algorithm is applied to obtain the corresponding units ON/OFF Status. The flow chart for dynamic programming is shown in Figure-1. The Matlab Simulation software 7.12.0 (R2011a) is used to obtained the corresponding results.

Figure-2: IEEE 14-Bus System[10]

Figure-1: Flow Chart: Single Area Unit Commitment using Dynamic Programming

VI. TEST SYSTEM, RESULTS AND DISCUSSION

TABLE-I: IEEE 14-Bus Test System characteristics [4]

	P_{max}	P_{min}	c	b	a	MU_i	MD_i	H_{cost}	C_{cost}	C_{hour}	IniState
Unit1	250	10	0.00315	2	0	1	1	70	176	2	1
Unit2	140	20	0.0175	1.75	0	2	1	74	187	2	-3
Unit3	100	15	0.0625	1	0	1	1	50	113	1	-2
Unit4	120	10	0.00834	3.25	0	2	2	110	267	1	-3
Unit5	45	10	0.025	3	0	1	1	72	180	1	-2
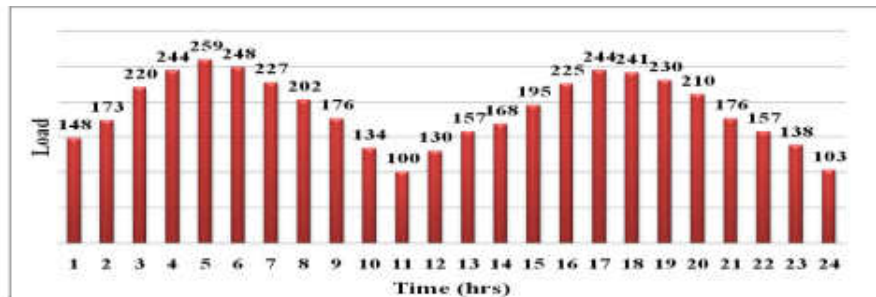
Figure-1: Load Demand pattern for 24-hours for 14-Bus System

Table-II: Unit Commitment Schedule of IEEE 14-Bus System for 24-hours

Hour	Generating Units ON/OFF Status					Startup Cost	Fuel Cost
	U1	U2	U3	U4	U5		
0	1	0	0	0	0	0	0
1	1	1	1	0	0	300	487
2	1	1	1	0	0	0	717
3	1	1	1	0	0	0	1029
4	1	1	1	0	0	0	1384
5	1	1	1	0	1	180	1957
6	1	1	1	0	1	0	2332
7	1	1	1	0	0	0	2656
8	1	1	1	0	0	0	2937
9	1	1	1	0	0	0	3173
10	1	1	1	0	0	0	3335
11	1	1	1	0	0	0	3460
12	1	1	1	0	0	0	3615
13	1	1	1	0	0	0	3818
14	1	1	1	0	0	0	4039
15	1	1	1	0	0	0	4308
16	1	1	1	0	0	0	4629
17	1	1	1	0	0	0	4984
18	1	1	1	0	0	0	5333
19	1	1	1	0	0	0	5663
20	1	1	1	0	0	0	5958
21	1	1	1	0	0	0	6194
22	1	1	1	0	0	0	6396
23	1	1	1	0	0	0	6565
24	1	0	1	0	0	0	6679

VII. CONCLUSION

This research papers researchers have presented the solution of IEEE 14-Bus System single area unit commitment problem for 24-hours load. The corresponding results has been successfully evaluated using MATLAB 7.12.0(R2011a) simulation software.

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Catenary Wire Protection Using Impedance Protection Relays

K. N. Dinesh Babu

Isaac Ramalla

Abstract: In this paper, an attempt to overcome the challenges in catenary wire protection using impedance protection techniques has been made. Impedance protection relays utilize the comparison of the measured impedance with the set impedance and the result is utilized to decide whether a fault has occurred or not. When a fault occurs, the current magnitude increased and the voltage magnitude decreases which results in a dip in impedance. Hence when the measured impedance is lesser than the set impedance then the relay will trip the breaker. This concept is perfect in most of the application but in catenary wire protection the set impedance varies dynamically. The dynamic variation of the set impedance is due to the movement of electric locomotives where the locomotive transformer gets included in the circuit. The theoretical solution towards this concept is proposed in this paper.

Keywords: Merz-Price Scheme; MHO, Quad

I. INTRODUCTION

Protection of overhead transmission line is one of the oldest concept and many solutions are been in existing like Merz-Price scheme of differential protection, phase comparison relaying, resistance, admittance, and impedance relaying. Impedance relays with MHO and quadrilateral characteristic are the most popular methods due to the flexibility in adapting to any kind of application. The shape of the MHO characteristics can be made as tomato or lenticular characteristic with the invent of numerical relay technology. In all these modes of operation the relay utilises a simple comparison technique where the set impedance is compared with the measured impedance.

II. SYSTEM DESCRIPTION

The set impedance of the relay is calculated based on the positive sequence impedance of the transmission line (Z_1) which is expressed as a sum of resistance and reactance in complex form.

$Z_1 = R_1 + jX_1$

Where

Z_1 is the positive sequence impedance of the transmission line

R_1 is the resistance of the transmission line

X_1 is the reactance of the transmission line

This value is calculated based on the criteria provided by the user or as per the guidelines of IEEE C37.113 standard. There are various types of conductors selected based on the current and voltage rating. The impedance varies based on the type of conductor being used. The protected transmission line is divided into zones and a typical calculation is shown in section 3.

III. TYPICAL SETTING CALCULATION FOR A OVERHEAD TRANSMISSION LINE

Radial Line

25 KV line

Given:

$Z_1 = 0.1 \angle 70° \; \Omega/km$

$Z_o = 0.2 \angle 70° \; \Omega/km$

Line Length = 100 km

CT Ratio = 25000/1

PT Ratio = 25000/1

V_{sec} p-n = 63.4 V

SIR < 30

Max Fault Clearance < 10 cycles

System Frequency = 50 Hz

Solution:

Total primary impedance

$Z_1pr = 10 \angle 70° \; \Omega$

$Z_opr = 20 \angle 70° \; \Omega$

Most of the numerical relays are configured in secondary Ω

Zsec = Zpr X (CT ratio / PT ratio)

$Z_1sec = 10 \angle 70° \; \Omega$ { Since CTratio / PTratio = 1}

$Z_osec = 20 \angle 70° \; \Omega$

Forward looking Zones

Zone1 = 80% of Z1sec = $8 \angle 70° \; \Omega$ Timing = 0 ms

Zone2 = 120% of Z1sec = $12 \angle 70° \; \Omega$ Timing = 300 ms

Zone3 = 120% of 2 X Z1sec = $19.2 \angle 70° \; \Omega$ Timing = 1000 ms

Reverse looking Zone

Zone4 = 20%   of Z1sec = 2 ∠ 70° Ω   Timing
= 1000 ms

For Ground

Zo/Z1 = 2 ∠ 0°

IV. CHALLENGES IN CATENARY WIRE PROTECTION

A catenary wire used in electric traction is of 25kV rating and it is divided into multiple neutral sections. The length of the section depends on many factors and hence the total impedance of the line varies for every section. The setting calculation shown in section 3 is the values entered in the relay and is referred as the set impedance. The relay measures voltage and current from which the impedance is calculated continuously. The calculated impedance is referred as the measured impedance. The measure impedance should always be greater than the set impedance which confirms that there is no fault in the line. In case the measured impedance is lesser than the set impedance, it confirms that the load current is not flowing through the entire line and there is a fault in the line.

In case of tractions system, the set impedance varies due to the fact that the electric locomotive that enters in that section has a locomotive transformer whose impedance gets added in the circuit. This was not calculated earlier in section 3 and hence the relay is comparing the measured impedance with a wrong value. Moreover the number of electric locomotives in the section is also not a fixed parameter. This adds to further complications.

V.   SOLUTION UTLIZING NUMERICAL RELAYS

Modern numerical relays have the facility of multiple groups. The application of multiple groups can be used to resolve this challenge. Group 1 can be configured for the transition line without a locomotive. Group 2 can be configured for a traction line with one locomotive etc.. and it goes on up to 6. The advanced numerical relays can have 6 groups hence up to 6 electric locomotives can be handled in each section. More than 2 locomotives in a single section, has operational difficulty and hence this is more than sufficient to currently handle the problem.

Switching of groups can be performed utilized an overcurrent element. Distance protection relays have several stages of over current elements. Each overcurrent element can be set for a different pickup value and the group can be switched when a particular overcurrent element is armed. Example, Overcurrent 1 (OC1) can be set to 0.5 per unit (p.u) whereas OC2 can be set to 1 p.u. Most of the distance relays have six over current stages and hence 6 group switching can be done using this over current elements. When there is no train in the section, OC1 is not picked up and hence Group 1 will be active which has the set impedance parameters configured for the catenary wire impedance. When a train enters into the section, OC1 is armed since the load current of the train will initiate this element within the relay. This will result in switching from group 1 to group 2 where group 2 is configured for the sum of catenary wire impedance and the locomotive transformer impedance.

VI. CONCLUSION

In this paper, the theoretical solution of one of the commonly available challenges is provided. In long transmission lines, when a fault occurs, the relay trips perfectly and the fault location information provided is used to rectify the fault. In case of long transmission lines which runs for several hundred kilometres, this information is one of the basic requirement without which the identification and rectification would be tedious and time consuming. In case of traction systems, the length of the sections is limited and hence the importance of fault locations was not a major factor. Modern numerical relays have this feature and by correct programming of relay, this issue is handled as described.

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AUTHORS BIOGRAPHY

[a]**K N Dinesh Babu** received his B.E. in Electrical & Electronics Engineering from Sri SSN College of Engineering, Chennai, Tamilnadu in 2004. He is currently pursuing Ph.D. Degree in University of Petroleum & Energy Studies in the area of grid connected solar photovoltaic system. He has 9 years of industrial experience and is currently working for GE Energy as a Lead Application Engineer for Protection & control in Power system division. He has worked for ALSTOM and ABB as Testing & Commissioning Engineer and was responsible for Testing and Commissioning of Protection Equipment including Substation Automation System.

Tel: +91-9790920721 E-mail: dineshbabukn@gmail.com

[b] **ISAAC RAMALLA** received his B.Tech. in Electrical & Electronics Engineering and M Tech (Power Systems) from JNTU, Hyderabad, Andhra Pradesh in 2005. He is currently pursuing Ph.D. Degree in University of Petroleum & Energy Studies in the area of grid connected solar photovoltaic system. He has 7 years of teaching and is currently working as Assistant Professor in Department of Electrical, Power and Energy, University of Petroleum & Energy Studies.

Tel: +91-9759204177 E-mail: isaac_1724@yahoo.com

Study & Analysis of Power System Stabaliy

Jaspreet Singh
Punjab Technical University
Jalandhar
jaspreet74275@gmail.com

Gurwinder Singh
Punjab Technical University
Jalandhar
er.gurwindersra@live.com

Akshay Agnihotri
CTIEMT,
Jalandhar
agnihotrii@gmail.com

Abstract:- **The stability of an interconnected power system is its ability to return to normal or stable operation after having been subjected to some form of disturbance, With interconnected system continually growing in size and extending over vast geographical regions, it is becoming increasingly more difficult to maintain synchronism between various part of the power system. Stability designated as two type i.e. Dynamic stability & Transient stability. Dynamic stability deals with small disturbance of longer time & transient stability deals with the effect of large disturbance results in loss of generation. Line switching operation, sudden load change are other factors which effects of transient stability. During disturbance synchronous machine frequencies undergo transient deviation from synchronous frequency. To solve these stability problem numbers of algorithms has been proposed for reducing fault clearing times. This paper deals with power disturbances clearing time removal methods.**

Keywords:-Power system stability, transient, dynamic stability, transient stability

I.   INTRODUCTION

Modern Electric Power system is a complex network of synchronous generators, located at far distances, transmission lines and loads. With changes in generation schedules and load, the system characteristics will vary accordingly [1]. The interconnection improved reliability but has given birth to instability issues as the disturbances can propagate through the system. Depending on the magnitude of disturbance the system can become transiently unstable. The first requirement of reliable service is to keep the synchronous generators running in parallel and with adequate capacity to meet the load demand [2]. Synchronous machines do not easily fall out of step under normal conditions [5]. If a machine tends to speed up or slow down, synchronizing forces tend to keep it in step [4]. A second requirement of reliable electrical service is to maintain the integrity of the power network. The high-voltage transmission system connects the generating stations and the load centers [3-4]. Interruptions in this network may hinder the flow of power to the load. This usually requires a study of large geographical areas since almost all power systems are interconnected with neighboring systems [3]. Random changes in load are taking place at all times, with

subsequent adjustments of generation [5].Synchronism frequently may be lost in that transition period, or growing oscillations may occur over a transmission line, eventually leading to its tripping. These problems must be studied by the power system engineer and fall under the heading "power system stability"[1-4]. These studies are important in the sense that they are helpful in determining critical information such as critical clearing time of the circuit breakers and the voltage level of the power system [5]. The various power system stability problems has been discussed in the following paragraphs after which one important problem will be singled out for discussion and research.

II.   MULTI MACHINE STABILITY

The diagram below shows a power system networks with various generators, distribution networks connected with transmission lines. The transmission lines are shown with their impedances & distributed loads with their admittances. The reference point for all the voltages is assumed as node point zero.
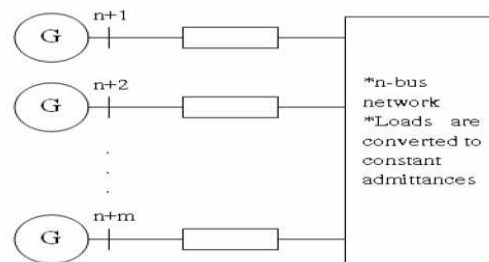
Fig 1. Distribution Network

Nodes n+1, n+2, . . ., n+m are the internal machine buses, i.e., the buses behind the transient reactances. The node voltage equation with node 0 as reference for this network, is shown.

$$\frac{d\delta_i}{dt} = \Delta\omega_i , \qquad 2.1$$

$$\frac{d\Delta\omega_i}{dt} = \frac{\pi f_0}{H_i}(P_{mi} - P_{ei}^f) . \qquad 2.2$$

To simulate the power system distribution network, the test system IEEE-9 bus and 5 bus system that has been considered . The bus system is a prototype and real time

systems are designed and developed with reference to such prototype models. The prototypes are subjected to contingency analysis and results are obtained. The load flow analysis and transient stability for the standard IEEE-9 bus system are performed. The standard IEEE 9 bus system consists of 9 buses, 3 generators, 3 loads and 3 transformers. And the 5 bus system has 5 buses, 2 Generators, 1 load as shown in the diagram below.
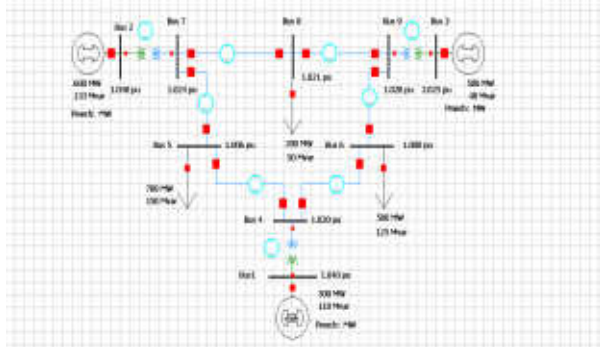
Fig 2 Simulink model in power world   simulator
(IEEE- 9 Bus system)

In this system , 3 Phase solid fault is applied between Bus 7 and Bus 2 (ckt no 1) after 1 sec and cleared after 1.1 sec. In the following waveforms the disturbance in load or power angle delta with supply frequency and are compared with two methods named as Runge kutta method and Euler method.
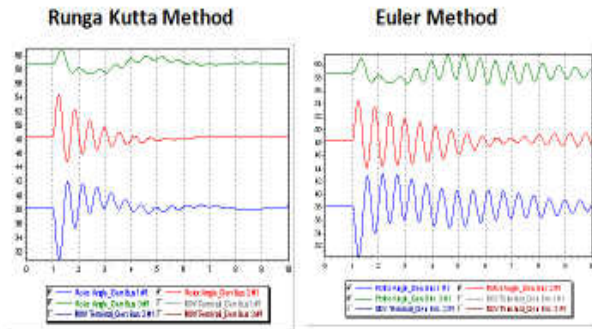
Fig 3 Power Angle (δ)
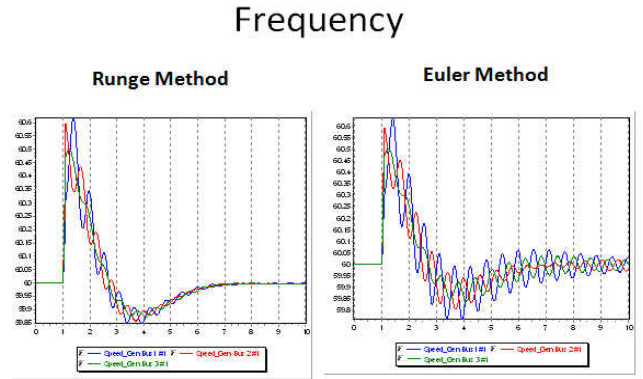
Frequency

Fig 4 Frequency V/S Time
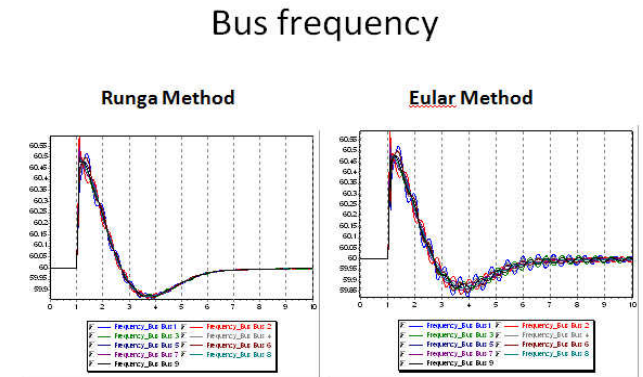
Bus frequency

Fig 5 (Bus frequency V/S Time)
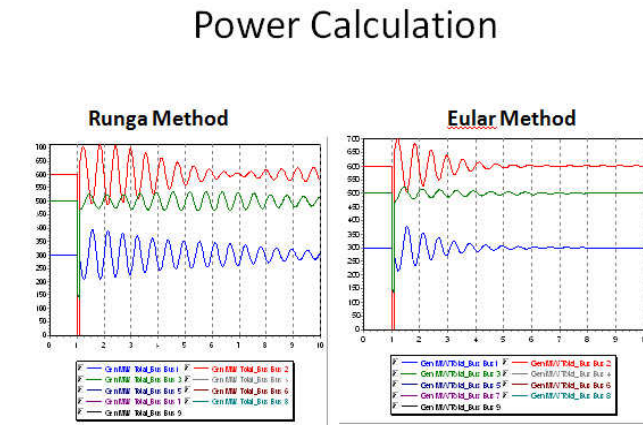
Power Calculation

Fig 6 Power calculation V/S Time

The results of the comparison of two methods are appendedd below.

CLEARING TIME (SEC)	ANGLE (RUNGA METHOD)	ANGLE (EULAR METHOD)
1.1	29.608	30.146
1.2	44.507	45.496
1.3	71.129	72.282
1.4	100.721	102.108
1.5	133.404	135.078
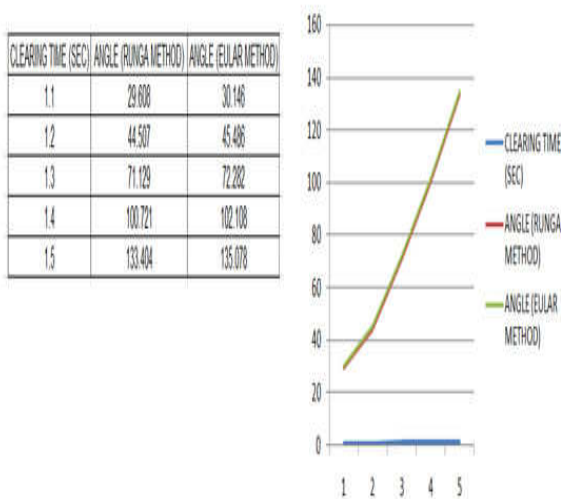
Fig 7 Comparison Between Runga And Eular Method

Firstly , the fault was cleared after 0.1 sec and maximum angle difference between is 29.608 deg (Range Method) and 30.146 deg(by Euler method). If we compare both methods Runga method gives fast response as compared to Euler method. The max difference between the angle is 30.146 deg and system is stable after some time when cleared after 0.1 sec , but when we increase the critical clearing time the difference between angle is also increase , this mean system is going towards un stability mode .if we take more time to clear the fault system will go out of synchronism , so our critical clearing time should be very low to keep the system in synchronism.

III. CONCLUSION

In this paper it is concluded that Power system should have very low critical clearing time to operate the relays, if we isolate the faulty section within very short time, thus system can obtain the stability otherwise it will go out of synchronism. Thus the protection system provided for the system should have fast response.

IV. SUGGESTIONS FOR FUTURE WORK

Such Studies are very helpful for determining the nature of relaying system needed, critical clearing time of circuit Breaker, voltage level and transfer capability of the System. When New Power System is required to planned then from Stability point of view the Characteristics of the Relays and Circuit Breakers is required to be the factor which to be considered at the most.

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Electrical Energy Audit of Sugar Industry
(Energy Audit of Wahid Sandhar sugars, Phagwara)

Mandip Singh
Dept. of Electrical Engg.,
Guru Nanak Dev Engg. College
Gill Road, Ludhiana, Punjab, INDIA
Mandipsingh408@gmail.com

Gagandeep Singh Sodhi
Dept. of Electrical Engg.,
Guru Nanak Dev Engg. College
Gill Road, Ludhiana, Punjab, INDIA
gagan_sodhi76@yahoo.com

Abstract:- This paper presents an electrical energy audit of a sugar industry, as we know the demand of electrical energy is increasing day by day so we can save energy by some improvement on our existing system,

In this paper lighting system, power factor correction & VFD importance to improve the efficiency of motors are discussed.

Keywords:- Hg Lamps, Metal Halide Lamps, Static & Dynamic Capacitor Banks, VFD (Variable Frequency Drives), DTC(Direct Torque control).

I. INTRODUCTION

Energy audit is an important tool in transforming the fortunes of any organization. This is highly relevant to the sugar industry as it deals with a renewable energy source and looked upon as rural power house. The scope for conservation is immense and if properly harnessed can take the organization to the path of prosperity. Energy audit becomes all the more important in view of the energy conservation Act 2001 enacted by Government of India.

This paper covers the three areas lighting system, power factor correction & by installation of VFD drives on induction motors (30 HP to 175 HP) on which we can save energy by doing some amendment.

In this industry mercury vapours lamps are installed, these lamps can be replaced by metal halide lamps which have high luminous intensity and power consumption is lower then mercury vapor lamps (Hg lamps).

Power factor correction can be done by using dynamic capacitor bank beside the static capacitor bank. Wahid Sandhar sugars having 1200kVAR capacitor bank, which is a dynamic capacitor bank, i.e. 1200 kVAR is divided into many number of groups and each group is connected with a specific number of motor to avoid the leading power factor and a automatic relay is connected with capacitor bank which adjust the capacitor bank according to the working load.

VFD (variable frequency drive) implementation is also a method to start the motor at rated load. A variable or adjustable frequency drive is connected with the motor to control the speed and torque of motor.

II. ELECTRICAL ENERGY AUDITING

The audit is done on the following three parts of Wahid Sandhar Sugars ltd.(WSS), lighting system, power factor correction & by installation of VFD drives on induction motors. The detail energy audit is as follows:-

A. Lighting System

Lighting systems are widely used on both indoor and outdoor lighting of commercial, industrial, and residential spaces. Lighting control systems serve to provide the right amount of light where and when it is needed. WSS mill has lighting load is shown in table 1 and total lighting load is 5625 watts of mercury vapour lamps.

Table no.1

No. of hg vapour lamps	watt	working hours	life in hours	luman/watt	total lumans	total load(per day)	cost/set
200	125	15	24000	50	6250	375000	1600
125	250	15	24000	50	12500	468750	2200
	375	15			18750	843750	
Total						844kWh	
cost per kWh = 7 Rs							
running cost	844*7	5908					

If this whole system is replaced by metal halide lamps then huge amount of energy can be saved.as shown in table no.2 and

the investment on metal halide lamp can be recovered in 142 days.

Table no.2

No. of metal halide lamps	Watt	Working hours	life in hours	luman/watt	Total lumans	Total load(per day)	Cost/set
208	150	15	15000	90	18750	468000	1800
Cost per unit = 7 Rs						468kWh	
Running cost	468*7	3276					
Total saving	5908-3276	2632					
cost required for replace ment	374400						
		142.2492401	142 days approx				

A metal-halide lamp is an electric lamp, produces light by an electric arc through a mixture of gaseous of vaporized mercury and metal halides (compounds of metals with iodine or bromine). It is a of high-intensity discharge (HID) gas discharge lamp. It was Developed in the 1960s, they are similar to mercury vapor lamps, but metal halide compounds are contained in the arc tube, which improve the efficacy and color of the light.

Metal-halide lamps have high luminous efficacy of around 75 - 100 lumens/watt, which is about two times that of mercury vapor lights and 3 to 5 times that of intense white light and incandescent lights. Lamp having life is 6,000 to 15,000 hours. As one of the efficient sources of high CRI white light, metal halides were fastest growing segment of light industry as of 2005.These are used for overhead lighting of commercial, industrial, and public places, such as parking areas, sports

arenas, factories, and retail stores, as well. as residential security and automotive head lamps (xenon head lights).

The lamps consists of a ceramic arc tube or small fused quartz which contains the arc and gases, enclosed inside a larger bulb of glass which has a filter coating out the ultraviolet light produced. They can operate at a pressure between 5 to 20 atms, and special fixtures are required to operate safely, and prevention from electrical ballast. Metal atoms produce the high light output. A warm-up period is required of several minutes to reach full light output.

But there are so many drawbacks of metal halide lamps are there:-
1. Disposal of metal halide lamp is so difficult.
2 Life period of metal halide lamps is small.
3. it takes some time to fully glow up.

4.Risk of lamp explosion.

B. Power Factor Correction

Power factor of an electrical circuit shows the performance of a circuit how much delivered power is converted in useful work. Power factor of an electrical circuit is defined as

1. Ratio of true power to apparent power provided to the circuit.

Cos Ø = true power / apparent power

2. Cosine of the angle between voltage and current.

P=VI cos Ø

3. ratio of resistive components of circuit and impedance offered by the load.

Cos Ø= resistive components/ impedance offered.

Apparent power is the product of the voltage and current flowing through the circuit. Due to the energy stored in the load and returned to source, or due to non-linear load the wave shape is distorted of the current drawn from the source, the apparent power will be greater than the active or real power. If load generates more power which flows in back ward direction then a negative power factor occurred. The load is normally considered the generator.

In an electric power system, more current is drawn by a load with a low power factor than a load with a high power factor for the same useful power transferred. The higher energy lost in the distribution system occurs due to large currents, and require high rating of wires and other equipment. Because of the low power factor, costs of larger equipment and wasted energy, electrical utilities will charges increases to higher cost to industrial or commercial customers.

The Linear loads having low power factor (such as induction motors) can be corrected by a passive network of capacitors or inductors. Non-linear loads, such as converters, rectifiers, current drawn from the system is distorted. In such cases, to counteract the distortion and raise the power factor active or passive power factor correction is used. The power factor correction devices may be a spread out over a distribution system , at central sub station or built into power - consuming equipment.

1. Power Factor Correction For Linear Loads

A high power factor is required in a transmission system to reduce transmission lines losses and voltage regulation improvement at load. It is required for adjustment of the power factor near to unity. When reactive elements absorb reactive power near the load, the apparent power reduces. Power factor correction is applied by an electric power transmission utility to improve the efficiency and stability of the transmission network. Individual electrical customers who are charged by low power factor utility may install correction equipment to reduce those costs.

The power factor of an AC circuit brings closer to unity by installing power factor & supplying reactive power of opposite sign , adding inductor or capacitors that cancels the effect of each other accoding to the requirement of the load, respectively. For example, the inductive effect of motor loads may be offset by installing parallel capacitors. If a load had a capacitive value, inductors (also known as reactors) are connected to correct the power factor near to unity. In the electricity industry, inductors are said to consume reactive power and capacitors are said to supply it, even though the energy is just moving back on each AC cycle.

The reactive elements can create harmonic noise & voltage fluctuations when switched on or off. They will supply or sink reactive power regardless of whether there is a corresponding to load operating nearby, increases the system's no-load losses. And create resonant conditions, resulting in overvoltage fluctuations in system and creates instability in system. As such, reactive elements cannot simply be applied without any engineering analysis.

A capacitor bank mainly consists of following components.

1. Reactive Power Control Relay,
2. Network connection points,
3. Slow-blow Fuses,
4. Inrush Limiting Contactors;
5. Capacitors (single-phase or three-phase units, delta-connection);
6. Transformer (for controls and ventilation fans)

An automatic power factor correction unit consists of a group of capacitors that are switched by contactors according to the connected load. The contactors are controlled by a regulator, which measures power factor of an electrical network. Depending on the power factor and load of the network, the power factor controller will switch On/Off the necessary blocks of capacitors in steps to make sure the power factor near to the set value.

WSS have a dynamic capacitor bank of 1200 KVar which is divided into number of sections. And an automatic units is installed and works as above explained.

An unloaded synchronous motor may be installed to supply reactive power instead of switched capacitor bank. The reactive power drawn by the synchronous motor is function of field excitation of that motor. This is known as a synchronous condenser. It is connected and started to the electrical network. It operates at leading power factor and produces vars onto the network as required to support the system voltage or to maintain the power factor of system at a specified level near to unity.

The condenser's operation and installation are identical to large electric motors. Its principal advantage is the ease with which the amount of power factor correction can be adjusted. it acts like a variable capacitor. Unlike capacitors, the amount of reactive power supplied is proportional to voltage, not the square of voltage; this improves voltage stability & efficiency on large networks. Synchronous condensers can also be used in connection with high-voltage direct-current transmission projects or in large industrial plants.

For power factor correction of high-voltage power systems, fluctuating of industrial loads, power electronic devices such as the Static VAR compensator or STATCOM are becoming more popular. These systems having quick response to compensate sudden changes of power factor than contactor-switched capacitor banks, and being solid-state devices require less repair & maintenance than synchronous condensers.

2. Non Linear Loads

A non-linear load in power system is typically are rectifier (such as used in a power supply), or some devices like arc discharge device such as a fluorescent lamp, electric welding machine, or arc furnace. Because current interruption occurs in these systems is by a switching action, the frequency components contains current that are multiples of the power system frequency. Distortion power factor is a measure of

how much the harmonic distortion of a load current decreases the average power transferred to the load.

III. VFD IMPLEMENTATION

A variable frequency drive (VFD) is a motor-driven system can offer potential energy savings in a system in which the loads variation with time. VFD is a group of equipment called adjustable speed drives or variable speed drives. (Variable speed drives can be mechanical or electrical. The operating speed of a motor connected to a VFD varies by changing the frequency of the motor supply voltage. This process allows continuous speed control.

Motor-driven systems are often designed to handle peak loads that have a safety factor. This often leads to energy inefficiency in systems that operate for extended periods at reduced load. The ability to adjust motor speed enables closer matching of motor output to load and often results in energy savings.

WSS mill having two VFDs installed on 250 kW Motors which give very good results for energy efficiency.

For example a 250 kW motor requires 850 amp current at starting time on full load.this motor can also starts by using VFD by 5-6 amps.VFD is not required just to start the motor it also helps to control the speed and torque of induction motors.

In WSS mill VFD Can also be implemented on 30 to 175 hp motors. At presents star delta starters are used for starting which requires very large current at starting time. In sugar industry speed variations are there so VFD also helps for the same control.

IV. CONCLUSIONS

Energy audit is a very tool in transforming the fortunes of any industry. Industry norms should be set and continuously checked during the course of operations of industry, just as any other economical or production or commercial parameters. As seen above, the huge potential can be saved, if properly harnessed can take any organization to the path of prosperity. Particularly where cogeneration of power is involved in a sugar industry, every unit of power saved and every ton of bagasse saved adds to the additional revenue of the organization. Potential for energy conservation in sugar industry is immense because of the fast developments that are taking place in the industry as well as the traditionally conservative outlook of the Industry in India and their present status. This paper highlights

Only a few important areas that has come to light during the audit of different factories. There may be many more areas uncovered by this report typical to individual units.. It will be different in different places and there are bound to be concern areas in all places if honestly looked into, since no one could claim to have reached the state of perfection.

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Electrical Overhead Transmission Line Design and Analysis using MATLAB

Balraj Dadhwal
EED, BBSBEC Fatehgarh Sahib
engg.balraj@yahoo.com

Gursewak Singh Brar
EED, BBSBEC Fatehgarh Sahib
gursewak.singh@bbsbec.ac.in

Abstract: Electric-power transmission is the bulk transfer of electrical energy, from generating power stations to electrical substations located near demand centers. For economical & reliable power transmissions and erection the transmission line design is the first step to consider. Conventional design can be done by manual calculations. MATLAB is a mathematical tool which reduces the calculation time and increases the reliability with reduction of human error. The objective of this paper is to develop a software tool for designing transmission line in MATLAB and to use it to analyze effect of size on voltage-regulation and efficiency .also It indicates how the voltage regulation and efficiency varies with length of transmission line.

Keywords: Transmission line design, power system analysis, MATLAB ,etc .

I. INTRODUCTION

A. Introduction to Electrical design of Transmission Line

Transmission lines transmit power over the required distance economically and satisfy the electrical and mechanical requirement. In designing, several parameters are to be calculated in steps like selection of voltage, spacing between conductors[7], conductor size, calculations of line parameters and line constants(ABCD), on the basis of that calculation sending end voltage, sending end current and sending end power can be find out. Whole designing must be done by keeping minimum voltage regulation, permissible limit of corona loss and maximum desirable efficiency. The transmission system may have to be modeled and solved in many different ways such as PLSCAD, MATLAB. It is desirable to have a single software platform from which several power system designing functions can be easily calculated [1].

B. Introduction to MATLAB program and GUI (An Overview)

1. GUI Layout:

GUIDE, the MATLAB graphical user interface development environment, provides a set of tools for creating graphical user interfaces (GUIs).These tools simplify process of laying and programming GUIs. Using the GUIDE Layout Editor, populating the GUI by clicking and dragging components such as axes, panels, buttons, text fields, sliders, and so on into the layout area can be made. From the Layout Editor, it can size the GUI, modify component look and feel, align components, set tab order, view a hierarchical list of the component objects, and set GUI options.

2. Available Components

The component palette at the left side of the Layout Editor contains the components that can add to GUI.
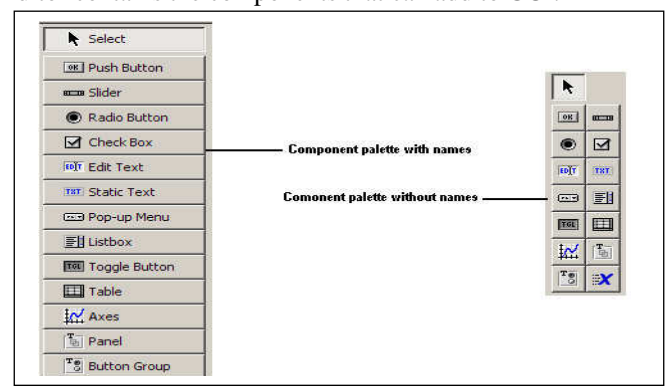
Fig 1:GUI components

When Layout Editor opens, the component palette contains only icons. To display the names of the GUI components, select Preferences from the File menu, check the box next to Show names in component palette, and click OK.

3. Running a GUI:

GUI is run by executing the M-file that GUIDE generates. This M-file contains the commands to load the GUI and provides a framework for the component callbacks. When the M-file executes, a fully functional copy of the GUI displays on the screen [8].opens the GUI M-file in default editor.

II. DESIGNING METHEDOLOGY

The Flow chart describes the process for building the Transmission line design software which includes the various steps used in it:
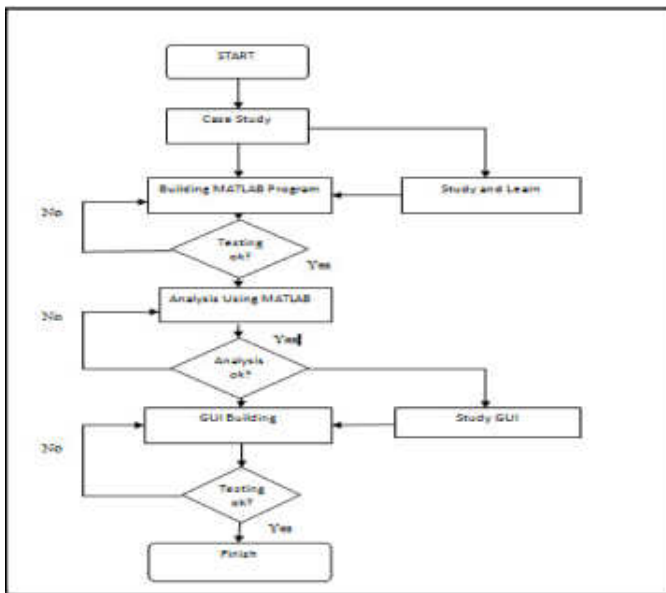
Fig 2: Flow chart of the designing process

A. Case Study

Design a transmission line to transmit three-phase 85000 kW load at 0.80 power factor lagging over a distance of 60 km. The regulation should be within 12.5% and the efficiency of transmission not less than 95% [1][2].

Different steps are:

- Choose voltage, size of conductor and spacing between the conductors
- Calculate constant of line
- Find sending and receiving end voltage
- Determine the regulation
- Corona loss
- Efficiency

B. Solution by different steps:

Loading on line = $85000 \times 160 = 13.6 \times 10^6$ kW km

Voltage required for this loading = 132 kV

Current at receiving-end,

$I_r = 414 \angle-25.83°$ A

Approximate equivalent spacing of the conductors for 132 kV line is, $D_m = 6$

Copper equivalent cross-sectional area $= 1.6125$ cm^2

Nominal copper area $= 0.322$ cm2

Number of strands and diameter of aluminium = 30/0.335

Number of strands and diameter of steel = 7/0.335

Overall diameter = 2.347 cm

Total number of strand =37

Resistance of line per km at 20° c=0.1091 Ω_l

Resistance for 160 km line per phase= 17.45 Ω_l

The receiving-end voltage V_r per phase = $132/\sqrt{3}=76.4 \angle0°$ kv

Self-GDM for 37 stranded wires = 0.768R

Outer radius = 2.347/2 = 1.1735 cm

Total Self-GDM, D_s = 0.768× 1.1735 =.9 cm

Inductance per phase per meter = $2\times10^{-7}\times$ ln (D_m/D_s)

Inductance per phase for 160 km line = $2\times10^{-7} \times160 \times1000 \times$ln (600/0.9)

= .208H

$X = 2 \pi f l = 65.4 \Omega_l$

$Z = 17.45 + j 65.4 = 67.8 \angle75°$

The ratio = D_m/R = 600/1.1735 = 511

The Capacitance per phase per meter = 1/ (18× 109 × ln 511)

The Capacitance for 60 km line per phase, C_N = 160 × 1000/ (18× 10^9 × ln 511) = 1.1425 × 10^{-6} F

Admittance of line is =

$Y = 2 \pi f C_N$ = 0.000448 $\angle90$ Ωi^1

ZY = 0.0304 $\angle 165°$

ZY = 10^{-2} [-2.94 + j 0.787]

$ZY/6$ = 10^{-2} [-0.49 + j 0.1312]

$Z^2Y^2/120$ = $10^{-6} \times$ [6.65– j 3.8]

Line constants A and D

$A = D = 1+ZY/2$ = 1- 0.0147 + j 0.003935

$A = D$ = 0.9853 + j 0.003935= 0.9853 $\angle0.22°$

Line constants B and C

$B = Z [1 + ZY/6 + Z^2Y^2/120 +...]$ = 67.81 $\angle75\times0.9951$ $\angle0.08°$

B = 67.5 $\angle75.08°$

$C = Y [1 + ZY/6 +...]$

= 0.000448$\angle90°$ [1 – 0.0049 + j 0.001312]

= 0.000445 $\angle90°$

Receiving end voltage per phase, V_r = 76.4 $\angle0$ kV

Receiving end current per phase, $I_r = 414 \angle\text{-}25.83°$ A

Now as sending end voltage $V_s = A\,V_r + B\,I_r$

$V_s = 75150 \angle 0.22° + 28600 \angle 49.25° = 93850 + j\,21936$

Hence sending end voltage $V_s = 96200 \angle 13.2$ kV

Voltage regulation, V.R. = {(96200 - 76400) × 100/76400} = 25.9% ≅ 26%

Thus, the regulation for a conductor of this size and line-voltage 132kV is not within permissible limit of 12.5% [6].

Table 1: Data calculated at 166 kV

V_L(KV)	I_L(A)	D_m(m)	Conductor Size in cm2	I(A)	%V.R
166	329	8	1.6125	505	14.5

Thus, again the regulation for a conductor of this size and line-voltage 166kV is not within permissible limit of 12.5%.

Table 2: Data calculated at 230kV

V_L(KV)	I_L(A)	D_m(m)	Conductor Size in cm2	I(A)	%V.R
230	237	10.2	.805	300	10.5

Now the voltage regulation is good and under the prescribed limit of 12.5%.

III.   SOFTWARE TOOL DEVELOPED FOR OVERHEAD TRANSMISSION LINE DESIGN :

When it is needed to run the standalone application of the tool, then steps should be followed

Step 1: While pressing enter, user will be in the designing environment. And the following will be displayed

Fill all required parameters and click on calculate for electrical design of the overhead transmission line.

Step 2: Figure: 3.1 will show the electrical design and display a text showing voltage regulation is less than 12.5% or not .

If the voltage regulation is not less than 12.5%, then click on BACK to go to previous page and increase the voltage so area of the conductor to get the more efficient and stable design. Otherwise , if the regulation is good enough.**.** By using this designing software best suitable design can be calculated.
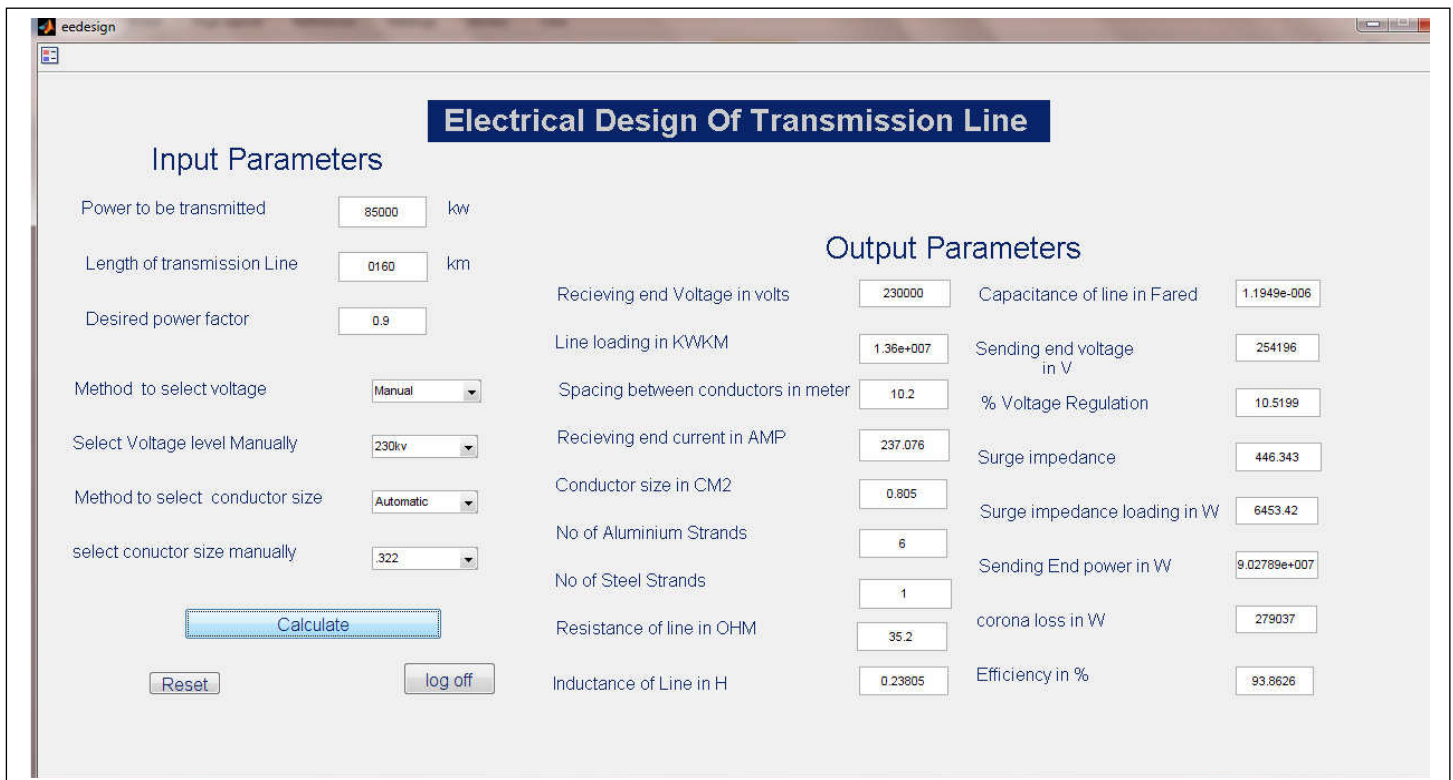
Fig 3. Display on the screen for transmission line design

IV.   RESULTS & DISCUSSIONS

Design a transmission line to transmit 85MW load at 0.9 power factor lagging over a distance of 160 km the voltage regulation at full load.

A.   Select the proper voltage.
  - Choose the proper conductor and span for the line
  - Calculate the line parameters
  - Estimate the regulation for full load condition and efficiency.

1) Analyze the effect of transmission line length on regulation and efficiency for same power and at different voltage levels.

2) Analyze the effect of increasing size of conductors on regulation and efficiency at different voltage levels for same power.

By using transmission line designing software, the voltage regulation at different voltage levels of transmission is obtained. On filling the starting inputs to the software, it gives automatically the voltage of transmission, i.e. 132kV. Based upon these parameters the 27.5% voltage regulation is obtained. To improve voltage regulation it is necessary to choose next voltage level of transmission i.e. 166kv.On filling the voltage level 166 KV the output is 18 % which is again not desirable for the transmission of 85 MW under 160 Km line. So again it become upgrade the voltage level from 166 KV to 230 KV for this level of voltage the voltage regulation observed is 10.5% which fulfill the requirement of voltage regulation less than 12.5%.All parameters are shown in fig 3

a) Distance vs Regulation

Fig 4.1: Variations of Regulation with Distance

Depicts four curves have been plotted to show variation of voltage regulation with distance of transmission line for transmission of 85MW power. With increase in distance the voltage regulation increases .but on selecting high voltage level, steepness of curve reduces .For transmitting 85 MW and up to 50 km length 110kv is suitable and for a distance

above 50km regulation increases beyond the desirable limit of 12.5%.from 50 to 75km,132kv is preferable and 75to100kms,166kv holds good. from 100 to 200kms 230 kv gives good voltage regulation .

(b) Distance vs Efficiency
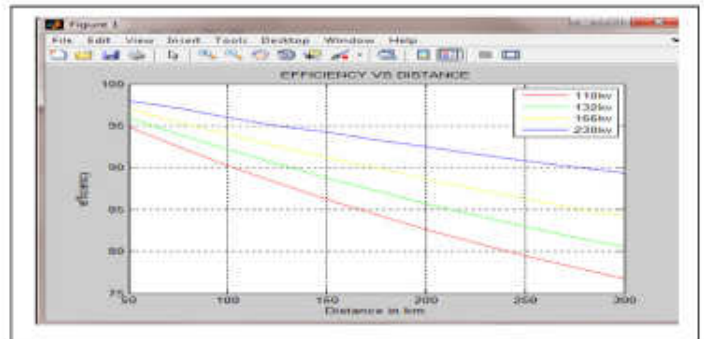
Fig.4.2: Variations of Efficiency with Distance

Above fig indicates the variations of   efficiency with distance from 50 km   to 300 km to transmit 85MW power at different voltage levels. As the distance increase the resistance of line conductors increases .As the line losses depends upon resistance ,so it increases. and efficiency decreases.so as the distance   increases   the voltage levels increases. For transmitting 85MW, below 50 kms the 110kv is suitable, and as the distance increases higher voltage selection is required and for 160 km line 230kv gives good efficiency i.e. 94%.

c): Size vs Regulation
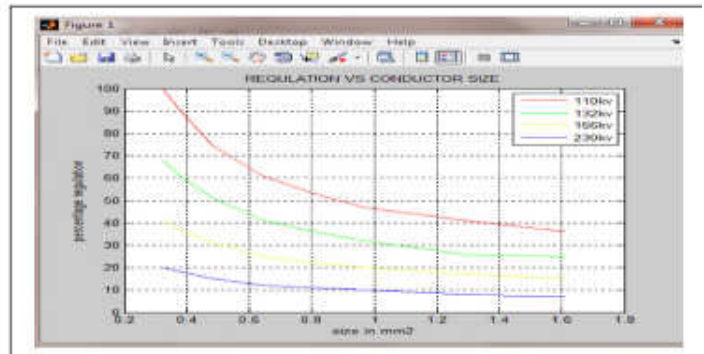
Fig4.3: Regulation variation with size of conductor

Depicts the variation voltage regulation with size of conductor for 85MW power and 160 km line. As the conductor size increases the resistance decreases hence regulation decreases.as per regulatory board below 12.5% voltage regulation is desirable. Voltage regulations at 110kv, 132kv, 166kv are 36%, 25%, 15%.and for 230kv curve ,on increasing the size of conductor to .805mm^2 regulation comes 12%.this graph also shows on selecting higher voltage levels regulation decreases.

d): Size vs Efficiency
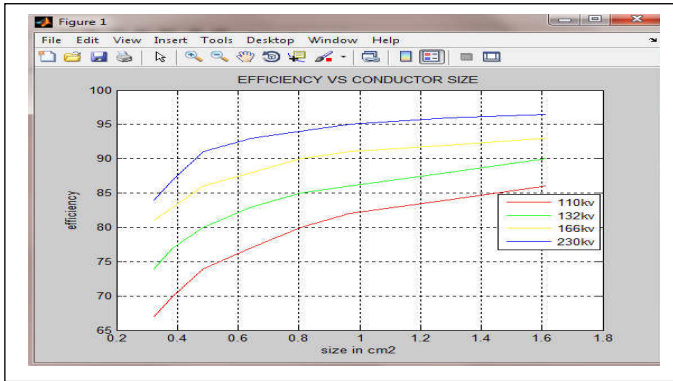
Fig4.4:Efficiency variation with size of conductor

Fig4.4 indicates efficiency variation with size of conductor. Efficiency increases with increase in size,the efficiency does not hold good for transmitting 85MW by using 110 kv,132 kv and 166kv transmission lines. For 230kv line efficiency is above 95%.On selecting higher kv for transmission, the efficiency improves as current decreases and losses reduced.

V. CONCLUSION

In the present paper an approach is made to provide a tool for designing transmission line model and to get more reliable solution. Using this TLD software some analysis is done. Which provides two major consequences, first is on increasing the length of transmission line, The voltage regulation increases and efficiency decreases i.e this describes the line voltage for range of transmission line length. and second is this paper describes the selection of conductor size. By using this transmission line model and its analysis, suitable design can be selected.

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Power Quality Improvement Using Advanced Multilevel SVPWM DSTATCOM

Manjeet Singh
Dept. of Electrical Engineering,
CT Group of Institutions
Jalandhar

Kushdeep Singh
Dept. of Electrical Engineering
GNDEC

Taranpreet Singh Talwar
Dept. of Electrical Engineering
CT Group of Institutions Jalandhar

Abstract: Power quality is simply the interaction of electrical power with electrical equipment. If electrical equipment operates correctly and reliably without being damaged or stressed, we would say that the electrical power is of good quality. On the other hand, if electrical equipment malfunction, or is damaged during normal usage, we would suspect that the power quality is poor. In this paper , power quality is improved by using Advanced multilevel SVPWM Distribution Static Compensator (DSTATCOM).

Key words: Space Vector Pulse Width Modulation (SVPWM), Voltage Source Inverter (VSI), Distribution Static Compensator (DSTATCOM)

I.   INTRODUCTION

.In 20th century the expansion of power system and electronic devices has been grown at very fast rate. The most noticeable topic for electrical engineer is power quality in recent years. Power quality problem as an occurrence manifested as a nonstandard voltage, current or frequency that results in a failure or a mis operation of the end user equipments. With power quality problem utility distribution networks, industrial loads, sensitive loads etc are suffered. With the restructuring of power systems and with shifting trend towards distributed and dispersed generation , the issue of power quality is going to take newer dimensions. To overcome the problem related to power quality custom power devices are introduced. A number of power quality solution are provided by custom power devices. At present, a wide range of very flexible controller, which capitalize on newly available power electronics components are emerging for custom power applications. Among these, the distribution static compensator is use in the present work. The fast response of the distribution static compensator (DSTATCOM) makes it efficient solution for improving power quality in distribution systems. DSTATCOM can use with different types of controllers. The device consider in this work is distribution static synchronous compensator (DSTATCOM) with SVPWM technique to improve the power quality under different abnormal conditions like single line to ground fault, double line to ground fault in distribution network with static linear and static non linear loads.

II.   MULTILEVEL INVERTERS AND MODULATING TECHNIQUES

A.   Pulse Width Modulation(PWM) Technineque

A power electronic inverter is essentially a device for creating a variable AC magnitude and frequency output from a DC input. The frequency of the output voltage or current is readily established by simply switching for equal time periods to the positive and negative DC bus and appropriately adjusting the half cycle period. However the variable frequency ability is accompanied by a corresponding need to adjust the amplitude of fundamental component of the output waveform as the frequency changes i.e., voltage control. One of the widely utilized strategies for controlling the AC output of power electronic converters is the PWM [4] Technique. This varies the duty cycle of the inverter switches at a high frequency to achieve a target average low-frequency output voltage or current**.**

Modulation theory has been a major research area in power electronics for over three decades and continues to attract considerable attention and interest. On the other hand, there have been a number of clear trends in the development of PWM concepts and strategies since 1970s, addressing the main objectives of reduced harmonic distortion and increased output magnitudes for a given switching frequency and the development of modulation strategies to suit different converter topologies.

B.   Principle of PWM

Fig. 1 illustrates the circuit model of a single-phase inverter with a center-tapped grounded DC bus and Fig. 2 illustrates the principle of PWM.

1. When Vcontrol > Vtri , VAO = Vdc/2

2. When Vcontrol < Vtri , VAO = -Vdc/2

   M= Vcontrol /Vtri
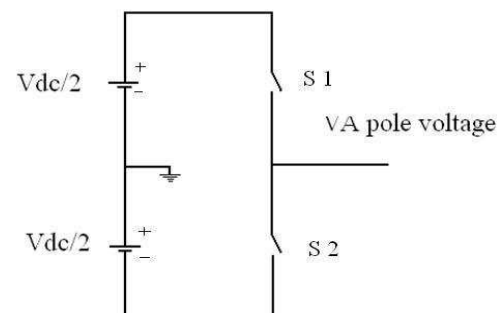
Fig. 1 Circuit Model of Single - Phase I
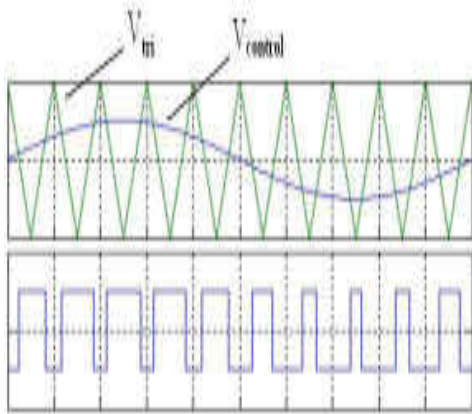
Fig. 2. Pulse Width Modulation(PWM)

From Fig. 2 the inverter output voltage is determined in the following

$$THD = \frac{\sqrt{\sum_{n=2}^{\infty} H_{(n)}^2}}{H_1}$$

III. MODULATION TECHNIQUES FOR DIODE CLAMPED MULTILEVEL INVERTER

A. Third Harmonic Injected PWM

The reference ac waveform is not sinusoidal as illustrated in Fig. 3 but consists of both fundamental component and a third harmonic component. As a result, the resulting peak to peak amplitude of the resulting reference function does not exceed the dc supply voltage , but the fundamental component is higher than the available supply. The presence of exactly the same third harmonic component in each phase results in an effective cancellation of the third harmonic component at the neutral terminal and all sinusoidal with peak amplitude. This is approximately 15.5% higher in amplitude than that achieved by the sinusoidal PWM. Therefore, the third harmonic PWM provides better utilization of the dc supply voltage.
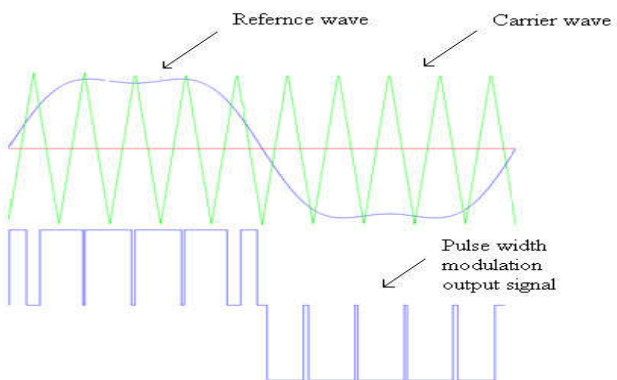
Fig. 3. Third Harmonic Injected PWM with Triangular Carriers for Multilevel Inverter

IV. PRINCIPLE OF SPACE VECTOR MODULATION

An inverter is now-a-days commonly used in variable speed ac motor drives to produce a variable, three phase ac output voltage from a DC voltage. Since AC voltage is defined by two characteristics, amplitude and frequency, it is essential to work out a strategy that permits control over both these quantities. PWM controls the average output voltage in a sufficiently small period, called switching period, by producing pulses of variable duty-cycles [3]. Here, sufficiently small means the switching is small compared to the desired output voltage which may be considered as equal to desired.
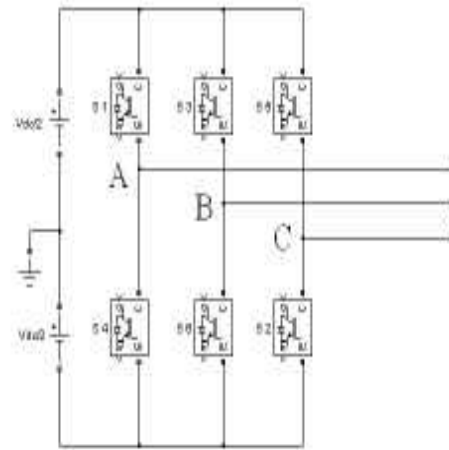
Fig. 4. Three-phase two-level PWM inverter

V. OPERATION OF THREE-PHASE THREE-LEVEL INVERTER
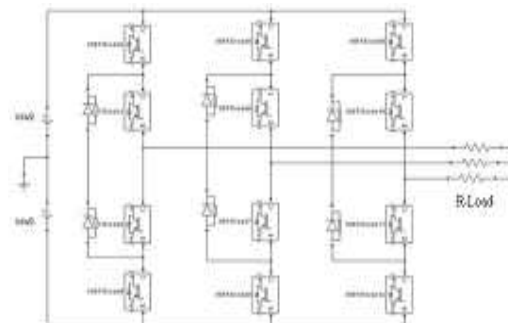
Fig. 5 Power circuit for Three-phase

A. Three-Level Inverter

Fig. 5 illustrates the basic circuit for the three-level DC3LI. The circuit employs 12 power switching devices and 6 clamping diodes (D1-D6)and the DC bus voltage is split into three-levels(+Vdc/2, 0,-Vdc/2). Thus, the voltage stress of the switching device is greatly reduced. The output phase voltage Vao has three different states: +Vdc/2, 0, -Vdc/2. Here take phase A as an e.g., for voltage. For voltage +Vdc/2, Sa1 and Sa2 need to be turned on. Inverter, the switching states of each bridge leg of three-phase three-level inverter is described by using switching variables Sa, Sb and Sc.The difference is that, in three-level inverter, each bridge leg has three different switching states.

Table 1 Switching variables of phase A

Vao	Sa1	Sa2	Sa2'	Sa1'	Sa
+Vdc/2	ON	ON	OFF	OFF	2
0	OFF	ON	ON	OFF	1
-Vdc/2	OFF	OFF	ON	ON	0

Using switching variable Sa and DC bus voltage Vdc, the output phase voltage Vao is obtained as follows:

Van=(Sa-1)*Vdc/2

B. SPACE VECTOR PWM FOR THREE LEVEL INVERTER

There are altogether 27 switching states in a DC3LI. They correspond to 19 voltage vectors whose positions are fixed. These space voltage vectors can be classified into four groups, where the first group corresponds to 3 zero vectors or null vectors (V0, V7, V14), the second group consists of large voltage vectors (V15-V20), the third group consists of medium voltage vectors (V8-V13) and finally the fourth group consists of small voltage vectors (V1-V6). The last three groups can be distinguished into three hexagons illustrated in Fig.6
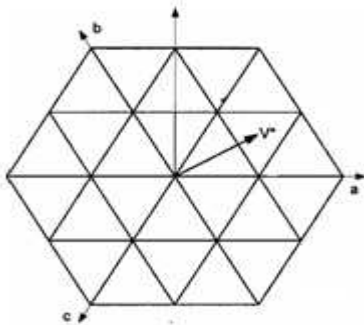
Fig. 6 Space Vector hexagon

The plane can be divided into 6 major triangular sectors (1-6). Each major section represents pi/3 of the fundamental cycle. Within each major sector, there are 4 minor triangular sectors. There are totally 24 minor sectors in the plane and the vertices of these sectors represent the voltage vectors.
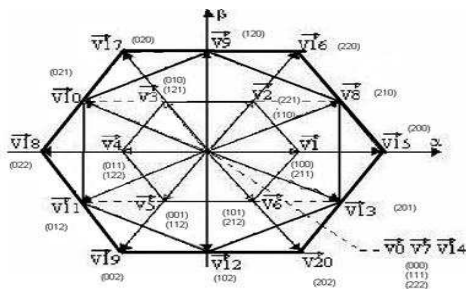
Fig. 7 Space Vector hexagon displaying switching states

In three-phase three-level inverter, when the rotating voltage vector falls into one certain sector, adjacent voltage vectors are selected to synthesize the desired rotating voltage vector based on the vector synthesis principle, resulting in three-phase PWM waveforms. By the examination of the phase angle and the magnitude of a rotating reference voltage vector V*, the sector wherein V* resides can be easily located.

From table1, each small voltage vector and zero voltage vector have 2 and 3 redundant switching states, respectively. This will be analyzed in the later section.

X = Tx/Ts ; Y = Ty/Ts ; Z = Tz/Ts

Based on the principle of vector synthesis, the following equations can be written:

X+Y+Z=1

Vx *X +Vy *Y+ Vz *Z

The modulation ratio of three-phase three-level inverter is represented as follows:

M=|V*|/ (2/3Vd) = 3|V*| /2Vd

VI. PARAMETERS OF THE SYSTEM

The modelled system has been tested on different fault conditions with linear as well as non-linear load. The system is employed with three phase generation source with configuration of 25 KV, 50Hz. The source is feeding two transmission lines through a three phase, three winding transformer with power rating 250MVA,

50 Hz.

Winding 1: V1rms (ph-ph)= 25KV, R1= 0.002(pu), L1=0.08(pu)

Winding 2: V2rms (ph-ph)= 11KV, R2= 0.002(pu), L2=0.08(pu)

Winding 3: V3rms (ph-ph)= 11KV, R3= 0.002(pu), L3=0.08(pu)

A. SIMULINK MODEL OF THE TEST SYSTEM WITH STATIC LINEAR LOAD

Simulink model of the test system is given in Figure 8. The system consists of two parallel feeders with similar loads of same rating. One of the line is connected to DSTATCOM and the other is kept as it is. This system is analyzed under different fault conditions.
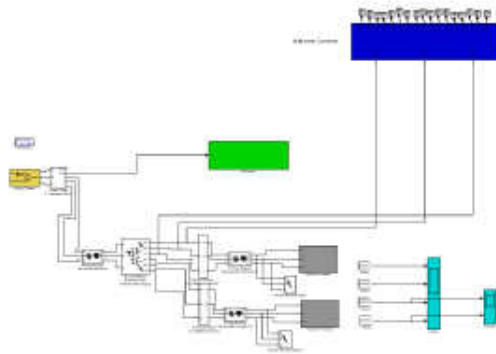
Figure 8: Simulink model of test system

B. RESULTS UNDER DIFFERENT FAULT CONDITIONS

Three different fault conditions are considered for the test system as shown in figure 9. The three different fault conditions are single line to ground, double line to ground and three phase to ground fault. The results for each fault condition are given one by one.

1. CASE 1. Single Line to Ground Fault Condition

In first case a single line to ground fault is considered for both the feeders. Here the fault resistance is 0.66 ohm and the ground resistance is 0.001. The fault is created for the duration 0.3s to 0.5s. The output wave for the load current with compensation and without compensation is shown in figure 9, figure 10. respectively.
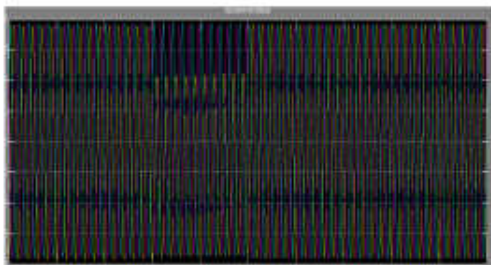
Figure-9: Load Current (with compensation)
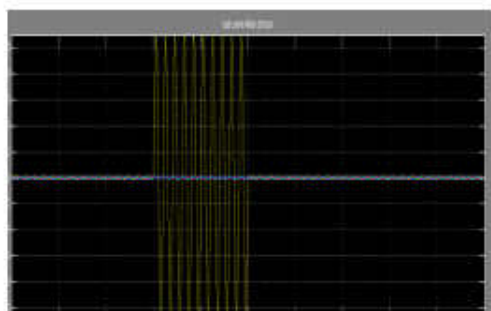
Figure 10 Load Current (without compensation)

Here it is clear from the output wave shapes that the current in the phase where fault is created is during increasing during the fault duration in the uncompensated feeder. So, here the unbalancing the in the system where DSTATCOM is connected is reduced clearly.

2. CASE2. Double Line to Ground Condition

In second **case** considered fault for both the feeders is double line to ground fault. For this fault resistance and ground resistance is .66 ohm and 0.001 ohm respectively. And the time duration for this fault is 0.3s to 0.5s . The output for the load current with compensation and without compensation is shown in figure 11 and figure 12 respectively.
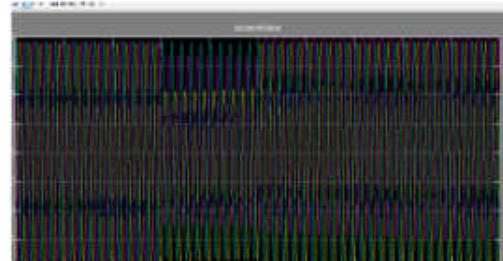
Figure-11 Load Current (with compensation)
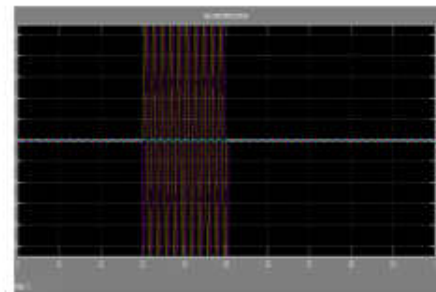
Figure-12 Load Current (without compensation)

The output wave shapes clear that the current in the phase where fault is created is increasing during the fault duration in the uncompensated feeder, but in system where the DSTATCOM is connected through unbalancing is reduced clearly.

3. CASE3. Three Phase Line to Ground Fault Condition

In third case a considered fault for both the feeders is three phase to line fault. The fault created for the duration of 0.3s to 0.5s . And fault resistance and ground resistance is 0.66 ohm and 0.001 ohm respectively. The output wave for the load current with compensation and without compensation is shown in figure 13 and figure 14 respectively
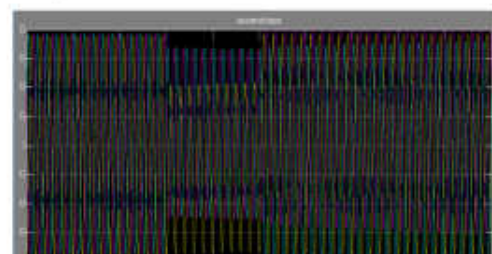
Figure 13 Load Current (with compensation)
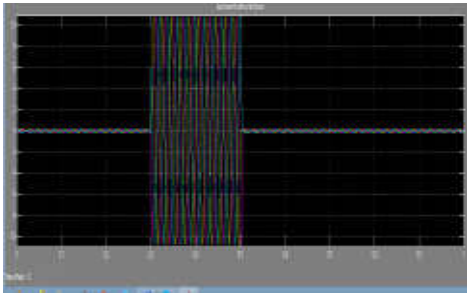
Figure 14 Load Current (W/O compensation)

The figure 13 and figure 14 espectively shows the wave shapes that the current in the phase where fault is created is increasing during the fault duration in the uncompensated feeder. And the system where DSTATCOM is connected unbalancing is reduced clearly.

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Artificial Intelligence in Electrical Power Distribution Planning

Navpreet Singh Tung
Dept. of Electrical Engineering
CT Group of Institutions
Jalandhar,India
icenitj@gmail.com

Taranpreet Singh Talwar
Dept. of Electrical Engineering
CT Group of Institutions
Jalandhar India
icenitj@gmail.com

Harkamal Singh Bhullar
Dept. of Electrical Engineering,
CT Group of Institutions
Jalandhar India
icenitj@gmail.com

Sandeep Chakravorty
Dept. of Electrical Engineering
Baddi University,Baddi India
sandeep@baddiuniversity.ac.in

Abstract—Distribution system is an integral part of power system planning and it is of utmost importance for the electrical utilities and power engineers to explore this area in short and long term planning scenarios. Load demand requirements subjected to economic feasible solutions matching voltage profile, reactive power demand, minimization of losses, voltage stability, capacitor allocation and improve the capacity of the system is the need of the hour. Optimization techniques based on evolutionary computing, artificial intelligence, search method finds their applications in the area of electrical distribution system planning to reach global optimal solution for this multi-decision, multi-objective combinatorial problem subjected to different constraints. Researchers lead their way out to reach at common platform for optimal solution on this problem. This paper flashed different advanced techniques applied to distribution system planning field and direct the future research for power engineers working in this area.

Keywords-: Distribution System (DS), Capacitor Allocation (CA), Voltage Stability (VS)

I. INTRODUCTION

Capacitor banks are extensively used in distribution systems for reactive power compensation to achieve power and energy loss reduction, optimum voltage profile and enhance voltage stability [1]. The limit of these positive scenarios depends on the location, size, type and number of the capacitors subjected to different constraints. The capacitor allocation (CA) problem is a well-explored topic in literature for distribution system planning. The necessity to find a global solution for real distribution systems along with growth in digital system invites a new generation of methods and techniques based on computer applications. These methods suggested a global solution for the optimization of distribution system planning [2]. Different conventional methods have been used for load flow calculations and to find optimum capacitor allocation problem. In the present scenario, extended distribution systems are radial in nature and produce very low voltages at the different load buses situated at long from the sub-station. These minute voltages at the load points results in huge power losses and reduce the power factor lower than expected. In addition, the contemporary distribution systems are being faced with an exponentially growing load demand and experience sudden variations in load levels every day; and hence are operated in the region of their steady state power transfer limit [13]. During peak load, even a small change in the load pattern may threaten the voltage stability (VS) of the system. The process of voltage instability is generally triggered by some form of disturbance or change in operating conditions that create an increased demand for reactive power, which is in excess of what the system is capable of supplying. The problem of voltage instability has thus become a matter of great concern to the utilities in view of its prediction, prevention and necessary corrections to ensure stable operation [13].

II. PROBLEM FORMULATION

Capacitor sizes and locations for allocation are inherent variables for distribution system planning for voltage profile and stability; this subjected the capacitor placement problem as a multi-objective and multi-decision combinatorial optimization nature [14].

$$\text{Min Z} = \sum_{k=1}^{n} T^k P^k \tag{1}$$

$$\text{Min Z} = \sum_{k=1}^{n} x^k T^k P^k \tag{2}$$

$$\text{Min Z} = \sum_{k=1}^{n} x^k T^k P^k + C \tag{3}$$

$$\text{Min Z} = \sum_{k=1}^{n} x^k T^k P^k + C + y P^p \tag{4}$$

Z = the value of the desired objective function

n = number of load levels

T^k = time duration for the k-th load level

P^k = power loss at the k-th load level

x^k = per unit cost of energy loss at the k-th load level

C = investment cost of capacitor

y = per unit cost of peak power loss

P^p = power loss at peak load level

III. OPTIMIZATION TECHNIQUES

There are many methods proposed in literature for distribution system planning. Below are some conventional and advanced methods for distribution system planning -

A. Traditional Techniques

- Newton Raphson
- Fast Decoupled
- Gauss Seidal
- Branch Bound
- Dynamic Programming
- Lagrange Algorithm

B. Advanced Techniques

- Branch Exchange
- Neural Network
- Honey Bee Optimization
- Shuffled Frog Leaping
- B Snake
- Dijkstra Algorithm
- Harmony Search
- Greedy Snake
- Tabu Search
- Pattern Search
- Meta Heuristic
- Ant Colony
- Differential Evolution
- Biogeography Based Optimization
- Cuckoo Search
- Ant Bee
- Plant Growth
- Ladder Method
- Fire Fly
- Bee Hive
- Fuzzy Logic
- Genetic Algorithm
- Particle Swarm Optimization

IV. LITERATURE BACKGROUND

Ahmad Galal Sayed and Hosam K.M Youssef[1] proposed an algorithm for CA based on genetic algorithm for interconnected distribution system in nonlinear load environment. A line losses, operating conditions, harmonic constraints and annual profits have been investigated for optimal size and location of capacitor bank on test system based on configuration. Dr.Akram F.Bati et al[2] developed a technique based on genetic algorithm for optimal location and sizing of capacitor to improve voltage stability, voltage profile and minimize losses at different load levels subjected to cost of capacitor and economic saving. Solution in terms of global minima and accuracy has been observed in test results. This technique is tested on 11 and 69 node distribution system. A. Kartikeya Sarma and K. Mahammad Rafi[3] formulated a technique for capacitor selection based on plant growth simulation algorithm for radial distribution system.The main objective is to enhance the voltage level of line and reduction in line losses. Load sensitivity factor is deployed to locate the points of capacitor placements. Plant Growth Simulation Algorithm is utilized for CA. Suggested technique is tested on 33,34 and 69 bus radial system. Test results shows the promising results when compared with other advanced techniques. Rosana Satie Takehara and Ruben Romero[4] applied a method based on artificial immune system to capacitor allocation problem. This method is tested on 9,69 and 135 bus system. Fixed and variable capacitor banks are considered in the case study. Power factor improvement, losses reduction, voltage profile improvement and capacity increase has been achieved in this research. Yasser Gallal et al[5] proposed a method for CA in distribution system with fuzzy logic.Fuzzy logic is explored for capacitor location and capacitor size is found with Q-V analysis. Comparison with particle swarm optimization is carried on IEEE 16 bus distribution system. VS and minimum cost have been achieved using fuzzy logic. M.Heydari et al[6] used distributed generation incorporating harmonic and resonance analysis in the proposed discrete particle swarm optimization technique to solve CA problem for VS in distribution system. A case study of IEEE 33 bus system is considered for investigation. Total harmonic distortion, voltage profile have been improved in simulation results. Mauricio Granada.E et al [7] solved CA problem in DS using Ant colony approach. Sensitivity analysis has been carried out to locate the capacitor position as it reduces search space for solution. A case study of 9 bus system and 69 bus system has been taken to evaluate the proposed approach. Economic savings, reactive power requirement has been revealed with this approach.Reza Sirjani and Badiossadat Hassanpour[8] coined novel ant colony method for power flow calculation .Total cost and losses are greatly reduced when proposed method is tested on 9 bus system. Results are compared with other standard techniques to benchmarks the suggested approach.Rajeev Annaluru et al[9] solved CA problem in DS with multilevel ant colony algorithm. Test system comprises 30 bus radial distribution system with one main feeder and 6 laterals.Test results reveals the minimum computational efforts as compared to other techniques as well as achieved VS and improved voltage profile. Bharat Solanki et al[10] suggested a technique to solve CA problem with ant colony and gradient method. Gradient method is used to accelerate the solution.System

incorporates 27 and 55 nodes system.Reduced active power losses have been achieved in the case study. Vikrant Kumar et al[11] developed an algorithm based on path search for the optimization of radial network.Total annual cost of the network minimization and optimal route of the load points have been achieved. A case study of 24 load points has been selected to investigate the proposed algorithm. Tanuj Manglani and Y.S Shishodia[12] presented a survey of different techniques based on conventional and advanced methods.Genetic Algorithm, particle swarm optimization, fuzzy logic, simulated annealing, ant colony methods have been in the paper for CA problem.S.Neelima and Dr.P.S Subramanayam [13] developed a method for CA problem in DS based on differential evolution.Proposed method is tested on IEEE 69 bus system and results are compared with other techniques.It outperforms other algorithms in terms of losses and cost.E.Dolatdar et al [15] proposed model based on tree algorithm for load flow in DS.Genetic algorithm is also used to reduce search space. Proposed method is tested on IEEE 33 bus system.Test results show the effectiveness of the suggested technique.

V. CONCLUSION

Application of artificial intelligence techniques in power distribution system planning optimization has been inherently evolving for last few decades. Different evolutionary computation methods whether stand alone or hybrid in nature have been developed and successfully applied to distribution system network expansion. In the current text, an application of artificial computing has been presented through different contemporary researches done by investigators in the distribution system planning. This paper will serve as a benchmark for future researchers to investigate this area and develop new techniques which are reliable and lead to optimal solution.

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Self Excited Induction Generators and Methods of Performance Analysis

Ashish Sharma
Punjab Technical University,
Kapurthala,India
ashishdpr@rediffmail.com

Raja Singh Khela
Quest Group of Institutes,
Mohali, India
rskhela@rediffmail.com

Abstract— Induction generators are increasingly used in non-conventional systems. In modern times, as the population increases, the demand for electricity also increases. As it is difficult for developing countries to generate that amount of electricity, so induction generators are used as standalone system to provide the electricity to remote areas. But the need for an external supply of reactive power (to produce a rotating magnetic flux wave) limits the application of an induction generator as a standalone generator. The induction machine can be operated as a Self-excited Induction Generator (SEIG) if capacitors are connected to the stator terminals in order to supply the necessary reactive power to achieve generating electrical energy in remote areas. In this paper, various types of SEIG and methods involving analysis of self excited induction generator are presented.

Keywords— Self Excited Induction Generator, Genetic algorithm, Artificial neural networks

Nomenclature:

R_r, X_r = Rotor resistance and reactance
R_s, X_s = Stator resistance and reactance
R_L, X_L = Load resistance and reactance
R_e = Core loss resistance
X_m = Per phase Saturated magnetic reactance
X_{mu} = Unsaturated magnetizing reactance
X_C = Per phase capacitive reactance
F_g = Generated frequency
F_r = Rated frequency
a = Ratio of generated to rated frequency
b = Ratio of actual rotor speed to synchronous speed corresponding to rated frequency
I_s = Stator current
I_L = Load current
I_r = Rotor current
I_C = Capacitive current
E_l = Air gap voltage per phase at rated frequency
Z = Impedance of complete circuit

I. INTRODUCTION

In recent years, the increased emphasis on renewable resources has lead to the development of Self Excited Induction Generator (SEIG) as standalone system. This emphasis on renewable resources was started during 1970's when there is oil crisis. In developing countries like India, the focus on generation of electricity is mainly based on thermal, nuclear and hydro plants. [1] But with the crisis, degradation of environmental conditions and depletion of conventional sources, SEIG has attracted attention towards the non-conventional energy resources. It has many advantages like brushless construction with squirrel cage rotor, reduced size, absence of dc supply for excitation, maintenance cost is low as compared to conventional synchronous generators. This paper presents a review on steady state analysis by various researchers on SEIG. A change in the load impedance directly affects the excitation of the machine because the reactive power of the excitation capacitors is shared by both the machine and the load. [2] The self excitation capacitors connected at the stator terminals of the induction machine must produce sufficient reactive power to supply the needs of the load and the induction generator.

II. CLASSIFICATION OF INDUCTION GENERATOR

A. On the basis of excitation process used, induction generators are of two types

1. Grid Connected Induction Generator (GCIG) - This type of generator takes the reactive power from the grid and generates real power with the help of slip control when driven above synchronous speed.

2. Self- excited Induction Generator (SEIG) - It takes the power for excitation process from the capacitor bank which is connected across the stator terminals of induction generator. The capacitor bank supplies the reactive power to the load.

B. On the basis of prime movers used and their locations, these can be classified as under [4]

1. Constant-Speed Constant Frequency - In this type, the prime mover speed is held constant by continuously adjusting the blade pitch and characteristics of generators. An induction generator can operate on an infinite bus bar at a slip of 1% to 5% above the synchronous speed.[3] Induction generators are simpler than synchronous generators. Induction generators are easier to operate, control and maintain and are economical. They do not have synchronization problems.

2. Variable-Speed Constant Frequency - The variable-speed operation of wind electric system yields higher output for both low and high wind speeds. This results in yielding the higher annual energy per rated installed capacity. To obtain constant frequency from variable speed can be of two types. One is AC-DC-AC link and the other is Double output Induction

generator. Bidirectional power flow between the stator and the rotor through the DC link and so operation at sub and super synchronous speed with low distortion currents are achieved. The stator voltage is regulated by controlling the stator flux magnitude indirectly. The stator frequency is kept constant with the variable rotor speeds by imposing slip-frequency rotor currents in the machine. The advantages of DOIG in wind energy conversion systems is that it is the only scheme in which the generated power is more than the rating of the machine. But due to some operational disadvantages, the DOIG scheme could not be used much. The maintenance is high, power factor is low and reliability is poor under abnormal conditions due of the sliding mechanical contacts in the rotor. As it needs grid supply to maintain excitation, this scheme is not suitable for isolated power generations.

3. Variable-Speed Variable Frequency- With varying speed of prime mover, the performance of synchronous generators can be influenced. For variable speed with respect to the changing derived speed, SEIG can be extensively used for resistive heating loads, which are usually frequency insensitive. This scheme becomes important for stand-alone wind power application.

III. STEADY STATE ANALYSIS OF SELF EXCITED INDUCTION GENERATOR

The steady state analysis of induction generator can be done using steady state equivalent circuit as shown in Figure 1.The equivalent circuit can be represented in terms of its impedances. The impedance of stator branch Z_s consists of the stator resistance, stator reactance, load resistance and load reactance representing the power drawn and excitation capacitor. [4] The impedance of rotor branch and magnetizing branch is represented by Z_r and Z_m respectively and admittances are Y_s, Y_r and Y_m. Various parameters like Stator resistance, leakage reactance, rotor resistance, leakage reactance referred to stator, un-saturated magnetizing reactance representing core loss branch of the machine are to be found using various test on the machine such as no load test , blocked rotor test .
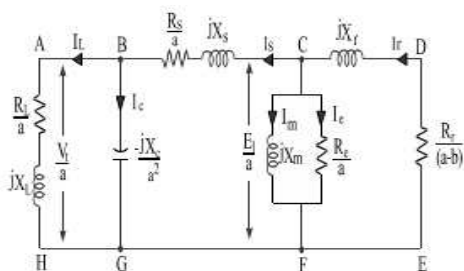
Fig. – 1. Equivalent circuit of SEIG

When we solve the equivalent circuit, it results into a single loop equation i. e. $I_s * Z = 0$
And when solve by nodal equation, it results into
$$I_s * Y = 0$$

For successful voltage build up in SEIG, I_s cannot be zero hence Z and Y should be zero respectively in each case. Thus by separating the real and imaginary components of Z and by putting all the values of parameters we get two non-linear equations. These two equations are obtained in terms of machine parameters, speed, capacitive resistance/reactance, magnetizing reactance (X_m) and generated frequency (a).[6-9]

Real $(X_m, a) = P_1 X_m a^5 + P_2 X_m a^4 + (P_3 X_m + P_4)a^3 + (P_5 X_m + P_6)a^2 + (P_7 X_m + P_8)a + P_9 X_m + P_{10}$ (1)

Imaginary $(X_m, a) = (Q_1 X_m + Q_2)a^4 + (Q_3 X_m + Q_4)a^3 + (Q_5 X_m + Q_6)a^2 + (Q_7 X_m + Q_8)a + Q_9$ (2)

Where P_1- P_{10} and Q_1- Q_9 are the coefficients in terms of various machine parameters. These are shown in appendix. Now for the analysis, we have to solve these two non-linear equations. There are various methods involved in the solution as discussed below:

1. Newton Raphson Method

This method is iterative process. As the non-linear equations are not easily solvable, some numerical iterative technique has to be adopted to find the values of capacitance reactance and the output per-unit frequency for the given values of machine parameters. Here the Newton- Raphson method has been found to be very appropriate in solving the two equations. The Newton-Raphson method provides solution in three or four iterations. [12] It requires very little computational time and provides the result to an accuracy of 10^{-4}, but the iterative technique has divergence problem .In this method, the Jacobian matrix [J] is given by:

$$[J] = \begin{matrix} J_{11} & J_{12} \\ J_{21} & J_{22} \end{matrix}$$

$$J_{11} = \frac{\partial f}{\partial X_m} \quad J_{12} = \frac{\partial f}{\partial a} \quad J_{21} = \frac{\partial g}{\partial X_m} \quad J_{22} = \frac{\partial g}{\partial a}$$

The Newton-Raphson method requires the initial guess of the values of the unknowns, say X_{m0} and a_0. The initial value of X_{m0} should be well less than unsaturated and a_0 should be less than the per unit speed.

$X_{m0} = X_m$ (unsaturated)
$a_0 = b$

After the first iteration, X_m and a will assume the values $X_{m0}+ h$ and $a_0+ k$ in the process of satisfying non linear equations the increments h and k are given in equation

$$\binom{h}{k} = J^{-1} \binom{-f_0}{-g_0}$$

This iteration process can continue till the desired accuracy is reached, i.e. when $|f (X_m, a) | < \varepsilon$ and when $|g (X_m, a) | < \varepsilon$. A simple computer algorithm can be developed incorporating the above procedure and steady-state values of X_m and a can be computed for any value of C, b and R_L. In the analysis by this

method, the problems faced are like lengthy and step-by-step algebraic calculations. Also in this method, partial derivatives are required.

2. Secant Method

This method is suitable to the system where there is varying speed. This is an additional iteration method which is introduced for variable speed nature. Unlike Newton Raphson method, it do not require complicated derivations and convergence rate is high and good accuracy. The process of solving equations is as follows. [13-14] The secant method requires two initial values for solving equation. From the nodal equations of equivalent circuit we get

$$Y_s + Y_m + Y_r = 0 \qquad (3)$$

$$\text{Where} \quad Y_s = 1/R_s + jX_s = G_s + jB_s \qquad (4)$$

$$Y_m = a/R_C - j/X_m = G_m + jR_m \qquad (5)$$

$$Y_r = 1/(R_r/(a-b) + jX_r) = G_r + jR_r \qquad (6)$$

From (4), (5), (6), we can also deduce the conductance and susceptance equation as below. Conductance equation (7) is independent of X_m so it can be used to determine a. After calculating a, X_m can be calculated from (8)

$$G_s + G_m + G_r = 0 \qquad (7)$$

$$B_s + B_m + B_r = 0 \qquad (8)$$

From (7) and (8), the recurrent formula can be written as:

$$a_{n+1} = f(a_n) \qquad (9)$$

Steps followed in this method are as:
(1) Assume initial values of per unit frequency and we take $a_0 = b$ for convenience.
(2) Determine conductance's.
(3) Determine new value of a using equation (9)
(4) Repeat steps b) and c) until value of a in successive iteration by small value ε .

3. Genetic Algorithm

Genetic Algorithm (GA) is one of the optimization method which is based on natural selection. This method used the same non linear equations to solve unknown parameter unlike in conventional methods of analysis. The two unknowns X_m and a are determined by optimizing the fitness function. There are other optimization techniques like pattern search, Quasi Newton but GA has more advantages than others. It does not require accurate initial guess and is robust in nature. The genetic algorithm has been implemented to find the optimum value of the frequency (a) and magnetic reactance (X_m), Equation (3) can be considered to be the objective (fitness) function for the GA. The objective function is minimized subjected to constraints that shown in equation (10)

$$0.9 \square \ a \square \ 0.99$$
$$96 \square \ X_m \ \square 285 \qquad (10)$$

The first constraint involves that the obtained frequency must be less than the prime mover's speed involves and second constraint that the induction generator must operate in the saturation region which means the magnetizing reactance is always less than the unsaturated value. The 1st step comes with GA optimization started with a population of randomly generated individuals representing a set of solutions for the problem. Each individual is composed of the problem variables the population size is chosen to be 160. The 2nd step comes with computing the fitness function for the entire available elements for such parameter. [15-16]The 3rd step select two parents from a population according to their fitness (the better fitness, the bigger chance to get selected) which the roulette wheel selection is applied followed by uniform cross over with probability of 0.8. The 4th step is the death process eliminate all population, which have bad fitness according to a crossover probability of 0.8. The 5th step is the crossover process to generate offspring to keep up the same number of population and to have improved parameters values. The crossover process uses the parents with best fitness, a binary coding is used to express weight's magnitudes, and single-point crossover method is used in our case. The 6th step is the mutation process with mutation probability of 0.05, finally, the new population is formed and procedures repeated until reaching the accuracy $\epsilon < 0.001$.. If the convergence is optimal then it will stop otherwise fitness function evaluation takes place again.

4. Particle Swarm Algorithm

The another technique has proposed to solve problems based on user friendly software. This technique is different from conventional optimization methods proposed by Kennedy in 1995. This PSA uses the mechanism of swarm behavior in birds flocking and fish schooling to help the particles to search for optimal solutions. [17] This particle swarm optimization algorithm is better than the above explained GA technique. It is fast in solving non linear equations, easy implementation, few parameters to adjust, computational time is less and less memory required. If the induction generator is driven by constant speed prime mover to supply constant load impedance with fixed value of X_c, the equation can be solved to find the values of unknown values a and X_m . In most of the previous methods of analysis, the determination of a and X_m is tedious and time consuming task. The value of total impedance is considered as fitness function and the problem space is two dimension.[18] The various characteristics of the generator can be obtained from its equivalent circuit but that requires to run PSO for different possible values of a particular parameter. Equation (3) is solved using PSO method to find the values of unknown a and X_m and then determine the value of the terminal voltage. The objective function of the system is total admittance Y_t

Let $Y_t (Y_s, Y_m, Y_r) = 0$

Subject to $0.9 < a < 0.99$

$$96 < X_m < 285 \qquad (11)$$

The value of the total admittance is considered as fitness function and the problem space is two dimensions a and Xm. Population size is chosen to be 160, the search will be terminated if the number of iterations reaches 200.

Steps:
(1) Input SEIG circuit parameters and its magnetization curve.
(2) Let PSO population size equal to 160 and generation it in a random set.
(3) Evaluate fitness function.
(4) Update practical velocity and position of the two unknown (X_m and a).
(5) Evaluate fitness function of particle with new particle position.
(6) Repeat the step till convergence.

5. Pattern Search

PS is a subclass of direct search algorithms, which involve the direct comparison of objective function values and do not require the use of explicit or approximate derivatives. Direct search is a method for solving optimization problems that does not require any information about the gradient of the objective function. As opposed to more traditional optimization methods that use information about the gradient or higher derivative to search for an optimal point, a direct search algorithm searches a set of points around the current point, looking for one where the value of the objective function is lower than the value at the current point. Direct search can be used to solve problems for which the objective function is not differential, or even continuous.

Steps:
(1) Input SEIG circuit parameters and its magnetization curve.
(2) Initially generated patterns.
(3) Evaluate the fitness function.
(4) Pattern search terminology i.e. pattern, pattern vector, mesh.
(5) Optimization Convergence test.

6. Artificial Neural Networks

At present, Artificial Neural Networks (ANN) techniques are towards great importance in field of engineering.[18-21] These are the computational tools adopted by human brain. These involve two components i.e. neurons and synapses (weights).Neurons are present in different layers. There are 3 layers – input layer, hidden layer and output layer. The number of inputs and outputs contains equal number of neurons respectively. To get the optimal performance the number of neurons in hidden layer should be appropriate. Analysis using ANN's does not involve any cumbersome calculations as in conventional methods.. When an input is applied in the network, based on the given data it will give training parameters to get the accurate results. The ANN model is designed to have 8-11-2 structure. Machine parameters are taken as eight inputs or we can say that input layer has 8 neurons and output as X_m and a. In this structure, the hidden layer consists of 11 neurons. The design of the network and selection of optimum training parameters are performed by hit, trial and error. So, Levenberg training function is used which causes lesser epochs as compared to other training functions. This type of training has been found to be very effective.

IV.   CONCLUSION

The steady state analysis of self excited induction generator by various techniques has been presented. Newton Raphson method and secant method involves iteration process which made the analysis complicated. To overcome the problems of these methods and make the analysis simple, methods like genetic algorithm, particle swarm algorithm have been proposed and were found more reliable. Among all the methods discussed for the analysis, ANN technique is latest and accurate. This technique is simple and most suitable for the behavior analysis of SEIG. It does not require any assumptions and complex computations. The accuracy can further be improved by increasing the number of training parameters. The future work can be based on the fuzzy logic approach as neural networks can be used only if training data is available and there is no guarantee of success and the learning process is very long in ANN.

V.   ACKNOWLEDGMENT

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APPENDIX

Coefficients are given as :

$P_1 = - (X_s X_r X_L)$

$P_2 = (X_s X_r X_L)*b$

$P_3 = X_s*(R_r*R_L+R_e*R_L+X_r*X_c)+X_r*(R_e*R_s+X_c*X_s+R_s*R_L)+X_s*(R_e*R_r+ R_e*R_s+ R_s*R_r)$

$P_4 = X_s*R_e*(X_r*R_L+R_r*X_L)+R_e*R_s*X_r*X_L$

$P_5 = -X_s*(X_r* X_c +R_e*R_L)*b- X_r*(R_s*R_L+ R_e*R_L+ X_c*X_L)*b-(R_s*R_e*X_L)*b$

$P_6 = -X_r*R_e*(R_s*X_L+X_s*R_L)*b$

$P_7 = -X_c*R_r*(R_s+ R_L)-X_c*R_e* (R_s+ R_L+ R_r)$

$P_8 = -(R_e*X_r*X_c*(R_L+R_s))-(R_e*R_r*X_c*(X_L+X_s))-(R_e*R_s*R_r*R_L)$

$P_9 = R_e*X_c* (R_s+ R_L)*b$

$P_{10} = X_c*X_r*R_e*(R_L+R_s)*b$

$Q_1 = X_s*X_L*(R_e+ R_r)+X_s*X_r*R_L+X_r*X_L*(R_e+ R_s)$

$Q_2 = X_s *X_r*X_L*R_e$

$Q_3 = -X_s*(R_e*X_L+X_r*R_L)*b-X_r*X_L*(R_s+ R_e)*b$

$Q_4 = - (X_s*X_r*X_L*R_e)*b$

$Q_5 = -X_c*R_e*(X_s+X_r+X_L)-R_L*R_e*(R_s+Rr)-R_L*(X_r*X_c+R_r*R_s)-X_c*(R_s*X_r+X_s*R_r+X_L*R_r)$

$Q_6 = -R_e X_r*(X_s*X_c+ X_c*X_L+R_s*R_L)-R_r *R_e*(X_s*R_L+R_s*X_L)$

$Q_7 = R_e*(X_r*X_c+X_s*X_c+ *X_L+R_s*R_L)*b+ X_c*X_r*(R_s+ R_L)*b$

$Q_8 = R_e*X_r*(X_s*X_c+ X_c*X_L)*b+ (X_r*R_e*R_L*R_s)*b$

$Q_9 = R_e*X_c* R_r*(R_L+R_s)$

Track 2

Mechanical Engineering

To Investigate Stresses and Deformation Analysis in Skeletomuscular Regions While Sitting Positions using FEM

Gurudutt Sahni
Leader Valves Ltd Jalandhar
Punjab, India
C Eng (Institution of Engineers India)
drguruduttsahni@rediffmail.com

Balpreet Singh
Deptt. of Mech. Engg.
Beant College of Engg. & Tech., Gurdaspur
Punjab, India
uniquekalra@rediffmail.com

Abstract- Stress analysis are one of important consideration while determining different sitting positions The study is motivated by the need for a better understanding of the design of wheelchair cushions and the prevention of decubitus ulcers. The finite element method is used on an axisymmetric model. Surface pressure distribution, surface friction, hydrostatic pressures and von Mises stresses are obtained. The finite element model reveals the three-dimensional state of stress at all internal locations for a typical human body. Main objectives are:

- To investigate the deformations and stresses in skeletomuscular regions of a person when he sits on a cushion.

- To see how structural load analysis helps in adopting new sitting positions for better health

Keywords: Structural analysis; sitting posture; chair positions.

I. INTRODUCTION

An estimated 50% of people in the industrialized world suffer some form of back complaint and many of these are related to poor seat design. How we sit and what we sit on affects the health of thespine. The lumbar region is the most frequently damaged [5, 6].

A. Definition - Sitting is a body position in which the weight of the body is transferred to a supporting area mainly by the ischialtuberosities of the pelvis and their surrounding soft tissue.

B. Purpose - to remove weight from the feet and maintain a stable posture so muscles not directly involved with the work can relax.

C. Ideal - There is no single ideal sitting posture. Illustrated 90-degree person sitting posture is for anthropometric reference only. Can't design a chair for the best single way to sit. We need a variety of chairs that allow different users to each sit in a variety of postures

II. POSTURE

The relative orientation of parts of the body in space.

A. Best Posture - imposes the least postural stress. Muscles must do work to counteract the effects of gravity and other forces as the body stands or moves through space.

B. Postural Strain - adverse consequences of more than a few minutes of postural stress.

C. Fidgeting - is the bodies defense against postural stress of which discomfort is a sign.

D. Rate of Fidgeting - can be used as an index of chair discomfort. Higher fidgeting rates correspond to higher discomfort rates.

E. Crossing and uncrossing the legs - is a characteristic way of re-distributing pressure on the buttocks and also helps to pump blood through these tissues.

F. Postural Comfort - is defined as the absence of postural discomfort, it is therefore a neutral state that we cannot sense [1].

III. BIOMECHANICS OF SITTING

Depending on chair and posture, some proportion of total body weight is transferred to the floor via the seat pan and feet, armrests, and backrests [4].

A. Lumbar Region - is normally lordotic (concave, toward the stomach). This reduces the pressure between the vertebrae. The region is normally lordotic for two reasons:

B. Thickness - Vertebrae and discs are thicker anteriorly than posteriorly.

C. Sacrum - Upper surface of sacrum is at an angle to the horizontal plane.

D. Pelvis - The sacrum is fixed to the pelvis, so rotational movement of the pelvis affects lumbar vertebrae.

E. Forward rotation - of the pelvis leads to increased lordosis of the lumbar spine, helping to maintain an upright trunk position.

F. Backward tilt - of the pelvis leads to increased flattening of the lumbar spine and eventually increases kyphosis. As shown in fig. 1.

RED AREAS SHOWING STRESS ON BONES

Fig. 1. Heading towards preferred sitting positions and its analysis

IV. MODULES OF PROJECT

A. Modeling

3D models of critical components of chair are prepared using (SOLID WORKS). The detailed dimensions are taken from its 2D drawings.

B. Importing 3d Model

3D model prepared using SOLID WORKS is imported into FEA software (ANSYS).

C. Preferences:

1. Structural or static analysis method is selected. Pre-processing: 2. Define element type   3. Apply material properties
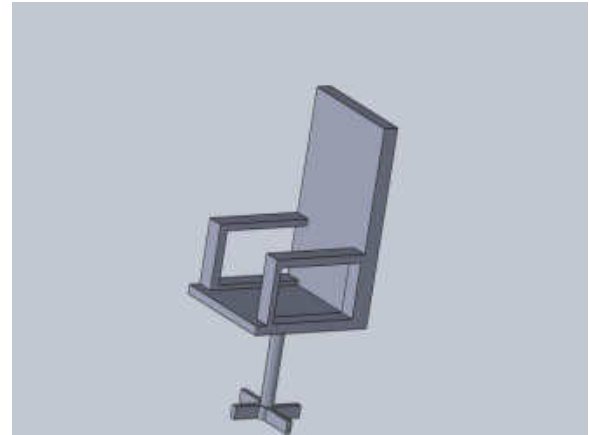
Fig. 2. Design of a chair in solid works

D. Preferred angles for sitting position are as follows
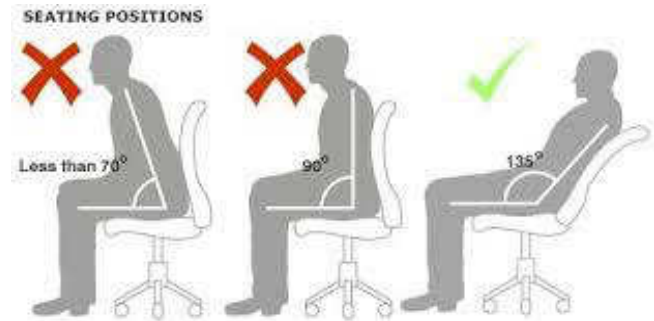
Fig. 3. Preferred angles for sitting position

We can see in figure 3 preferred angles for sitting while watching anything or relaxing. So we can perform analysis at these angles and can see results.

Stress analysis on chair while sitting at angle of 90deg or less than 70deg in figure 4

As we can see green areas which show higher level of stress
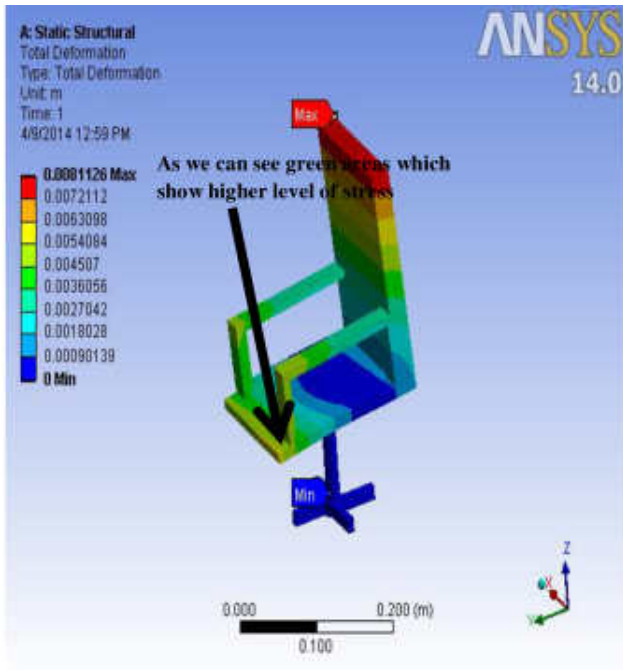
Fig. 4.   Stress analysis on chair while sitting at angle of 90deg or less than 70deg

Now we have to check the stress level at 135 deg as shown in figure 5

As we can see blue areas showing less stress on legs at angle of 135 deg
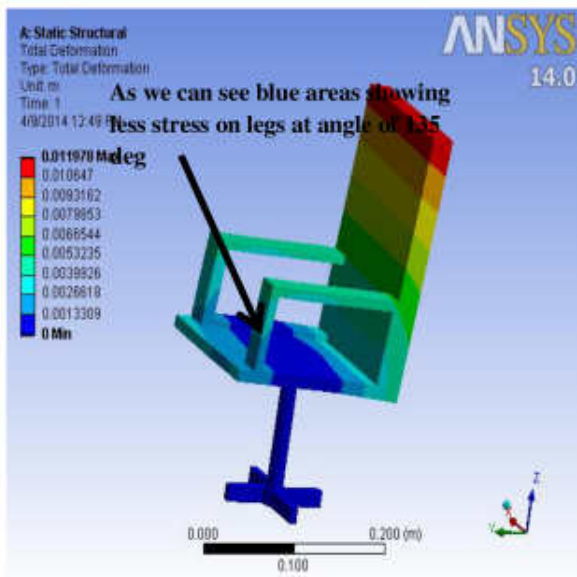
Fig. 5.   Stress level at 135 deg
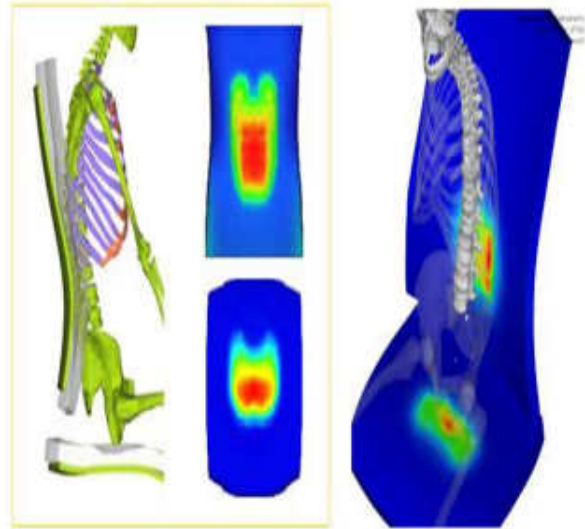
Fig. 6.   Analysis

So by performing analysis we can practically find the better angle for sitting purpose to face less stress.

V.   SEAT DESIGN CRITERIA

A.   Seat Height - Optimum seat height is controversial.

B.   Traditional Criterion - Seat height should be adjusted to support a knee angle of 90-degrees to prevent leg swelling. However 75% of leg swelling may be due to low leg muscle activity rather than chair.

C.   Minimum Height - should be 15" (38cm) which designs to the 5th percentile of women with 1" heels. The seat should adjust 9" (23cm).

D.   Fixed Height - should be about 17" (43cm). This is a compromise. A chair that is too high leads to increased pressure at the popliteal fold (underside of knees), decreasing blood circulation and increasing pressure on the nerve. A chair that is too low increases weight on the ischial tuberosities. [2, 3].

There is also an alternative if required chair is not available then we have different postures for different chairs as follow.
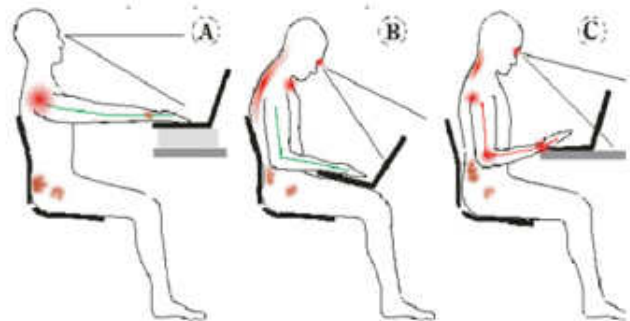
Fig. 7.   Prefer method while using notebook

As we can see in figure 7 while using notebook we should prefer method which require less stress.

On a chair with no back support there is always stress on bones

Fig. 8.   Sitting on chair without back support

A few more positions being suggested while sitting or performing different activities as follows

Head forward   Chest stuck out   Ear over shoulder
Pelvis tucked   Pelvis over-tilted   Pelvis slightly
                                        tipped forward

NO!   NO!   YES!

Fig. 9.   Sitting on chair without back support
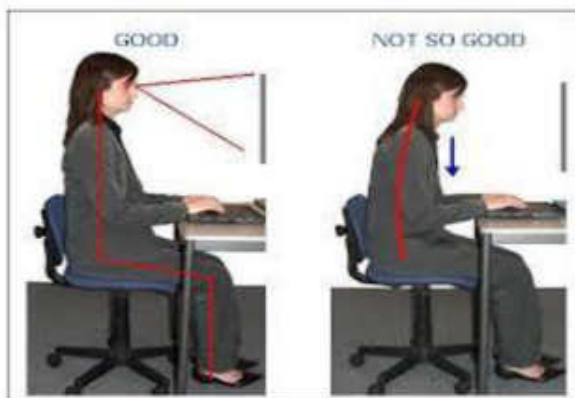
Fig. 10.   Sitting while typing and bending

While typing and bending forward put strain on back bone in figure 10.

VI.   CONCLUSION

- Stress Analysis is one of important consideration while determining different sitting positions.

- Preferred angles for sitting should be adopted in order to avoid stress problems in bones.

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Designing and Modal Analysis of Connecting Rod for Single Cylinder Camless Engine

Kanwar J.S Gill
Dept. of Mechanical Engineering
Gulzar Group of Institutes,Khanna
Ludhiana,India
mtechjabi@yahoo.co.in

Sukhchain Singh Dhillon
Dept. of Mechanical Engineering
Anand College of Engg.and Mgmt.
Kapurthala,India
dhillon78@gmail.com

Abstract— **The automobile engine connecting rod is a high volume production, critical component. It connects reciprocating piston to rotating crankshaft, transmitting the thrust of the piston to the crankshaft. Every vehicle that uses an internal combustion engine requires at least one connecting rod depending upon the number of cylinders in the engine. The connecting rod is subjected to a complex state of loading. It undergoes high cyclic loads of the order of 10^8 to 10^9 cycles, which range from high compressive loads due to combustion, to high tensile loads due to inertia. Therefore, durability of this component is of critical importance. Due to these factors, the connecting rod has been the topic of research for different aspects such as production technology, materials,performance simulation, fatigue, etc. For the current study, it was necessary to investigate finite element modeling techniques, developments in production technology, new materials, fatigue modelling.Here it is tried to investigate the performance of connecting rod with linear static analysis for single cylinder camless engine.The analysis was performed with ANSYS and it was found that Maximum total displacement is 1.85085E-07 mm and Maximum equivalent stress is 6.85006E-03 MPa**

Keywords—**connecting rod; linear static analysis; ANSYS; camless engine.**

I. INTRODUCTION

Automobile internal combustion engine connecting rod is a high volume production critical component. It connects reciprocating piston to rotating crankshaft, transmitting the thrust of piston to crankshaft, and is subjected to complex loading. It undergoes high cyclic loads of the order of 108–109 cycles, which range from high compressive loads because of combustion, to high tensile loads because of inertia. Therefore, durability of this component is of critical importance. Usually, the worst case load is considered in the design process.

Literature review suggests that investigators [1, 2] use maximum inertia load as one extreme load corresponding to the tensile load and compressive gas load producing load producing maximum torque as the other extreme design load corresponding to the compressive load. In recent years, more emphasis has been placed on higher vehicle fuel efficiency. Optimization of connecting rods in an engine is critical to fuel efficiency. Proper optimization of this component, however, necessitates a detailed understanding of the applied loads and resulting stresses under in-service conditions. Inertia load is a time-varying quantity and can refer to inertia load of the connecting rod or of the piston assembly. Questions are naturally raised in light of such complex structural behaviour such as: Does the peak load at the ends of a connecting rod represent the worst case loading? Under the effects of bending and axial loads, can one expect higher stresses than that experienced under axial load alone? Moreover, very little information is available in the literature on bending stiffness requirements, or on the magnitude of bending and multiaxial stresses.

Webster et al. [2] performed three-dimensional finite element analysis (FEA) of a high-speed diesel engine connecting rod. They used maximum compressive load which was measured experimentally, and maximum tensile load which is essentially the inertia load of piston assemblymass in their analysis. Load distributions on the piston pin end and crank end were also determined experimentally. Ishida et al. [3] measured stress variation at the column center and column bottom of connecting rod, as well as bending stress at the column center.

From their study it was observed that at high engine speeds, the maximum stress in connecting rod column bottom does not occur at the top dead center. It was also observed that the stress ratio varies with location, and at a given location it varies with engine speed. The maximum bending stress over one engine cycle at the column center was found to be about 25 per cent of the maximum stress at that location.

Another study used FEA with applied loads including bolt tightening load, piston pin interference load, compressive gas load, and tensile inertia load [4]. On the basis of the stress and strain measurements performed on connecting rod, close agreement was found with loads predicted by inertia theory. The study indicated that stresses in a connecting rod due to bending loads are substantial, and that buckling and bending stiffness are important design factors that must be taken into account during the design process.

Balasubramaniam et al. [1] used the various individual loads acting on connecting rod for performing simulation and obtaining stress distribution by superposition. The loading consisted of inertia load, firing load, press fit of the bearing shell, and bolt forces. Athavale and Sajanpawar [5] also modelled the inertia load in their finite element (FE) model. An interface software was developed to apply the acceleration

load to elements on the connecting rod depending upon their location, as acceleration varies in magnitude and direction with location on the connecting rod. They fixed the ends of the connecting rod to determine its deflection and stresses.

This, however, may not be representative of the pinned joints that exist in a connecting rod. The connecting rod was separately analysed for tensile load due to piston assembly mass (piston inertia), and for compressive load due to gas pressure. The effect of inertia load due to mass of the connecting rod was also analysed separately. Pai [6] presented an approach to optimize the shape of the connecting rod subjected to a load cycle consisting of inertia load deduced from gas load as one extreme, and peak inertia load exerted by piston assembly mass as the other extreme and used fatigue life as the optimization constraint.

In this study, a detailed load analysis under service loading conditions was performed for a typical forged steel connecting rod, followed by quasi-dynamic FEA to capture stress variation over a cycle of operation. Such stress analysis under realistic operating loads is critical to any durability or optimization study of a connecting rod and is vastly different from the typical uniaxial testing and static analysis commonly conducted for this component. This is because, in a typical static analysis, the loads acting at the two ends of the connecting rod are equal in magnitude and are in static equilibrium. On the other hand, in a quasi-dynamic analysis, the loads at the two ends need not be equal and the connecting rod is in equilibrium at any instant in time, only when the inertia loads resulting from angular velocity and acceleration (both translational and angular) are accounted for.

Therefore, although the quasidynamic analyses are repeated at different time points, they are based on time-varying dynamic input data. For this reason, the analysis is referred to as 'quasi-dynamic'. Details of the dynamic load analysis are discussed in the next section. Optimization aspects and fatigue behaviour of the connecting rod are investigated in references [7, 8], respectively. In this article, FE modeling aspects, resulting stress-time histories, variation of stress ratio, presence of mean and bending stresses, and multiaxiality of stress states in various locations of the connecting rod under service operating conditions are discussed.

A comparison is also made between results obtained using static FEA commonly performed, and results using quasi-dynamic FEA representing more realistic service operating conditions.

II. ANALYTICAL VECTOR APPROACH TO KINEMATIC AND DYNAMIC

A. Analysis of The Connecting Rod. (Analytical method)
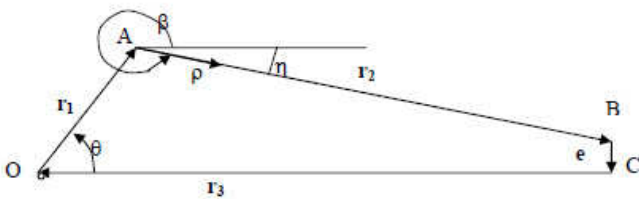
Fig. 1.   Vector representation of slider crank mechanism.

The following quantities will be required for performing FEA to simulate dynamic conditions using I-DEAS: angular velocity, angular acceleration, loads at the ends, and linear acceleration of crank end center. Determination of the loads at the ends requires determination of the inertia load at the center of gravity of the connecting rod and the inertia load due to piston assembly.

1) Angular velocity of the connecting rod:

Consider the offset slider crank linkage shown in Figure 1. The linkage can be described by the following vector equation:

$$e + r_1 + r_2 + r_3 = 0 \tag{1}$$

Where, e is constant in magnitude and direction. The bold letters represent vector quantities. Differentiating Equation 1 w.r.t. time:

$$\dot{e} + \dot{r}_1 + \dot{r}_2 + \dot{r}_3 = 0 \tag{2}$$

$$\omega_1 \times r_1 + \omega_2 \times r_2 - Vp = 0. \tag{3}$$

Where, $dr_3 / dt = - Vp$ and t stands for time. Slider velocity Vp is in x direction and angular velocity vectors are in the z direction. To eliminate Vp in Equation 3, take the dot product of each term with j:

$$\omega_1 \times r_1 . j + \omega_2 \times r_2 . j - V_p . j = 0.$$

$$\omega_1 r_1 . i + \omega_2 r_2 . I \qquad = 0$$

$$\omega_2 = - \omega_1 (r_1 . i) / (r_2 . i) \tag{4}$$

From Figure 1, the following equations can be written:

$$r_1 = r_1 \cos\theta \, i + r_1 \sin\theta \, j \tag{5}$$

$$r_2 = r_2 \cos\beta \, i + r_2 \sin\beta \, j \tag{6}$$

Substituting Equations 5 and 6 into Equation 4 gives the magnitude of ω_2, the angular velocity of the connecting rod:

$$\omega_2 = - (\omega_1 r_1 \cos\theta) / (r_2 \cos\beta) \tag{7}$$

For the case where the offset e   = 0, from Figure1:

$$r_1 \sin\theta = r_2 \sin\eta = r_2 \sin(2\pi - \beta) = -r_2 \sin\beta$$

$$\sin\beta = - (r_1 \sin\theta) / r_2 \tag{8}$$

$$\cos\beta = r_1 / r_2 * [(r_2 / r_1)2 - \sin^2\theta]^{0.5} \tag{9}$$

Equation 7 becomes:

$$\omega_2 = - \omega_1 \cos\theta / [(r_2 / r_1)^2 - \sin^2\theta]^{0.5} \tag{10}$$

Where, $\omega_2 = \omega_2 k$

2) Angular acceleration of the connecting rod:

To obtain the angular acceleration, consider Equation 3. Differentiating the equation w.r.t. time, for constant angular velocity of the crank, we get:

$$\omega_1 \times \omega_1 \times r_1 + \omega_2 \times \omega_2 \times r_2 + \alpha_2 \times r_2 - a_p = 0 \tag{11}$$

Since the acceleration of the slider is in the x direction, the last term in the above equation may be eliminated by taking the dot product of each term with the unit vector j.

The result is:

$\omega_1 \times \omega_1 \times r_1 . j + \omega_2 \times \omega_2 \times r_2 . j + \alpha_2 \times r_2 . j = 0$

$\alpha_2 = (- \omega_1 \times \omega_1 \times r_1 . j - \omega_2 \omega_2 \times r_2 . j) / (k \times r_2 . j)$ (12)

Evaluating each term:

$\omega_1 \times r_1 \qquad = \omega_1 k \times [r_1 \cos\theta\, i + r_1 \sin\theta\, j]$

$\qquad\qquad\quad = \omega_1 r_1 \cos\theta\, (k \times i) + \omega_1 r_1 \sin\theta\, (k \times j)$

$\qquad\qquad\quad = \omega_1 r_1 \cos\theta\, (j) + \omega_1 r_1 \sin\theta\, (-i)$

$\qquad\qquad\quad = \omega_1 r_1 \cos\theta\, j - \omega_1 r_1 \sin\theta\, i$

$\omega_1 \times \omega_1 \times r_1 \qquad = \omega_1 k \times [\omega_1 r_1 \cos\theta\, j - \omega_1 r_1 \sin\theta\, i]$

$\qquad\qquad\quad = -\omega_1^2 r_1 \cos\theta\, i - \omega_1^2 r_1 \sin\theta j$ (13)

$- \omega_1 \times \omega_1 \times r_1 . j = \omega_1^2 r_1 \cos\theta\, i . j + \omega_1^2 r_1 \sin\theta\, j . j$

$\qquad\qquad\quad = \omega_1^2 r_1 \sin\theta$ (14)

$\omega_2 \times r_2 \qquad = \omega_2 k \times [r_2 \cos\beta\, i + r_2 \sin\beta\, j]$

$\qquad\qquad\quad = \omega_2 r_2 \cos\beta\, (k \times i) + \omega_2 r_2 \sin\beta\, (k \times j)$

$\qquad\qquad\quad = \omega_2 r_2 \cos\beta\, j - \omega_2 r_2 \sin\beta\, i$

$\omega_2 \times \omega_2 \times r_2 \qquad = \omega_2 k \times [\omega_2 r_2 \cos\beta\, j - \omega_2 r_2 \sin\beta\, i]$

$\qquad\qquad\quad = \omega_2^2 r_2 \cos\beta\, (k \times j) - \omega_2^2 r_2 \sin\beta\, (k \times i)$

$\qquad\qquad\quad = - \omega_2^2 r_2 \cos\beta\, i - \omega_2 r2 \sin\beta j$ (15)

$-\omega_2 \times \omega_2 \times r_2 . j \quad = \omega_2^2 r_2 \cos\beta\, i . j + \omega_2^2 r_2 \sin\beta\, j . j$

$\qquad\qquad\quad = \omega_2^2 r_2 \sin\beta$ (16)

$k \times r_2 . j \qquad = k \times (r_2 \cos\beta\, i + r_2 \sin\beta\, j) . j$

$\qquad\qquad\quad = r_2 \cos\beta\, (k \times i) . j + r_2 \sin\beta\, (k \times j) . j$

$\qquad\qquad\quad = r_2 \cos\beta\, j . j + r_2 \sin\beta\, (-i . j) = r_2 \cos\beta$ (17)

Substituting Equations 14, 16, and 17 into Equation 12 gives the angular acceleration of the connecting rod:

$\alpha_2 \qquad\qquad = (1 / r_2 \cos\beta) [\omega_1^2 r1 \sin\theta - \omega_2^2 r_2 \sin\beta]$ (18)

where, $\alpha_2 \qquad\qquad = \alpha_2 k$

3) Absolute acceleration of the C.G. of the connecting rod:

In order to find the inertia forces at the C.G., we need to find the absolute acceleration of the C.G. This section will deal with the derivation of absolute acceleration of any general point on the connecting rod. Substitution of the center of gravity distance from the crank end center will yield acceleration of the center of gravity. Absolute acceleration of any point on the connecting rod is given by the following equation:

$$a = a_A + \overline{\omega}_2 \times \overline{\rho} + \overline{\omega}_2 \times \overline{\omega}_2 \times \rho$$
    (19)

Where, ω_2 is angular acceleration of the connecting rod, which is equal to α_2, and ρ is the position vector of any point on the connecting rod (refer to Figure 1). Evaluating each term in the Equation 19:

$a_A = - r_1 \omega_1^2 \cos\theta\, i - r_1 \omega_1^2 \sin\theta j$ (20)

$\rho = u \cos\beta\, i + u \sin\beta\, j$

$\omega_2 \times \rho \quad = \alpha_2 k \times [u \cos\beta\, i + u \sin\beta\, j]$

$\qquad\qquad = \alpha_2 u \cos\beta\, (k \times i) + \alpha_2 u \sin\beta\, (k \times j)$

$\qquad\qquad = \alpha2 u \cos\beta\, j + \alpha2 u \sin\beta\, (-i)$

$\qquad\qquad = \alpha_2 u \cos\beta\, j - \alpha_2 u \sin\beta\, i$ (21)

$\omega_2 \times \omega_2 \times \rho \quad = \omega_2 \times \omega_2 \times \rho$

$\omega_2 \times \rho \quad = \omega_2 k \times [u \cos\beta\, i + u \sin\beta\, j$

$\qquad\qquad] = \omega_2 u \cos\beta\, (k \times i) + \omega_2 u \sin\beta\, (k \times j)$

$\qquad\qquad = \omega_2 u \cos\beta\, j - \omega_2 u \sin\beta\, i$

$\omega_2 \times \omega_2 \times \rho \quad = \omega_2 k \times [\omega_2 u \cos\beta\, j - \omega_2 u \sin\beta\, i]$

$\qquad\qquad = \omega_2^2 u \cos\beta\, (k \times j) - \omega_2^2 u \sin\beta\, (k \times i)$

$\qquad\qquad = \omega_2^2 u \cos\beta\, (-i) - \omega_2^2 u \sin\beta\, (j)$

$\qquad\qquad = - \omega_2^2 u \cos\beta\, i - \omega_2^2 u \sin\beta\, j$ (22)

Substituting Equations 20, 21, and 22 into Equation 19:

$\mathbf{a} = - r_1 \omega_1^2 \cos\theta\, \mathbf{i} - \omega_2^2 u \cos\beta\, \mathbf{i} - \alpha_2 u \sin\beta\, \mathbf{i} - r_1 \omega_1^2 \sin\theta\, \mathbf{j} - \omega_2^2 u \sin\beta\, \mathbf{j} + \alpha_2 u \cos\beta\, \mathbf{j}$

$= (- r_1 \omega_1^2 \cos\theta - \omega_2^2 u \cos\beta - \alpha_2 u \sin\beta)\, \mathbf{i} + (- r_1 \omega_1^2 \sin\theta - \omega_2^2 u \sin\beta + \alpha_2 u \cos\beta)\, \mathbf{j}$

4) Forces at the connecting rod ends:

Figure 2 (b) shows the free body diagram of the piston. By applying dynamic equilibrium conditions to the piston we get:

$F_X - m_p a_P - \text{Gas Load} = 0$

The corresponding force in the X direction at the pin end is given by:

$F_{BX} = - (m_p a_P + \text{Gas Load})$ (24)
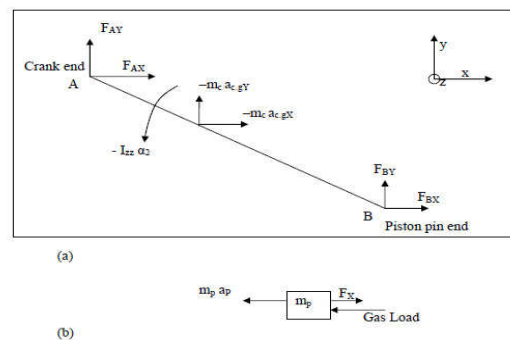
Fig. 2.   Free body diagram and vector representation. (a) Free body diagram of connecting rod. (b) Free body diagram of piston.

Figure 2(a) shows the free body diagram of the connecting rod. Application of dynamic equilibrium conditions to the connecting rod results in the following equations:

$F_{AX} + F_{BX} - m_c a_c.g_X = 0$ (summing forces in the X direction)

$F_{AY} + F_{BY} - m_c a_c.g_Y = 0$ (summing forces in the Y direction)

Taking moment about point A:

$F_{BX}\, r_2 \sin\eta + F_{BY} r_2 \cos\eta + (- m_c a_c.g_X) u \sin\eta + (- m_c a_c.g_Y) u \cos\eta + (- Izz\, \alpha_2) = 0$

Solving the above three equations gives:

$F_{AX} = m_c\, a_c.g_X - F_{BX}$ (25)

$F_{BY} = [m_c\, a_c.g_Y\, u\, \cos\beta - m_c\, a_c.g_X\, u\, \sin\beta + Izz\, \alpha_2 + F_{BX}\, r_2 \sin\beta] / r_2 \cos\beta$ (26)

$F_{AY} = m_c\, a_c.g_Y - F_{BY}$ (27)

From Equation 1 acceleration of the piston is given by:

$\mathbf{a_p} = \boldsymbol{\omega_1}\ x\ \boldsymbol{\omega_1}\ x\ \mathbf{r_1} + \boldsymbol{\omega_2}\ x\ \boldsymbol{\omega_2}\ x\ \mathbf{r_2} + \boldsymbol{\alpha_2}\ x\ \mathbf{r_2}$ (28)

$\boldsymbol{\alpha_2}\ x\ \mathbf{r_2} = \alpha_2\ \mathbf{k}\ x\ (r_2 \cos\beta\ \mathbf{i} + r_2 \sin\beta\ \mathbf{j}) = \alpha_2\, r_2 \cos\beta\ (\mathbf{k}\ x\ \mathbf{i}) + \alpha_2\, r_2 \sin\beta\ (\mathbf{k}\ x\ \mathbf{j})$

$= \alpha_2\, r_2 \cos\beta\ \mathbf{j} + \alpha_2\, r_2 \sin\beta\ (\mathbf{-i}) = \alpha_2\, r_2 \cos\beta\ \mathbf{j} - \alpha_2\, r_2 \sin\beta \mathbf{i}$ (29)

Equation 13: $\boldsymbol{\omega_1}\ \mathbf{x}\ \boldsymbol{\omega_1}\ \mathbf{x}\ \mathbf{r_1} = -\omega_1^2\, r_1 \cos\theta\ \mathbf{i} - \omega_1^2\, r_1 \sin\theta\mathbf{j}$

Equation 15: $\boldsymbol{\omega_2}\ \mathbf{x}\ \boldsymbol{\omega_2}\ \mathbf{x}\ \mathbf{r_2} = -\omega_2^2\, r_2 \cos\beta\ \mathbf{i} - \omega_2^2\, r_2 \sin\beta\ \mathbf{j}$

Substituting Equations 29, 13, and 15 into Equation 28:

$\mathbf{a_p} = (-\omega_1^2\, r_1 \cos\theta - \omega_2^2\, r_2 \cos\beta - \alpha_2\, r_2 \sin\beta)\ \mathbf{i} + (-\omega_1^2\, r_1 \sin\theta - \omega_2^2\, r_2 \sin\beta + \alpha_2\, r_2 \cos\beta)\ \mathbf{j}$ (30)

III. SOFTWARE ANALYSIS

Linear static analysis was performed and the material was assigned the properties of carbon steel, which showed a Maximum total displacement of 1.85085E-07 mm and Maximum equivalent tress of 6.85006E-03 MPa .Its weight was 6.5743E+07 N.

Fig. 3.   Model Geometry

The modeling of connecting rod was done in SOLIDWORKS and the analysis was performed in ANSYS. peculiarities. For example, the head margin in this template measures proportionately more than is customary. This measurement and others are deliberate, using specifications

Fig. 4.   Finite Element Mesh

TABLE I. DETAIL OF FINITE ELEMENT MESH

S.No.	Entity	Number Defined	Description
1.	SOLID92	1814	10-Noded Tetrahedron
2.	SURF154	262	Surface Element (for Force Transfer)
3.	Nodes	3819	

TABLE II.   MATERIAL PROPERTY

S.No.	Entity	Number Defined
1.	Modulus of Elasticity [MPa]	7.3000E+04
2.	Density [kg/mm^3]	2.7700E-06
3.	Poisson's Ratio	0.3300
4.	Thermal Expansion Coefficient [1/degC]	2.2700E-05

Fig. 5.   Loads and Boundary Conditions

TABLE III.   BOUNDARY CONDITIONS FOR ENVIRONMENT

S.No	Constraints Type	Entity	Direction	Coordinate System
1.	Constrained Translation	Area 5	XYZ	Global Cartesian
2.	Constrained Translation	Area 6	XYZ	Global Cartesian
3.	Constrained Translation	Area 7	XYZ	Global Cartesian
4.	Constrained Translation	Area 8	XYZ	Global Cartesian
5.	Constrained Translation	Area 11	XYZ	Global Cartesian
6.	Constrained Translation	Area 13	XYZ	Global Cartesian
7.	Constrained Translation	Area 16	XYZ	Global Cartesian

TABLE IV.   LOAD CONDITIONS

S. No	Loads	Values (Global Cartesian Directions)				
1.	Type	Entity	X	Y	Z	Applied to Entities
2.	Force [N]	Area	-2.500	0.000	0.000	2 3 14 16
3.	Gravity[mm/s^2]	Volume	0.000	0.000	0.000	All
4.	Angular Velocity [RPM]	Volume	0.000	0.000	0.000	All
5.	Uniform Temperature [degC]	Volume	0.000	(Tref = 0.000)		All
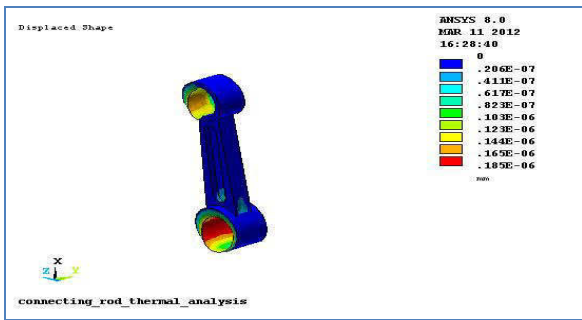
Fig. 6.   Displaced Shape
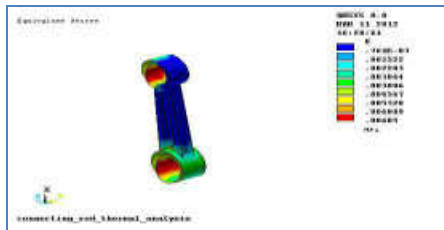
Fig. 7.   Equivalent Stress Contours

TABLE V.   SUM OF REACTION FORCES

Total Reaction Force [N]			
S.No.	X	Y	Z
1.	2.5000	-3.45100E-07	-1.25608E-06

TABLE VI.   MOMENT ABOUT THE GLOBAL ORIGIN DUE TO THE REACTION

Total Moment [N mm]			
S.No.	X	Y	Z
1.	-3.92837E-06	-9.36018E-07	7.20936E-07

TABLE VII.   DISPLACEMENTS

X	Y	Z	Vector Sum
-1.82206E-07	-8.43561E-08	5.75514E-08	1.85085E-07

TABLE VIII.   DIRECT STRESSES

Direct Stresses [MPa]			
	X	Y	Z
Minimum	-6.64149E-03	-3.58431E-03	-4.35261E-03
Maximum	6.14042E-03	4.50323E-03	3.45675E-03

TABLE IX.   SHEAR STRESSES

Shear Stresses [MPa]			
	XY	YZ	XZ
Minimum	-2.58239E-03	-1.35207E-03	-3.90608E-03
Maximum	3.52021E-03	1.33455E-03	3.91446E-03

TABLE X.   PRINCIPAL STRESSES

Principal Stresses [MPa]			
	1st	2nd	3rd
Minimum	-3.19285E-03	-3.92738E-03	-6.98645E-03
Maximum	6.75287E-03	4.00470E-03	3.40095E-03

TABLE XI.   STRESS INTENSITY AND EQUIVALENT STRESS

Stress Intensity and Equivalent Stress [MPa]		

	Stress Intensity	Equivalent Stress
Minimum	0.0000	0.0000
Maximum	7.90804E-03	6.85006E-03
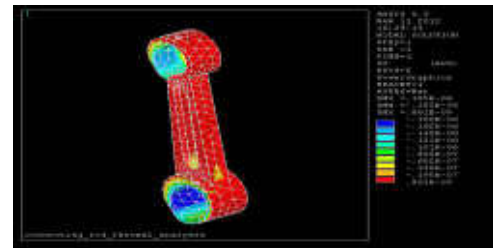
Fig. 8.   Degree of Freedom
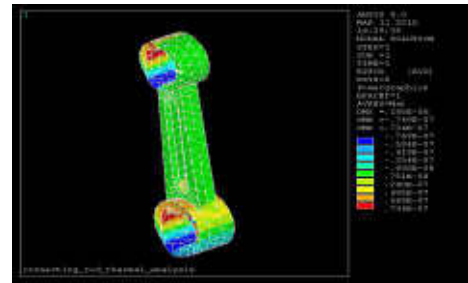
Fig. 9.   Strain
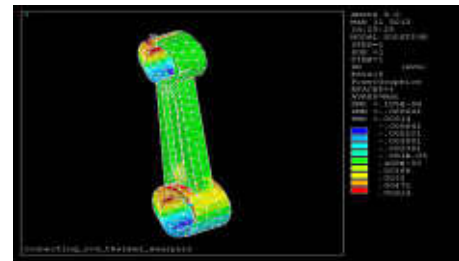
Fig. 10.   Stress

IV.   CONCLUSION

Stresses and displacements were observed to be significantly lower under conditions of assembly (with bearings, crankshaft and piston pin and bushing), when compared to stresses obtained from unassembled connecting rod subjected to loading. The section modulus of the connecting rod should be high enough to prevent high bending stresses due to inertia forces, eccentricities, as well as crankshaft and case wall deformations.

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Microstructural Development in Bentonite Modified with Lime and Phosphogypsum

Sujeet Kumar
National Institute of Technology,
Hamirpur, Himachal Pradesh,
India-177005
sujeetkumar.ce@gmail.com

VidyaTilak B.
National Institute of Technology,
Hamirpur, Himachal Pradesh, India-
177005
vidyatilakb@gmail.com

Rakesh Kumar Dutta
National Institute of Technology,
Hamirpur, Himachal Pradesh,
India-177005
rakeshkdutta@yahoo.com

ABSTRACT: The microstructural development of bentonite modified with 8 % lime and 8 % phosphogypsum were studied through techniques like the scanning electron microscope and the electron dispersive absorption x-ray diffraction to account for the changes in the structure of bentonite with the addition of lime and phosphogypsum. The specimens were cured for 7 and 28 days by ASTM method. Scanning electron micrographs of the bentonite specimens modified with lime showed the presence of compact matrix which increases with the increase in curing period. Further, this development led to the improvement in strength which was also observed in strength test results. Electron dispersive absorption x-ray diffraction study shows the emissions of Ca, Si and hydrates and Ca, Al and S due to addition of lime and phosphogypsum in bentonite respectively.

Keywords: - Bentonite; Lime; Phosphogypsum; unconfined compressive strength; SEM-EDAX.

I. INTRODUCTION

In India, states like Rajasthan, Madhya Pradesh, Gujarat, Andhra Pradesh, Karnataka and Tamil Nadu have adequate deposit of black cotton soil, bentonite, mar and kabar (Ameta et al., 2007). Bentonite exhibit high swelling, shrinkage, compressibility and poor strength in contact with water leading to cracks in overlying structures. In order to utilize the locally available expansive clays, different treatment techniques have been developed across the world. The best alternative approach is to modify the properties of these soils with some additives lime and phosphogypsum (a byproduct produced during the manufacturing of phosphoric acid) to make them suitable for the construction of overlying structures. In the present paper, scanning electron microscope and the electron dispersive absorption x-ray diffraction tests were carried out to identify the microstructural development due to the addition of lime, phosphogypsum and with the increase in curing period.

II. MATERIALS AND EXPERIMENTAL STUDY

The commercially available bentonite were used in this study and the physical and engineering of the bentonite were as follows: specific gravity, liquid limit, plastic limit, dry unit weight and optimum moisture content 2.30, 220 % and 39.74 %, 13.95 kN/m3 and 27.98 % respectively.. As per Universal Soil Classification System, the clay was classified as clay of high compressibility. Hydrated lime and phosphogypsum used

in this study was procured from the local market at Hamirpur, Himachal Pradesh, India. The specific gravity of lime and phosphogypsum was 2.37 and 2.20 respectively. The elemental composition of the bentonite, lime and phosphogypsum is given in Table 1.

TABLE I. ELEMENTAL COMPOSITION OF BENTONITE, LIME AND PHOSPHOGYPSUM

Element	Values (%)		
	Bentonite	**Lime**	**Phosphogypsum**
C	10.67	18.98	5.38
N	5.86	20.31	6.40
O	56.08	47.99	68.57
F	ND	ND	- ND
Na	2.02	ND	0.05
Mg	0.77	0.11	0.01
Al	7.61	0.05	0.05
Si	15.01	0.03	0.65
P	ND	ND	0.22
S	ND	ND	9.16
Cl	ND	0.02	0.04
K	0.19	0.05	0.04
Ca	0.03	12.24	0.00
Cr	0.02	ND	9.16
Fe	1.68	0.00	0.04
Zn	ND	0.24	0.01
Pb	ND	ND	ND
As	0.05	ND	ND
I	ND	ND	0.09
Note: ND → Not detected			

The content of lime and phosphogypsum was varied from 0 to 10 %. Mixes were prepared by adding 2 to 10 % lime and phosphogypsum to the bentonite. The optimum moisture content and maximum dry unit weight for the corresponding mix proportion were obtained from the standard proctor test

and the specimens were prepared for the unconfined compressive strength tests and cured for 3, 7, 14 and 28 days in a desiccator. Failed specimens of unconfined compression tests were powdered and sieved through a 45 μm sieve for SEM-EDAX tests.

III. RESULTS AND DISCUSSIONS

A. Scanning Electron Micrograph Study

Scanning electron micrographs (SEM) of the bentonite and bentonite + 8 % lime (cured for 7 and 28 days) are shown in Figs. 1-3. Study of Fig. 1 reveals the particles of bentonite. Fig. 2 reveals the formation of compact matrix (cementing gel) in bentonite with the addition of 8 % lime, cured for 7 days.
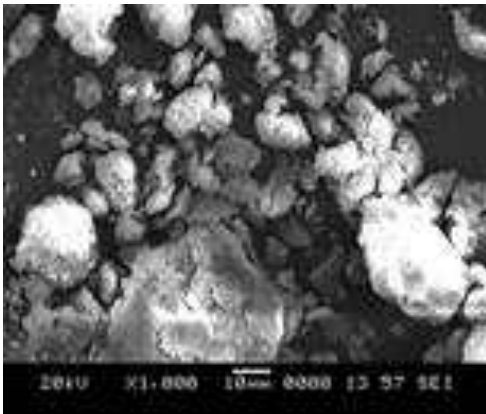
Fig. 1.   SEM of bentonite
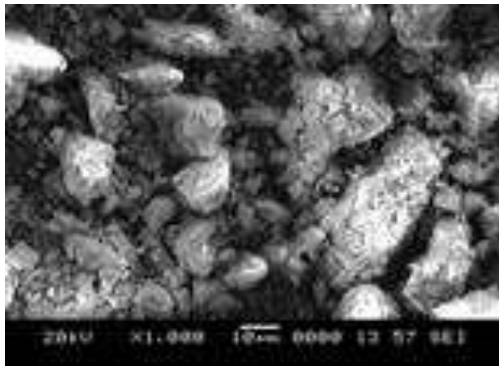
Fig. 2.   SEM of bentonite + 8% lime cured for 7 days
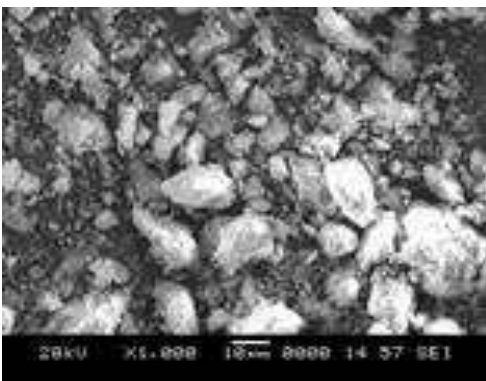
Fig. 3.   SEM of bentonite + 8% lime cured for 28 days

The formation of cementing gel increased with the increase in curing period to 28 days as evident from Fig. 3. Fig. 4 presents the results of the unconfined compressive strength of bentonite and bentonite + 8 % lime with the curing period.
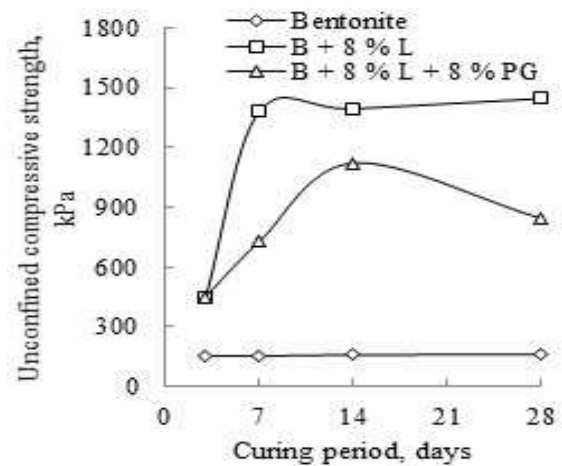
Fig. 4.   Variation of unconfined compressive strength of the mixes with curing period
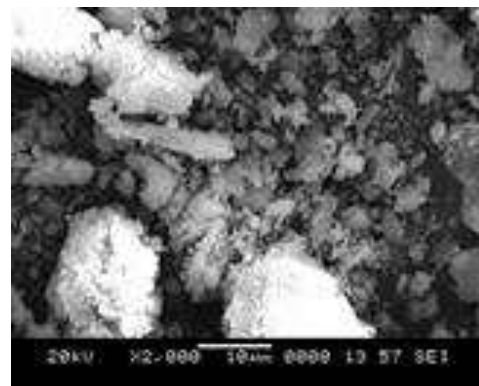
Fig. 5.   SEM of bentonite + 8% lime + 8 % phosphogypsum cured 7 days
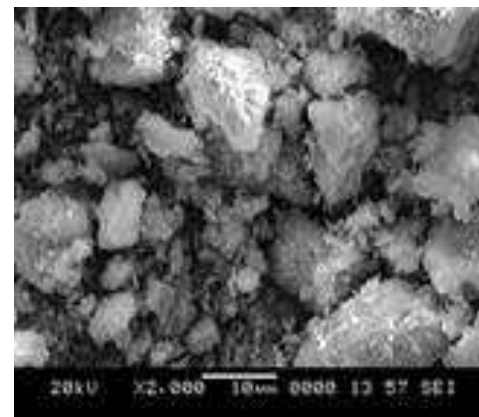
Fig. 6.   SEM of bentonite + 8% lime + 8 % phosphogypsum cured 14 days
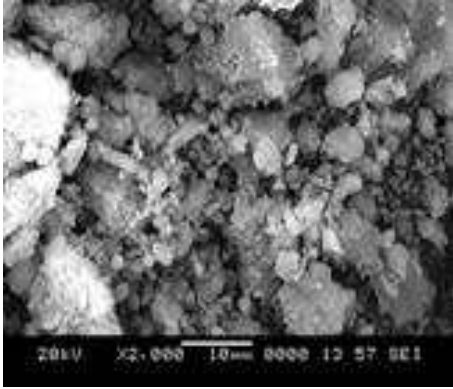
Fig. 7.   SEM of bentonite + 8% lime + 8 % phosphogypsum cured 28 days

Study of Fig. 4 shows marginal increase in the unconfined compressive strength of the bentonite with the increase in the curing period. However, the increase in compressive strength with the increase in curing period of bentonite + 8 % lime is due to the formation of cementing gel. The SEM of bentonite + 8 % lime + 8 % phosphogypsum with the curing period is shown in Fig. 5-7. Study of these figures reveals the formation of needle like interlocking matrix and formation of pozzolanic products. The effect of the later is dominant up to a curing period of 14 days.But, with the increase in curing period to 28 days, the dominant effect of the former gets more leading to decrease in strength of the bentonite+8% lime+8 %phosphogypsum as evident from Fig. 4.

B.   Energy-Dispersive X-Ray Spectroscopy Study

The energy-dispersive X-ray spectroscopy (EDAX) of the bentonite, bentonite + 8 % lime (cured for 7 and 28 days) and bentonite + 8 % lime + 8 % phosphogypsum (cured for 7, 14 and 28 days) are shown in Figs. 8-13.
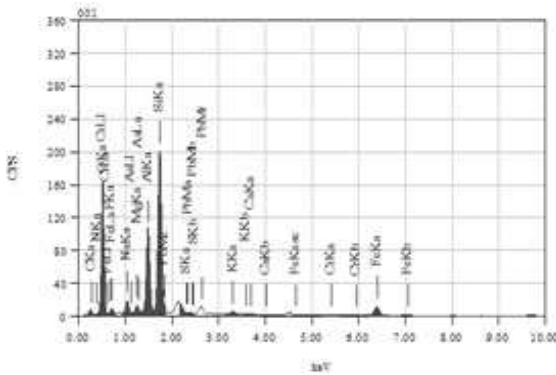
Fig. 8.   EDAX of bentonite
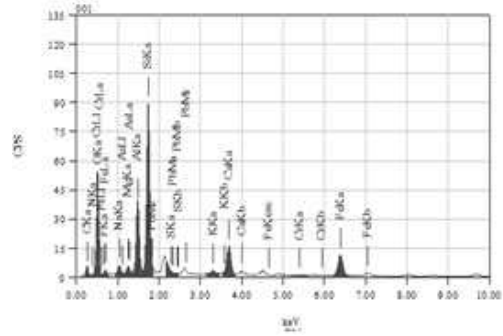
Fig. 9.   EDAX of bentonite + 8% lime cured for 7 days
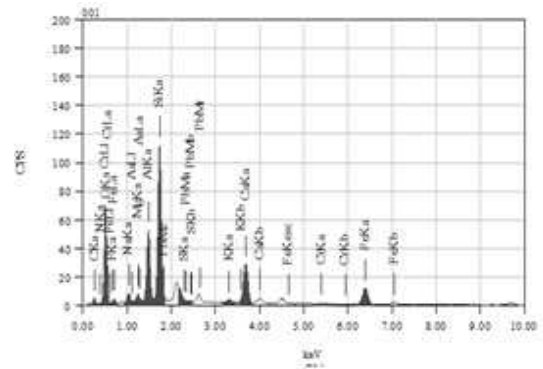
Fig. 10.   EDAX of bentonite + 8% lime cured for 28 days
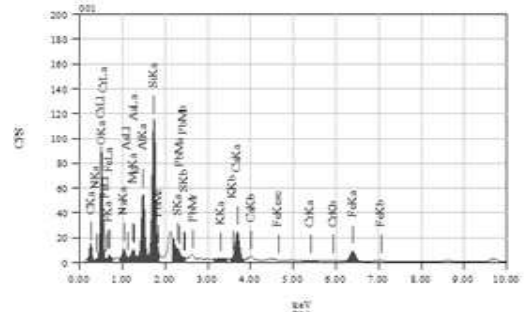
Fig. 11.   EDAX of bentonite + 8 % lime + 8 % phosphogypsum cured for 7 days
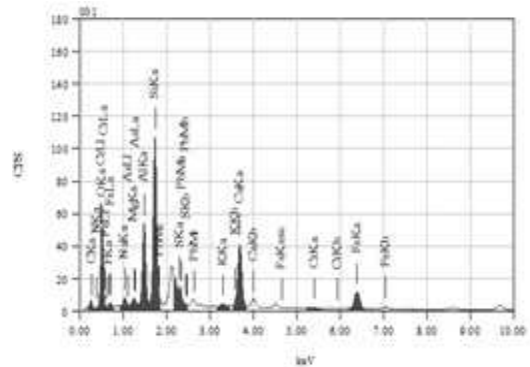
Fig. 12.   EDAX of bentonite + 8 % lime + 8 % phosphogypsum cured for 14 days
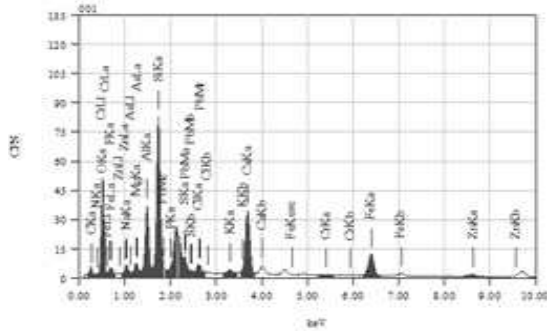
Fig. 13. EDAX of bentonite + 8 % lime + 8 % phosphogypsum cured for 28 days

Fig. 14 shows the variation of Ca: Si and Si: Al ratio of the mixes. A close examination of Fig. 8-10 and 14 reveals an increase in Ca: Si ratio of bentonite with the addition of 8 % lime as well as with the increase in curing period. The emissions of Ca, Si and O confirm the formation of cementing compound like C-S-Hleading to an increase in the unconfined compressive strength of the bentonite with the addition of lime as shown in Fig. 4. Further from Fig. 14, the Si: Al ratio of bentonite decreased with the addition of lime as well as with the increase in curing period.
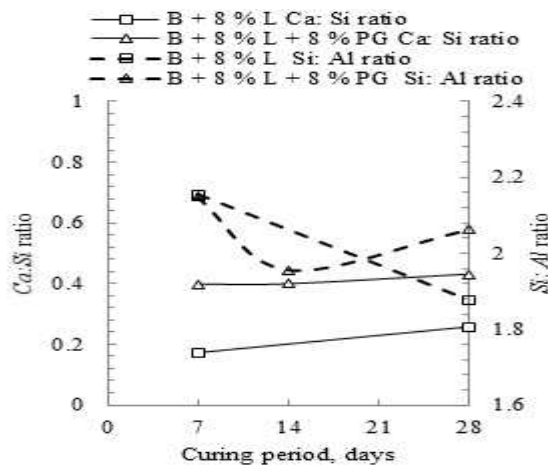
Fig. 14. Variation of Ca: Si and Si: Al ratio of the mixes with the curing period

The reduction in Si: Al ratio indicates the improvement in unconfined compressive strength. A close study of Fig. 11-14 reveals an increase in Ca: Si ratio of bentonite + 8 % lime with the addition of 8 % phosphogypsum and with the increase in curing period leading to an improvement in the unconfined compressive strength. The Si: Al ratio of bentonite + 8 % lime was 2.1556 and 1.8765 at a curing period of 7 and 28 days respectively. The Si: Al ratio changed to 2.1500, 1.9557 and 2.0672 with the addition of 8 % phosphogypsum to bentonite + 8 % lime mix at a curing period of 7, 14 and 28 days respectively. The decrease in Si: Al ratio continued upto a curing period of 14 days leading to improvement in unconfined compressive strength. The Si: Al ratio increased

beyond a curing period of 14 days indicates the reduction in the unconfined compressive strength due to the formation ettringitedue to the strong emissions of Ca, Al, S and O. Past study by Ghosh and Subbarao (2001)also analyzed the microstructural development through scanning electron micrograph and energy-dispersive X-ray spectroscopy microanalysis tests to acquire the information on the interaction between fly ash-lime and flyash-lime-gypsum. Roy et al. (1996)alsoconfirms the formation of ettringite in cement-phosphogypsum mixture.

IV. CONCLUSIONS

The microstructural study revealed the formation of cementing products in bentonite with the addition of 8 % lime to be the major factor responsible for the increase in the unconfined compressive strength. This was documented with the increase in Ca: Si ratio with the increase in the curing period showing slow pozzolanic reactions between bentonite and lime particles. The addition of 8 % phosphogypsum accelerated the formation of cementing products in the bentonite + 8 % lime along with minor formation of ettringite like structures up to 7 and 14 days of curing. The increase in ettringite formation led to a decrease in the unconfined compressive strength beyond a curing period of 14 days. This was verified with the EDAX study revealing a decrease in the Si: Al ratio after a curing period of 14 days.

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Analysis of Heat Transfer Through Different Type of Fins by Natural Convection

Mahipal Singh
Dept. of Production &
Industrial Engineering,
Dr. B R Ambedkar NIT,
Jalandhar, Punjab,
India

L.P. Singh
Dept. of Production &
Industrial Engineering,
Dr. B R Ambedkar NIT,
Jalandhar,
Punjab,India
.mahip.lamboria@gmail.com

Manjinder Bajwa
Dept. of Mechanical
Engineering,
Lovely Professional
University,
Punjab, India

Manish Nagpal
Dept. of Mechanical
Engineering,
Lovely Professional University,
Punjab, India

Abstract-In engines two types of cooling system are used, air-cooling and liquid-cooling. From these two cooling system, liquid-cooling is widely used due its capacity to transfer large amount of heat and air-cooling is preferred for small capacity engine in which cooling system is much simpler in design, low in cost and lighter in weight. In air-cooling engine fins with different profiles are used for heat transfer enhancement. So it is very important for an air-cooled engine to utilize effective fins profiles for better heat transfer. In this research work, the effect of air cooling was investigated using the different geometries of fins as variable for natural convection. Fins offer an economical and trouble free solution in many situations demanding natural convection heat transfer. The temperature inside of the cylinder & on the surface of the fins was measured by using thermocouples. Heat transfer through the fins was analyzed practically and then comparison through rectangular and triangular fins was considered. From the comparison, it proved that the rate of heat release from the cylinder was more when triangular shaped fin was used.

Keywords: Al-Cu Alloy Cylinder; Rectangular fins;Triangular fins Thermocouple; Ethylene glycol; Variable Transformer

I. INTRODUCTION

Fins are commonly applied for heat management in electrical appliances such as computer power supplies or substation transformers and Internal Combustion engine cooling, such as fins in a car radiator. The Rate of heat dissipation from a fin configuration by convection heat transfer depends on the heat transfer coefficient and the surface area of the fins. The surface area of the fins can also be increased by adding more fins to the base material in order to increase the total heat transfer from the fins. But the number of the fins should be optimized because it should be noted that adding more fins also decreases the distance between the adjacent fins. Using fins is one of the cheapest and easiest ways to dissipate unwanted heat. It has been observed that with increase in fin pitch heat transfer increases up certain extent. Heat release from the cylinder is analyzed at a wind velocity of 0 km/h. The trial conducted for 600 s, heat release by ethylene glycol through cylinder to fins is about 28.5 W for 10 mm pitch and 33.90 W for 20 mm pitch [1]. In another research, optimizes the cooling system of scooter engine by modification in cowl profile and cooling fan blade angle. It

has been observed that there is significant reduction in temperature of oil and fin surface with 3.1% reduction in fan power, while maintaining the same flow rate [2].

In another research, a parametric study of natural convection heat transfer from the horizontal rectangular fin arrays has been done. In this it is investigated the effects of a wide range of geometrical parameters like fin spacing, fin height, fin length and temperature difference between fin and surroundings; to the heat transfer from horizontal fin arrays. However, no clear conclusions were drawn due to the various parameters involved. Finally they concluded that, it is not possible to obtain optimum performance in terms of overall heat transfer by only concentrating on one or two parameters. The interactions among all the design parameters must be considered. This study has shown that each of the variables produces an effect on the overall heat transfer. As a whole, it can be concluded that the overall heat transfer is enhanced with the increase in the height (H), of the fin and decrease in the length (L) the fin [3]. Fins are generally used to increase the heat transfer rate from the surface.

In the analysis of fins it has been considered that the steady operation with no heat generation in the fin & assume the thermal conductivity of material is constant. The heat transfer coefficient is assumed to be constant over the entire surface of the fin. The value of h is much lower at the base than its tip. Because fluid is surrounded by the solid surface near its base. So by adding too many fins on a surface decrease the overall heat transfer coefficient when the decrease in h offsets any gain resulting from the increase in the surface area [4-5]. The heat transfer through the solid to the surface of the solid takes place through conduction whereas from the surface to the surroundings takes place by convection. Further heat transfer may be by natural convection or by forced convection. The rate of heat transfer from a surface at a temperature T_s to the surrounding medium at T_0 is given by the Newton's law of cooling as:

$$Q = h\, A_s\, (T_s - T_0)$$

Where: A_s - is heat transfer surface area and h -is the convection heat transfer coefficient. When the temperatures T_s

and T_0 are fixed by design considerations, as is often the case, there are two ways to increase heat transfer rates:

1) To increase convection average heat transfer coefficient [h_a] &

2) To increase the surface area [A_s] [6-8].

There are different fins profiles available but among all the profiles, which is suitable for better heat transfer in the natural convection that is analyzed in current research work. In the previous researches, the aluminum and copper materials were used as the fins material individually. No one use the alloy of aluminum and copper. So in this research work, the authors are used the Al-Cu alloy as the fins material and heat transfer rate is calculated. If the cooling rate is decreases, results in overheating leading to seizure of the engine. At the same time, an increase in cooling rate affects the starting of the engine and reduces the efficiency.

II. MATERIAL AND METHOD

A. Fins Material

The aluminum has a thermal conductivity of about 205W/mk. The production of aluminum heat sink is inexpensive. It is also very light. The copper having thermal conductivity of about 400 W/mk and its weight is very high. So here the alloys of aluminum and copper materials are used of making the fins which having thermal conductivity of about 350 W/mk and its weight also low. The individual compositions of Al-Cu alloys are shown in table 1.

TABLE I. THE COMPOSITION OF AL-CU ALLOYS

Material	Compositions (%)
Aluminum	62.9
Copper	33.7
Silicon	1.2
Manganese	0.8
Carbon	0.4
Tin	0.3

B. Experimental set-up

Since conducting an experiment on actual engine is tedious and costly process. For simplification test rig is prepared which save the time and cost. The method provides better control on measured parameter and maintains accuracy. The experimental equipment in figure 1 was set & the cylinder was filled with heat storage liquid. The heat storage liquid was heated using the heater & the stirrer was operated. When the heat storage liquid reached a temperature of approximately 120°C, the heater was turned off. The temperature of the heat storage liquid decreased to 100°C by cooling at room temperature & the temperature was recorded. The temperature was recorded until it reached room temperature. Ethylene Glycol is an organic compound which is used as heat storage due to freezing point -12 ^{0}C and boiling point 197 ^{0}C. In its

pure form, it is an odorless, colorless, syrupy, sweet-tasting liquid. Ethylene Glycol is toxic with molar mass 62.068 g/mol and density of about 1113.2 kg/m^3. Asbestos is used as heat insulating material at the top & the base of the cylinder. The asbestos is a good insulator of heat and can resist the temperatures up to 1500°C. As the heater was in direct contact with the insulation, the asbestos was used to resist the temperature of heater and to insulate the passage of heat from the cylinders. The asbestos sheet 22 mm in thickness was cut & machined to make the insulating covers for the cylinders. Two cylinders made of Al-Cu alloys are used to perform the experiment. The dimensions of the cylinders are shown in table 2.
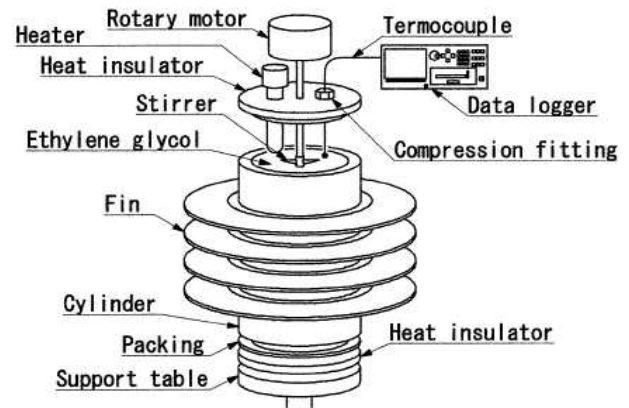
Fig. 1.   Test Rig set-up

TABLE II. SPECIFICATION OF TEST CYLINDER

Parameters	Dimensions
Length	200 mm
Thickness	2.5 mm
Outer diameter	75 mm
Inner diameter	70 mm
Stroke volume	780 to 825 cm^3

Fins: Four number of fins made of Al-Cu alloy are used in each cylinder. Four fins are of triangular shape & four are of rectangular shape. The Al-Cu alloy used for making fins is same as used for the cylinders. The spacing between the fins is 10 mm. The dimensions of the triangular and rectangular fins are shown in table 3 and the diagrams of cylinder with triangular and rectangular fins are shown in Figure 2 and 3 respectively.

TABLE III. SPECIFICATION OF FINS

Specification	Rectangular Fin	Triangular Fin
Length (mm)	50	50
Base thickness (mm)	3	3
	5	5
	7	7

	9	9
Edge thickness (mm)	-	2
Slope angle (^{0})	-	4

Fig. 2. Cylinder with triangular fins

Fig. 3. Cylinder with rectangular fins

The experimental setup which is performed in heat transfer laboratory is shown in figure 4.

Fig. 4. Experimental setup

The Closed type variable transformer of input and output voltage 240 V and 0-270 V respectively was used here to control the voltage supplied to the heater & to maintain a constant heating temperature. The current limit was 0-4 A and frequency 50/60 Hz. An AC motor of RPM 30-36 was used in

order to connect with the stirrer & to heat the Ethylene Glycol uniformly. The motor having power 4.5 W and frequency 50-60 Hz at voltage 220 V. A stirrer was used to rotate the ethylene glycol while it is heated & to make it uniformly heated. The stirrer was made from a hollow pipe of 10 mm dia. with a steel sheet of 1 mm welded with it. The stirrer was connected to the motor with a screw & hence rotated. The Pencil type heater was used to heat the ethylene glycol. The heater of length 6 inch and power 300 Watt was inserted in the cylinder by making a hole in the insulation cover & inserted in the ethylene glycol inside the cylinder.

C. Location of Thermocouples

K- Type and J- Type thermocouples were used in this experiment to measure the temperature of ethylene glycol & the surface temperatures of fins. The J-Type thermocouple was used to measure the temperature range of the ethylene glycol 0^0 to 900^0 inside the cylinders are shown in figure 5 & K-type thermocouples were used to measure the temperature of the fin surface upto 1300^0 are shown in figure 6. The position of J-type & K-type thermocouples are shown in table 4.

TABLE IV. POSITION OF THERMOCOUPLE

Thermocouple	Distance (mm) from Base of fin
T_1	10
T_2	20
T_3	30
T_4	40
T_5	50

Fig. 5. J-Type thermocouple

Fig. 6. K-Type thermocouple

Data Loggers: Data loggers or we can say temperature indicators were used in this project to show & record the temperatures. Two data loggers were used here as shown in figure 7. One is connected to the J type thermocouple & one is connected to K type thermocouples. The 1st logger which is

connected to the J type thermocouple indicates the changing temperature of the Ethylene Glycol inside the cylinders & the 2nd logger which is connected to the K type thermocouples indicates the surface temperature of the fins.

Fig. 7.   Data logger

III. RESULT AND DISCUSSION

Heat release from the cylinder was obtained by multiplying the Mass and heat storing capacity of the Ethylene Glycol by the difference between 100°C and the temperature after 10 minutes from the start of recording, then dividing it by the measurement time. The experiment was carried out at an ambient temperature of 25°C, because ambient temperature has a significant effect on temperature measurement of heat storing liquid.

Mass of Ethylene glycol   =   0.66792 Kg

Heat capacity of Ethylene Glycol =   3789.054 J/Kg

Temperature after 10 minutes=   48°C
Total Time Taken

   = 1500 Seconds Heat Release from the Cylinder

  = Mass*Heat capacity*(100-48)/Time

  = 0.66792*3789.054*52/1500 J/Sec

  = 87.732 Joules/Second

Temperature Distribution of Rectangular & Triangular Fins for thickness of 3 mm, 5 mm, 7 mm and 9 mm are shown in table 5, table 6, table 7 and table 8 respectively. The graph of temperature distribution for the rectangular and triangular fins for thickness 3, 5, 7 and 9 mm are shown in figure 8, 9, 10 and 11 respectively in which the temperature is decreased as distance increased from base to outer edge of the fin. But the rates of temperature decreasing are so fast in triangular fin as comparison to rectangular fin.

TABLE V.   TEMPERATURE DISTRIBUTION OF RECTANGULAR & TRIANGULAR FIN FOR 3 MM THICKNESS

Distance from Base (mm)	Rectangular Fin Temp. (°C)	Triangular Fin Temp. (°C)
10	66	62
20	64	60
30	62	59
40	60	58
50	58	56

TABLE VI. TEMPERATURE DISTRIBUTION OF RECTANGULAR & TRIANGULAR FIN FOR 5 MM THICKNESS

Distance from Base (mm)	Rectangular Fin Temp. (°C)	Triangular Fin Temp. (°C)
10	70	65
20	68	63
30	66	61
40	64	59
50	62	57

TABLE VII. TEMPERATURE DISTRIBUTION OF RECTANGULAR & TRIANGULAR FIN FOR 7 MM THICKNESS

Distance from Base (mm)	Rectangular Fin Temp. (°C)	Triangular Fin Temp. (°C)
10	71	67
20	69	65
30	67	63
40	65	61
50	63	59

TABLE VIII. TEMPERATURE DISTRIBUTION OF RECTANGULAR & TRIANGULAR FIN FOR 9 MM THICKNESS

Distance from Base (mm)	Rectangular Fin Temp. (°C)	Triangular Fin Temp. (°C)
10	72	69
20	70	67
30	68	65
40	66	63
50	64	61
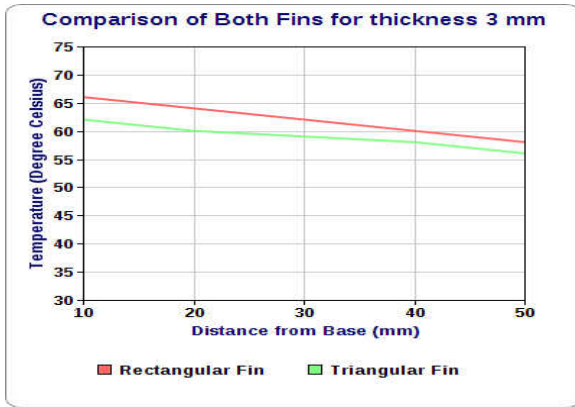
Fig. 8. Comparison of temperature distribution of both fins for thickness 3 mm
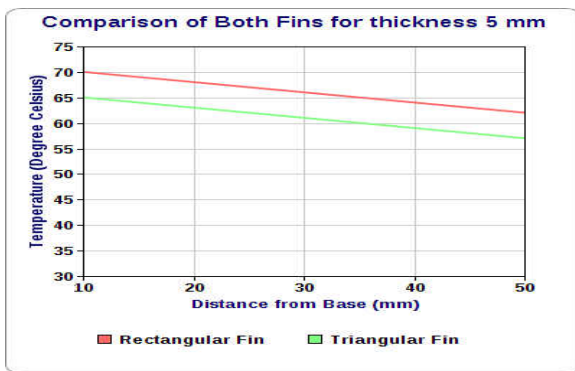
Fig. 9. Comparison of temperature distribution of both fins for thickness 5 mm
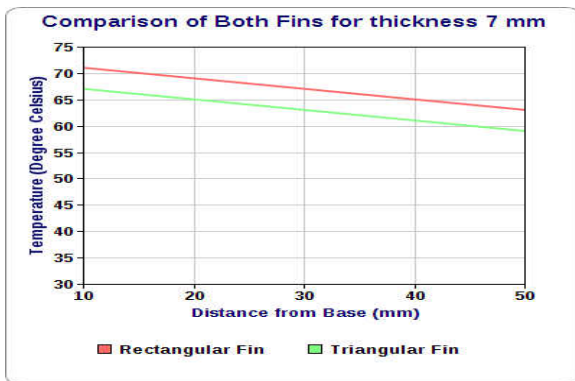
Fig. 10. Comparison of temperature distribution of both fins for thickness 7 mm
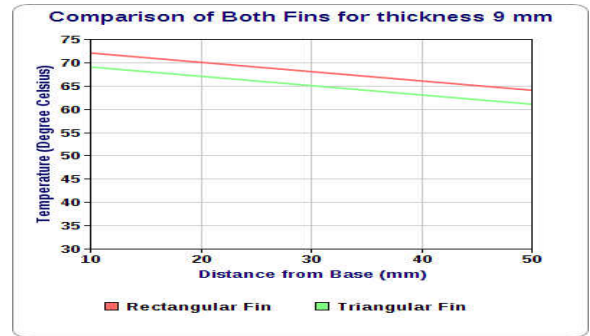
Fig. 11. Comparison of temperature distribution of both fins for thickness 9 mm

IV. CONCLUSION

From the experimental study it is found that the heat transfer rate in triangular fin is more than the rectangular fin. If the thickness of triangular fins is increased, then rate of heat transfer is decreased. So to increase the cooling of engine cylinder, keep the thickness of fins low. Also the Al-Cu alloy fins gives more heat transfer rate than the aluminum or copper fins. In this study, the natural convection are considered because in some cases like motor vehicles are stopped at red light but the engine are start. So in this case heat is transferred through the natural convection. The authors are considered one another case for using natural convection that is air cooling system in 4-stroke engine which are used in the field by farmers for extract the water from earth. In future scope in this study, we can change the shape of fins as trapezoidal etc and analyze the heat transfer rate.

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Swelling Characteristics of Bentonite-Lime-Gypsum Mix Reinforced with Sisal Fibres

Vidya Tilak B.
Dept.Civil Engineering,
National Institute of Technology,
Hamirpur, India
vidyatilakb@gmail.com

Sujeet Kumar
Dept. Civil Engineering,
National Institute of Technology,
Hamirpur, India
sujeetkumar.ce@gmail.com

Rakesh Kumar Dutta
Dept.Civil Engineering,
National Institute of Technology,
Hamirpur, India
rakeshkdutta@yahoo.com

Abstract- **The paper presents the swelling characteristics of the reference mix containing bentonite + 8 % lime + 4 % gypsum reinforced with sisal fibres. Sisal fibre content was varied from 0.25 to 2 % by dry weight of bentonite. The results of this study revealed an increase in the strength ratio of bentonite with the addition of lime-gypsum-sisal fibres. The swelling characteristics of bentonite were markedly reduced with the addition of 8 % lime, 4 % gypsum and 1 % sisal fibres. The end-time of primary swelling of bentonite + 8 % lime + 4 % gypsum + 1 % sisal fibres in duration of 40 days was 80 % less than that reached by bentonite. This accelerated reduction in swelling of bentonite brings new hope for the construction activities on such problematic areas.**

Keywords- **Bentonite, Lime; Gypsu; Sisal fibre; Compaction;Unconfined compressive strength; Swelling Characteristics.**

I. INTRODUCTION

In a developing country like India, infrastructural investment is up to the tunes of thousands of crores. The fulfillment of continuous demand for suitable construction site is becoming hard mainly due to the ever-increasing population. In such a scenario, shifting the focus on areas covering problematic soil shows good hope for engineers to build structures using stabilization techniques. Many researchers stabilized the expansive soils using additives like lime or gypsum or in combination in the pastto improve the unconfined compressive strength (Al-Rawas et al., 2005, Kavak and Akyarlı, 2007; Khattab et al., 2007; Abdelmadjid and Muzahim, 2008;Yilmaz and Civelekoglu, 2009;Seco et al.,2011; Neeraja, 2010; Ramesh et al., 2010; Sabat, 2012).Ferber et al. (2009)reported the influence of nature of clay fraction and mineralogy, the dry density and water content, and the amount of water intake as major parameters for the soil swelling deformation leading to non-negligible maintenance costs for the overlying structures.Muntohar (2004)reported the swelling pressure of montmorilloniteas high as 981 kPa. Research community is always in search of materials and techniques to arrest the swelling of expansive soils. Various types of natural fibres were used to stabilize the expansive soils(Rajan and Abraham, 2006; Ramesh et al, 2010, 2011; Sebastian et al, 2011; George at el, 2013) in the past. However studies related the addition of sisal fibres to the lime-gypsum stabilized expansive soils has not been investigated so far. Hence this research is taken up and the results obtained from the swelling potential has been presented and discussedin the present paper.

II. MATERIAL USED AND EXPERIMENTAL PROCEDURE

Bentonite used in this study was procured from Ludhiana, India. The physical and engineering properties of bentonite are given in Table 1.

TABLE I. PHYSICAL AND ENGINEERING PROPERTIES OF BENTONITE (AFTER TILAK ET AL., 2014)

Property	Value
Specific gravity	2.30
Liquid limit, %	220
Plastic limit, %	39.74
Optimum moisture content, %	27.98
Maximum dry density, kN/m^3	13.95
Type	CH

Hydrated lime and gypsum, and sisalfibres were procured from the local market at Hamirpur, Himachal Pradesh, and Patna, India respectively. The specific gravity of lime, gypsum and sisal fibre was 2.37, 2.89 and 1.4 respectively. The standard proctor compaction tests and unconfined compressive strength tests were conducted as per the relevant standards on bentonite-lime,bentonite-lime-gypsum and bentonite-lime-gypsum-sisal fibresmixtures by varying the content of lime, gypsum and sisal fibre from 2 to 10 %, 0.5 to 8 % and 0.25 to 2 % respectively and water was added as needed to facilitate the mixing. The specimenswere placed in air tight polythene bags and kept in the desiccator for curing for 3, 7, 14 and 28 days. Free swell test were conducted using 100 cc graduated glass jar using distilled water in one and kerosene in the other jar. About 15 g of bentonite was mixed in distilled water and stirred thoroughly before pouring the mix in the jar and was allowed to swell. The observations were recorded after 24 hours from the start of the test.For the swell potential tests, the specimen was prepared in the conventional odometer by compacting the mix into three layers using a rubber tamper in the consolidation ring of 60 mm internal diameter and 25.9 mm height in three layers and was applied a seating load of 5 kPa. The oedometer was then placed in a container filled with water and was allowed to swell for 40 days.

III. RESULTS AND DISCUSSIONS

A. Compaction and unconfined compressive strength tests

The variation of maximum dry unit weight with optimum moisture content of bentonite with the addition of varying percentages of lime is shown in Fig. 1.A decrease in maximum dry unit weight and increase in optimum moisture content of bentonite was observed with the increase in the lime content. Detailed study is reported in Tilak et al. (2014).To decide the optimum bentonite-lime mix for further study, unconfined compressive strength test was conducted on the lime-bentonite mixes. The change in the strength ratio with the increase in the lime content is shown in the Fig. 2. Study of Fig. 2 shows the increase in the strength ratio of bentonite with the increase in the lime content. The increase in the strength ratio is also observed with the increase in the curing period. A close study of the Fig. 2 shows the maximum increase in the strength of the bentonite occurred with the addition of 8 % lime. Hence, bentonite + 8 % lime was chosen for further study. The compaction studies were continued with the addition of varying percentage of gypsum to the bentonite + 8 % lime mix.The variation of maximum dry unit weight and optimum moisture content with the increase in the gypsum content is shown in the Fig. 3.
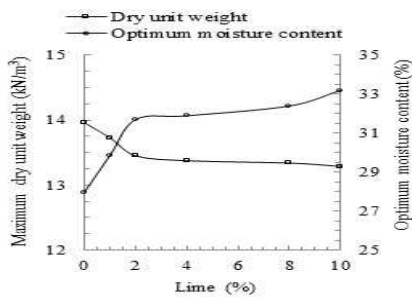
Fig. 1.   Variation of maximum dry unit weight and optimum moisture content of bentonite with varying lime content
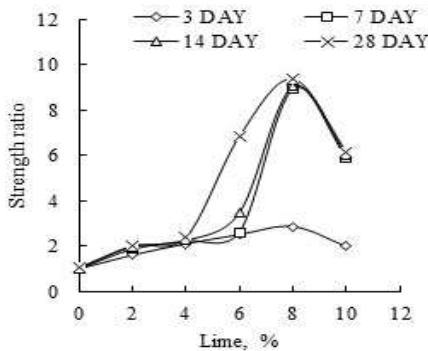
Fig. 2.   Variation of strength ratio of bentonite with varying percentage of lime and curing period
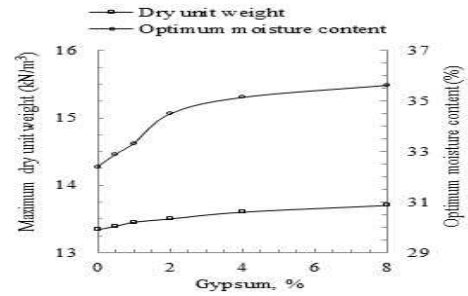
Fig. 3.   Variation of maximum dry unit weight and optimum moisture content of bentonite + 8 % lime with varying percentage of gypsum

To decide the optimum bentonite-lime-gypsum mix for further study, unconfined confined compressive study was conducted on the bentonite-lime-gypsum mixes. The change in the strength ratio with the increase in the gypsum content is shown in the Fig. 4.Study of Fig. 4 shows the increase in the strength ratio of bentonite + 8 % lime with the increase in the gypsum content. A close study of the Fig. 4 shows the maximum increase in the strength of the bentonite + 8 % lime occurred with the addition of 4 % gypsum. Hence, bentonite + 8 % lime + 4 % gypsum was chosen as the **"reference mix"** for further study. The compaction studies were continued with the addition of varying percentage of sisal fibers to the reference mix.
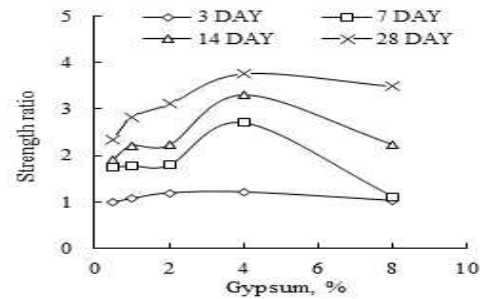
Fig. 4.   Variation of strength ratio of bentonite + 8 % lime with varying percentage of gypsum and curing period

Fig. 5 shows the variation of maximum dry unit weight and the optimum moisture content of the reference mix with varying percentage of sisal fibres. The decrease in the maximum dry unit weight of the reference mix with the addition of sisal fibres is due to the replacement of lighter sisal fibres with the heavier bentonite, lime and gypsum particles. The increase in the optimum moisture content with the increase in the addition of sisal fibers to the bentonite-lime-gypsum is due to the moisture absorption capacity of the fibres. A close study of the Fig. 6 shows the maximum increase in the strength ratio of the reference mix occurred with the addition of 1 % sisal fibres.The increase in strength ratio with the addition of sisalfibres up to a fibre content of 1.0 % is attributed to the fact that the cementing gel formed due to the reaction of bentonite with lime, binds the sisalfibres with the bentonite particles leading to enhancement strength ratio. The decrease in strength ratio beyond a fibre content of 1.0 %

is attributed to the fact that formation of lump of fibres due to excessive adhesion and poor contact of fibres with bentonite particles. Hence, reference mix + 1 % sisal fibres were chosen for studying the swelling characteristics.
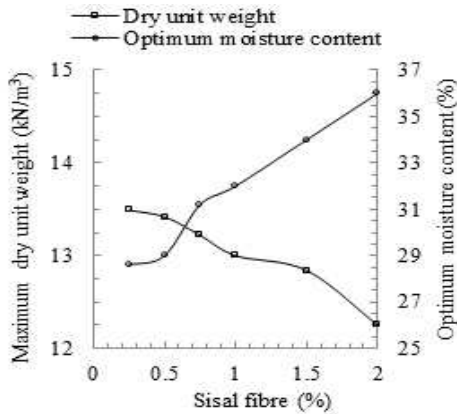
Fig. 5.   Variation of maximum dry unit weight and optimum moisture content of bentonite + 8 % lime + 4 % gypsum with varying sisal fibre content
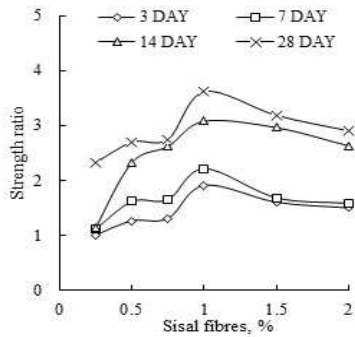
Fig. 6.   Variation of strength ratio of the reference mix with varying percentage of sisal fibres and curing period

B.   Swelling characteristics

Swelling characteristics was determined for bentonite, bentonite + 8 % lime, reference mix and reference mix + 1 % sisal fibres. Free swell index and swell potential were determined.

1.   Free swell index

The variation of free swell index for the mixes is shown in Fig. 7. A study of Fig. 7 reveals that the free swell index of the bentonite was 795.45 % which decreased to 100 % when the bentonite is mixed with 8 % lime. The free swell index of the bentonite + 8 % lime mix further decreased to 20 % with the addition of 4 % gypsum. There was a decrease of % with the addition of 1 % sisal fibres.
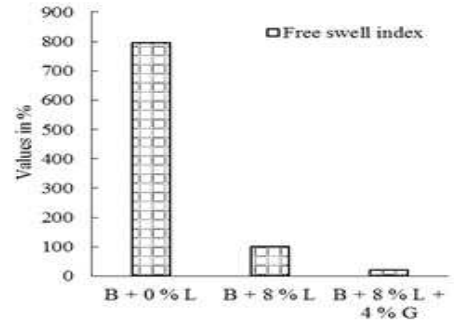
Fig. 7.   Variation of the free swell index with varies mixes

2.   Swelling potential

The swell potential is defined as the percentage swell of a laterally confined sample, which has soaked under a surcharge pressure of 3.89 kPa after being compacted to maximum density at optimum moisture content according to the compaction test (Muntohar, 2004). The swell is expressed as a percentage increase in sample height. The variation of swelling deformation in reference to the original volume of the compacted specimens with time is shown in the Fig. 8 for the mixes and the variation of total swell of the mixes with time is shown in Fig. 9.
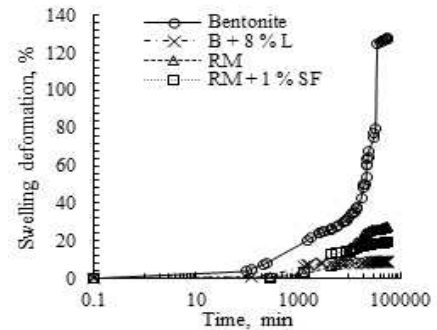
Fig. 8.   Variation of swelling deformation with varies mixes
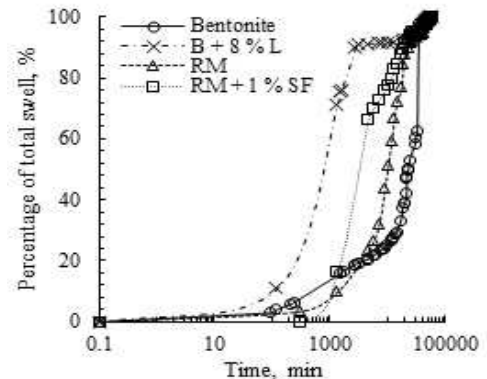
Fig. 9.   Variation of percentage of total swell of varies mixes

Study of Fig. 8 reveals the high swelling behavior of the bentonite. A 93 %, 79 % and 85 % reduction of swelling is observed with the bentonite + 8 % lime, reference mix and

reference mix + 1.0 % sisal fibresrespectively. The increase in the swelling behavior of bentonite + 8 % lime with the addition of gypsum is due to expansive action of sulphates. The inclusion of 1 % sisal fibres slightly decreases the swelling of the reference mix.A study of Fig. 9 shows an increase in swelling with log time being slow initially for all mixes, increased steeply, and then reached anasymptotic value. The time required to reach anasymptotic value varied considerably, dependingupon the percentage of bentonite and the amount of additives.
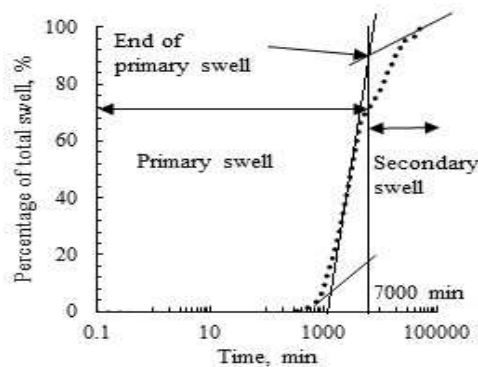
Fig. 10.   Variation of primary swell and secondary swell of reference mix + 1.0 % sisal fibres

Fig. 10 shows the close occurrence of the two stages in swelling namely, the primary swell and secondary swell. The first phase shows hydration of drybentonite particles, in which, water is adsorbed in successivemonolayers on the surface of bentoniteapart which referred to as interlayer orinter-crystalline swelling. The second phase ofswelling shows large volume changes due to double-layer repulsion. However, initial swellingis less than 10% of the total swelling(Muntohar,2004). A close study of Fig. 10 reveals the point corresponding to the end of primary swell for reference mix + 1.0 % sisal fibres. A reduction of 80 % in the end-time of primary swell is observed with the addition of sisal fibres to the reference mix.

IV. CONCLUSIONS

The study shows the increase in the strength ratio of bentonite with the addition of lime-gypsum-sisal fibres.The swelling characteristics of bentonite were markedly reduced with the addition of 8 % lime, 4 % gypsum and 1 % sisal fibres.The end-time of primary swelling of bentonite + 8 % lime + 4 % gypsum + 1 % sisal fibresin duration of 40 days was 80 % less than that reached by bentonite. This accelerated reduction in swelling of bentonite brings new hope for the construction activities on such problematic areas.

V. NOTATIONS

B   =   Bentonite

L   =   Lime

G   =   Gypsum

SF   =   Sisal fibre

RM   =   Reference mix

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Designing and Modal Analysis of Crankshaft for Single Cylinder Camless Engine

Kanwar J.S Gill
Dept. of Mechanical Engineering
Gulzar Group of Institutes, Hanna
Ludhiana, India
mtechjabi@yahoo.co.in

Sukhchain Singh Dhillon
Dept. of Mechanical Engineering
Anand College of Engg.and Mgmt.
Kapurthala, India
dhillon78@gmail.com

Abstract—**The three-dimensional finite element models was constructed and an analytical modal analysis is then performed to generate natural frequencies and mode shapes Modal Analysis of crank shaft for single cylinder camless engine is done by using Visual Nastran 4DFEA** software **as an analysis tool.Modal analysis evaluates normal modes and natural frequencies and it does not consider damping.Issues like,how stiffness and mass affect frequency of crankshaft are also considered and the solution for a single DOF model demonstrates that frequency is proportional to stiffness (K) and inversely proportional to the mass (M). The modal analysis gives us different modal shapes at its natural frequencies.Modal analysis is done in order to understand the pattern of shape change so as to decide the criticality at the same working frequency of the whole assembly. The software automatically adapts the default settings and run the analysis to give different modes.In this case we request the software for 10 modal outcomes.**

Keywords— **Finite element analysis (FEA), Experimental modal analysis (EMA), crankshaft,modal,frequency,camless**

I. INTRODUCTION

History shows that the idea of a camless internal combustion engine has its origins as early as 1899, when designs of variable valve timing surfaced. It was suggested that independent control of valve actuation could result in increased engine power [1]. More recently, however, the focus of increased power has broadened to include energy savings, pollution reduction, and reliability.To provide the benefits listed above, researchers throughout the previous decade have been proposing, prototyping, and testing new versions of valve actuation for the internal combustion engine. Their designs have taken on a variety of forms, from electro-pneumatic to electro-hydraulic [2,3]. These designs are based on electric solenoids opening and closing either pneumatic or hydraulic valves. The controlled fluid then actuates the engine valves.

Much of the available documentation deals with the either the control of the solenoids or the computer modeling of such control systems [4,5,6]. The research on the control of the solenoids is crucial since their precision and response is a limiting factor to developing a reliable camless valve actuator.

A comprehensive project using solenoid control of pneumatic actuators was completed in 1991 . This research included the development of the actuators, a 16 bit microprocessor for control, and comparative testing between a standard Ford 1.9 liter, spark ignition, port fuel injected four cylinder engine and the same engine modified for camless actuation. Testing compared the unmodified engine to that of the same engine, altered to include eight pneumatic actuators in place of the standard camshaft. As Gould et al states, their work cannot be considered feasible for implementation due to the high power requirements of the actuator. Furthermore, concerns related to the lack of research for the gas flow dynamics in variable valve timing designs were raised by the authors. The altered flow dynamics may have contributed to inconsistently favorable results.

Since the new research proposed by the University of South Carolina utilizes the emerging field of piezoelectric devices to replace solenoids in previous designs, a literature review of piezoelectric – hydraulic actuators was completed. Through this search, it was found that the combination of accuracy, force, and displacement were the greatest challenges facing such actuators. Recent research completed by Mauck et al [7] indicates that the need for "smart wing" technology is centered around the ability of a hybrid piezo-hydraulic pump to produce large displacements (0.1 to 10 mm) with high forces (10 to 2000 N). This is in line with this proposal; however, the actuation frequency of (1) is limited to low or intermediate frequencies (0.1 to 200 Hz). This is not compatible with the high frequency requirements of a camless engine. Earlier work by Yokota and Akutu [8] results in an on-off poppet-type valve that operates at higher speeds. However, actuation is limited to 2 kHz and simple binary function – open or closed. This is also not compatible with the requirements of variable timing and lift needed for the camless engine.

Another, more recent, advance in high operating frequency piezoelectrically-driven hydraulic actuators was completed by Roberts et al [9]. Their system provides actuation at frequencies up to 24 kHz, but valve stroke is limited to 40 μm.

II. CRANKSHAFT

Crankshaft is one of the most important moving parts in internal combustion engine [10]. It must be strong enough to

take the downward force of the power stroked without excessive bending. So the reliability and life of internal combustion engine depend on the strength of the crankshaft largely. And as the engine runs, the power inpulses hit the crankshaft in one place and then another. The torsional vebration appeas when a power impuls hits a crankpin toward the front of the engine and the power stroke ends. If not controlled, it can break the cuankshaft.

Srength caculation of crankshaft becomes a key factor to ensure the life of engine. Beam and space frame model were used to calculate the stress of crankshaft usually in the past. But the number of node is limited in these models. With the development of computer, more and more design of crankshaft has been utilized finite element method (FME) to calculate the stress of crankshaft. The application of numerical simulation for the designing crankshaft helped engineers to efficiently improve the process development avoiding the cost and limitations of compiling a database of real world parts. Finite element analysis allows an inexpensive study of arbitrary combinations of input parameters including design parameters and process conditions to be investigated [11-14].

Crankshaft is a complicated continuous elastomer. The vibration performance of crankshaft has important effect to engine. The calculation of crankshaft vibration performance is difficult because of the complexity of crankshaft structure, the difficult determinacy of boundary condition. Dynamic matrix method and dynamic substructural method combined with FME were used to calculate the vibration of crankshaft. The method of three-dimensional finite element was carried to analysis dynamical characteristic of diesel crankshaft [15-18].

III.   MODAL ANALYSIS

In the paper, 3-D finite element analyses are carried out on the modal analysis of crankshaft and the stress analysis of crankpin. And the FME software NASTRAN was used to simulate the modal analysis .The results of natural frequencies and mode shape were obtained. The results are regarded as a theory basis to optimize the design of crankshaft and analysis the structure dynamics of crankshaft. The experimental modal analysis (EMA) means the extraction of modal parameters (frequencies, damping ratios, and mode shapes) from measurements of dynamic responses.Basically, it is carriedout according to both input and output measurement data throughthe frequency response functions (FRFs) in the frequency domain,or impulse response functions (IRFs) in the time domain. For mechanical engineering structures, the dynamic responses (output) are thedirect records of the sensors that are installed at several locations .The finite element analysis (FEA) is currently a common way toperform an analytical modal analysis of crankshafts. However,some problems always occur when establishing an accurateFE model of the existing structure. The problem arises not onlyfrom the errors resulting from simplified assumptions made inmodeling of the complicated structures but also from parametererrors due to structural damage and uncertainties in the materialand geometric properties. The FEA is analytical, the EMA is experimental and modes are the common ground between the two. In fact the EMA is still used to validate FEA

models, but it is also heavily used for troubleshooting noise and vibration problems in the field. Once an FEA model has been validated, it can be used for a variety of static and dynamic load simulations

IV.   FINITE ELEMENT MODELING.

Now that the geometrical and mechanical properties of the crankshaft are decided, we can proceed with the finite element modeling. Three-dimensional linear elastic finite element model has been constructed using Visual Nastran 4D FEA software.The crankshaft is modeled using solid ten-noded tetrahedral elements (each node has 3 degrees of freedom UX,UY and UZ).Maintaining the Integrity of the Specifications.

TABLE I.

Environment Summary	
Environment	NX NASTRAN - Structural
Analysis	Structural
Problem abstraction	Simple
Time dependency	Steady state
Solver	NX NASTRAN

TABLE II. 1

Mesh Summary	
Total number of elements in the part	5884
Total number of nodes in the part	1762
Number of Tetra4 elements	5884
Minimum element label used	1
Maximum element label used	5884
Minimum node label used	1
Maximum node label used	1762

TABLE III.

Physical Property	
Name	PSOLID1
Type	PSOLID
Label	1
Material	Steel
CORDM Definition	User Defined
CORDM	Absolute

Physical parameters	Values
Tensile strength (MPa)	1080
Yield strength (MPa)	930
Elongation (%)	12
Reduction of cross sectional area (%)	5
Impacting energy (J)	63
Notched bar impact strength (J/cm2)	78
Rigidity (HB)	217
Modulus of Elasiticity (GPa)	210
Poisson ratio	0.3
Density (g/cm3)	7.9

Fig. 1.   Modal of camless engine shaft

Modal analysis evaluates normal modes and natural frequencies. It does not consider damping. The modes respond to the natural frequency of the body are.

Fig. 2.   Meshing Modal of camless engine shaft
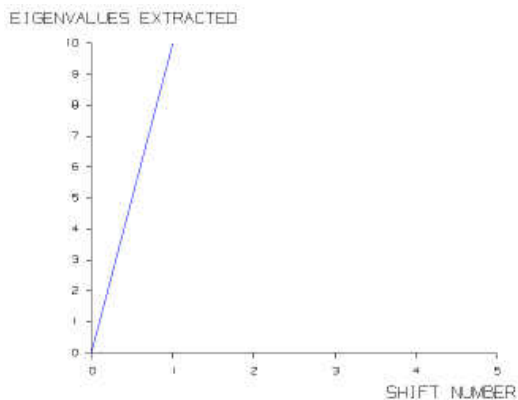
Fig. 3.   Meshing Modal of camless engine shaft

The solution for a single DOF model demonstrates that
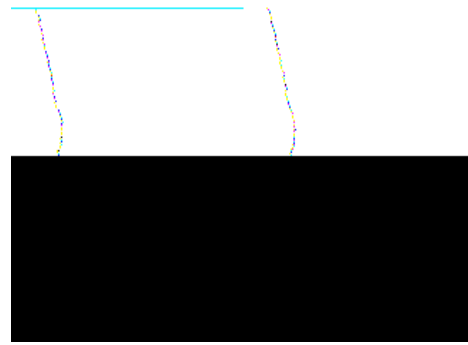
Fig.4 Solver output graph

frequency is proportional to stiffness (K) and inversely proportional to mass (M).

$$\Omega = \sqrt{\frac{K}{M}}$$

The modal analysis gives us different modal shapes at its natural frequencies. Modal analysis is done in order to understand the pattern of shape change so as to decide the criticality at the same working frequency of the whole assembly.

There is no boundary condition applies in this analysis. The software automatically adapts the default settings and run the analysis to give different modes. In this case we request the software for 10 modal outcomes.

V.   RESULTS

The result below shows different modal displacements and stress:
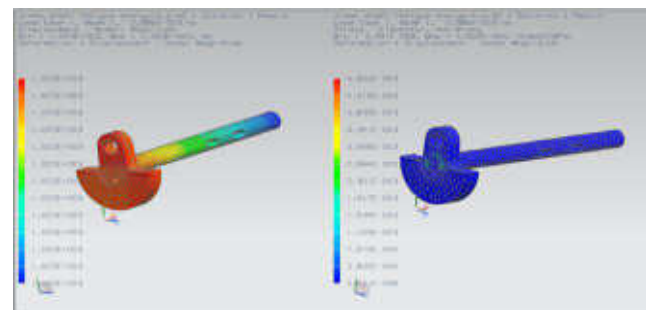
Fig.5 mode 1, stress and Displacement of calmless engine shaft
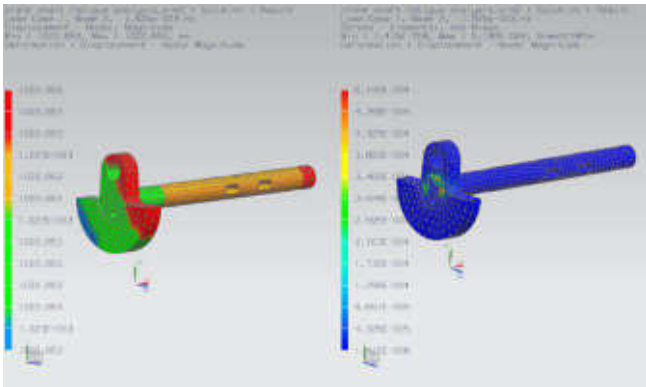
Fig. 6 Mode 2, Stress and Displacement of camless engine shaft
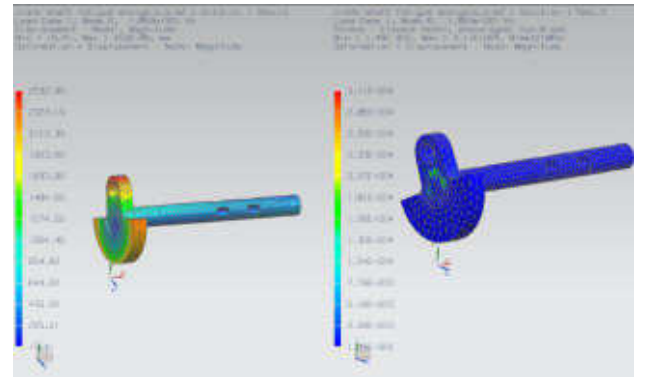
Fig. 10 Mode 6, Stress and Displacement of camless engine shaft
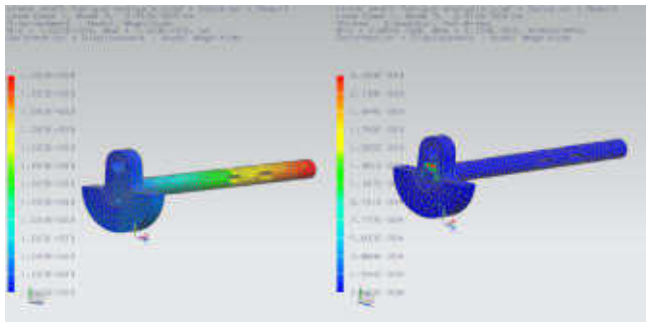
Fig. 7 Mode 3, Stress and Displacement of camless engine shaft
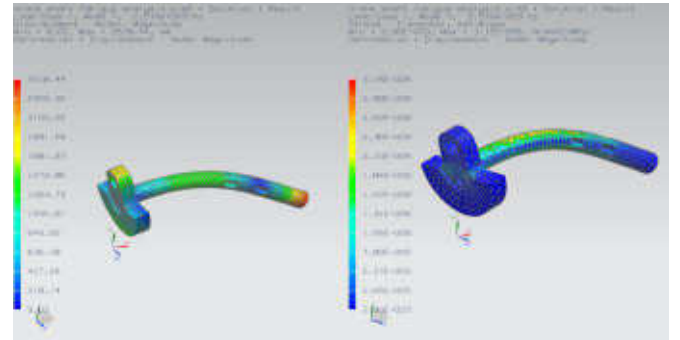
Fig. 11 Mode 7, Stress and Displacement of camless engine shaft
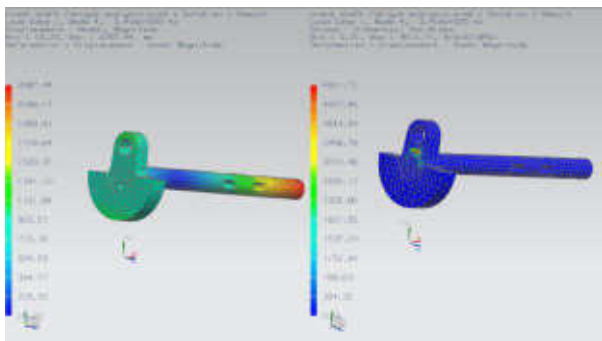
Fig. 8 Mode 4, Stress and Displacement of camless engine shaft
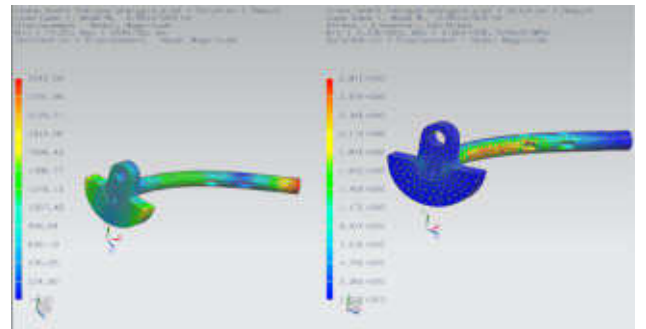
Fig. 12 Mode 8, Stress and Displacement of camless engine shaft
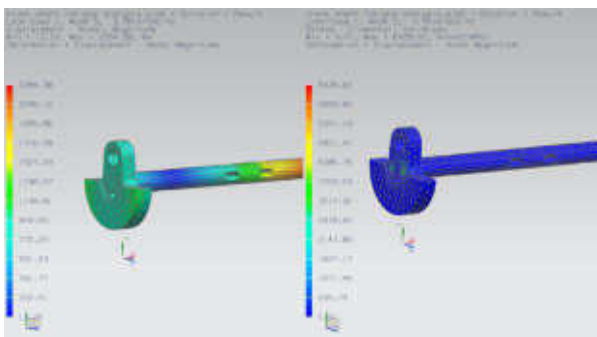
Fig. 9 Mode 5, Stress and Displacement of camless engine shaft
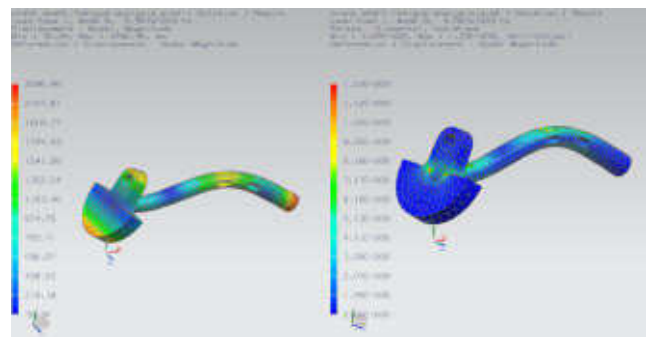
Fig. 13 Mode 9, Stress and Displacement of camless engine shaft

Fig. 14 Mode 10, Stress and Displacement of camless engine shaft

VI. CONCLUSION

In this paper, the crankshaft model and crank throw modal
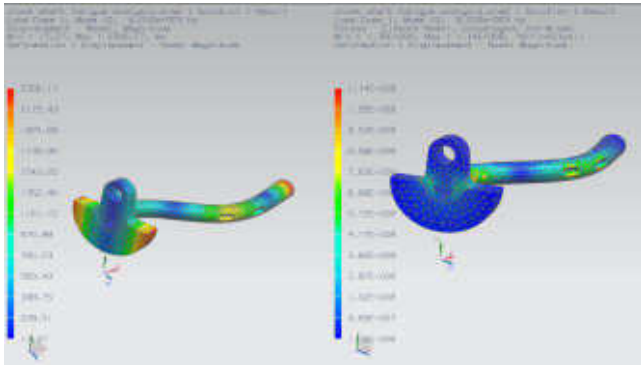
were created by pro/engineer software. Then the model created by pro/engineer was imported to NASTRAN software. The maximum deformation appears at the center of crank neck surface. The crankshaft deformation was mainly bending deformation under the lower frequency and the maximum deformation was located at the link between main bearing journal and crankpin and crank cheeks. So this area prones to appear the bending fatigue crack. Base on the results, we can forecast the possibility of mutual interference between the crankshaft and other parts. The resonance vibration of system can be avoided effectively by appropriate structure design the results provide a theoretical basis to optimize the design and fatigue life calculation

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Introduction to Axiomatic Design method: Corollaries and Theorems

Mohd Mujahid Khan
Dept. of Mechanical Engineering,
Jamia Millia Islamia,
New Delhi- 110 025, India
corresponding author's email address-
ermuhammadkhan@gmail.com

Pankaj K. Chauhan
Dept. of Mechanical and Automation
Engineering
G. B. Pant Engineering College,
New Delhi-110 020, India
pankaj2003_mit@yahoo.co.in

Mohd Suhaib
Dept. of Mechanical Engineering,
Jamia Millia Islamia,
New Delhi- 110 025, India
suhaib.jamia@gmail.com

Abstract— Axiomatic design (AD) is a design theory that was created and popularized by Professor Suh of the Massachusetts Institute of Technology (Suh 1990, 2000). It is quite a new design theory dating back for not more than twenty five years ago. Since 1990, many researchers are working on AD, defining and detailing even the smallest aspect of AD. Thus, there is a tremendous need of gathering all the corollaries and theorems of AD under the same roof. This paper solves the problem by collecting almost all corollaries and theorems of AD in it and explaining them in the simplest possible way.

Keywords— Axiomatic Design; Corollaries; Theorems; Independence Axiom; Information Axiom.

I. INTRODUCTION

From the Oxford Dictionary, the word 'Axi-o-matic' is an adjective and means 'Self-evident or unquestionable' or 'Relating to or containing axioms.' The method gets its name from its use of design principles or design Axioms (i.e., given without proof) governing the analysis and decision making process in developing high quality product or system designs. Axiomatic design is a systems design methodology using matrix methods to systematically analyze the transformation of customer needs into functional requirements, design parameters, and process variables (Deo & Suh, 2004). According to Prof. Nam P. Suh, "Axiomatic Design (AD) can be used to establish a scientific basis to improve design activities by providing the designer with a theoretical foundation based on logical and rational thought process and tools (Suh, 1990). The primarily goal of AD is to provide a thinking process to create a new design and/or to improve the existing design (Suh, 2001)."

AD is a general design framework, rather than a design theory. As the word "framework" indicates, it can be applied to all design activities. It is well known that the word "axiom" originates from geometry. An axiom cannot be proved and becomes obsolete when a counterexample is validated. So far, a counterexample has not been found in axiomatic design. Instead, many useful design examples with axioms are validated. Design is the interplay between "what we want to achieve" and "how we achieve it". A designer tries to obtain what he/she wants to achieve through appropriate interplay between both sides. The engineering sequence can be classified into four domains as illustrated in Fig. 1. Customer attributes (CAs) are delineated in the customer domain. In other words, CAs are the customer needs. CAs are transformed into

functional requirements (FRs) in the functional domain. FRs are defined by engineering words. This is equivalent to "what we want to achieve." FRs are satisfied by defining or selecting design parameters (DPs) in the physical domain. Mostly, this procedure is referred to as the design process. Production variables (PVs) are determined from DPs in the same manner. The aspects for the next domain are determined from the relationship between the two domains, and this process is called mapping. A good design process means an efficient mapping process.

It consists of two axioms. One is the Independence Axiom and the other is the Information Axiom. A good design should satisfy the two axioms while a bad design does not.
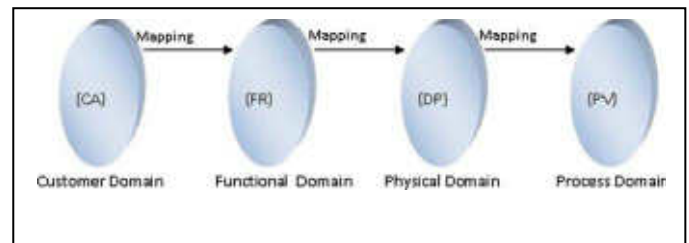
Fig. 1.   Graphical representation of the four domains of AD and the process of Mapping.

II. THE TWO-AXIOMS

A. The Independence Axiom

The independence of Functional Requirements (FRs) must be always maintained, where FRs are defined as the minimum number of independent functional requirements that characterize the design goals (Suh NP, 1990). It is also known as The Maximize Independence Law.

Alternate Statement 1: An optimal design always maintains the independence of FRs (Albano LD, Suh NP, 1992, 1993).

Alternate Statement 2: In an acceptable design, DPs and FRs are related in such a way that a specific DP can be adjusted to satisfy its corresponding FR without affecting other functional requirements (Albano LD, Suh NP, 1992, 1993).

Using vector notations for FRs and DPs, the relationship is expressed as the following design equation:
$$\{FR\} = [A]\,\{DP\}$$
Matrix A is called a design matrix. The characteristics of matrix A determine if the Independence Axiom is satisfied.

Suppose we have three FRs and DPs, then Matrix A is as follows:

$$\begin{bmatrix} FR_1 \\ FR_2 \\ FR_3 \end{bmatrix} = \begin{bmatrix} A_{11} & A_{12} & A_{13} \\ A_{21} & A_{22} & A_{23} \\ A_{31} & A_{32} & A_{33} \end{bmatrix} \begin{bmatrix} DP_1 \\ DP_2 \\ DP_3 \end{bmatrix}$$

If the design matrix is a diagonal matrix, it is an uncoupled design (UD). Because each DP can satisfy a corresponding FR, the uncoupled design perfectly satisfies the Independence Axiom.

When the design matrix is triangular, the design is a decoupled design (DD). A decoupled design satisfies the Independence Axiom if the design sequence is correct.

When a design matrix is neither diagonal nor triangular, the design becomes a coupled design (CD). In a coupled design, no sequences of DPs can satisfy the FRs independently. Therefore, an uncoupled or a decoupled design satisfies the Independence Axiom and a coupled design does not.

TABLE I. MATHEMATICAL AND GRAPHICAL REPRESENTATION OF UD, DD AND CD.

B. The Information Axiom

Among those designs that satisfy the Independence Axiom, the design that has the smallest information content is the best design (Suh NP, 1990). Violating Axiom 1 results in a coupled design, whereas, Violating Axiom 2 results in system complexity. It is also known as The Minimize Complexity Law.

Alternate Statement 1: The best design is a functionally uncoupled design that has minimum information content. The selection process is based on criterion, which states that the design resulting in the highest probability of FR success is the best design (Albano LD, Suh NP, 1992, 1993).

If the probability of success for a given FR is p, the information content is calculated by Equation 1:

$$I_i = \log_2 \frac{1}{p_i}$$

If there are more than one FR, the information content is as follow;

$$I_{system} = -\log_2 P_{(m)} \tag{1}$$

$$I_{system} = -\log_2 \left(\prod_{i=1}^{m} P_i \right)$$

$$I = \log \left(\frac{A_{sr}}{A_{cr}} \right) \tag{2}$$

Where 'ASR' is the Area under System Range, and 'ACR' is the Area under Common Range as illustrated in fig. 2:
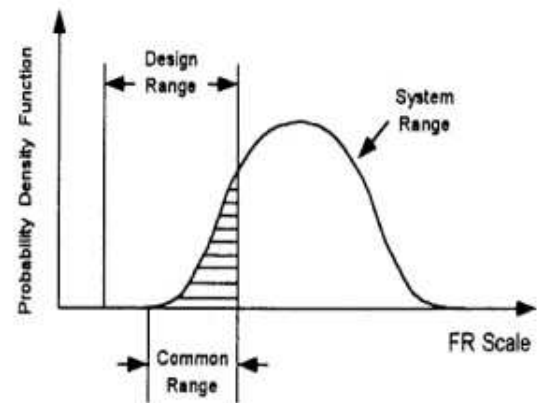
Fig. 2. Calculation of the Information Content using the Probability Density Function.

III. DESIGNING STEPS AND FLOW CHART

- Obtain complete list of Customer needs (CNs)
- Translate into functional requirements (FRs)
- Perform project learning on key technologies
- Match design parameters (DPs) with FRs
- Maximize independence between DPs
- Convert DPs to Process Variables (PVs) (via experiments, drawings, purchased parts and manufacturing plans)
- Decompose FRs, DPs and PVs by zigzagging

Fig. 3. chart of the application of Axiomatic Design
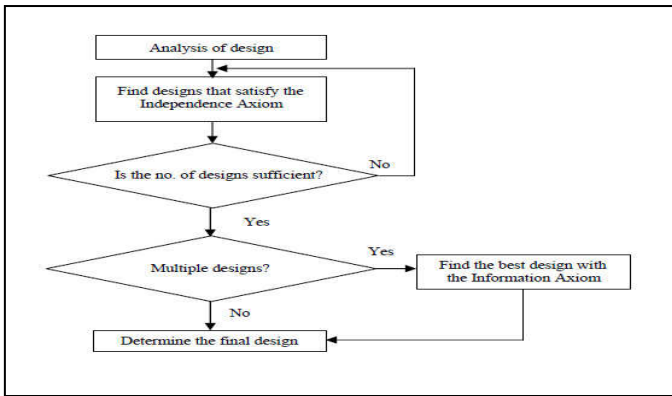
IV. COROLLARIES AND THEOREMS
[2,10,12,16,19,21,22,23,24,25,26,28]

A. Corollary 1 [Decoupling of Coupled Designs]

Decouple or separate parts or aspects of a solution if FRs are coupled or become independent in the designs proposed.

B. Corollary 2 [Minimization of FRs]

Minimize the number of FRs and constraints.

C. Corollary 3 [Integration of Physical Parts]

Integrate design features in a single physical part if FRs can be independently satisfied in the proposed solution
.

D. Corollary 4 [Use of Standardization]

Use standardized or interchangeable parts if the use of these parts is consistent with FRs and constraints.

E. Corollary 5 [Use of Symmetry]

Use symmetrical shapes and/or components if they are consistent with FRs and constraints.

F. Corollary 6 [Largest Design Ranges]

Specify the largest allowable design range in stating FRs.

G. Corollary 7 [Uncoupled Design with Less Information]

Seek an uncoupled design that requires less information than coupled designs in satisfying a set of FRs.

H. Corollary 8 [Effective Reangularity of a Scalar]

The effective reangularity R for a scalar coupling "matrix" or element is unity.

1) Theorem 1 [Coupling Due to an Insufficient Number of DPs]

When the number of DPs is less than the number of FRs, either a coupled design results or the FRs cannot be satisfied.

2) Theorem 2 [Decoupling of a Coupled Design]

When a design is coupled because of a larger number of FRs than DPs (i.e., m>n), it may be decoupled by the addition of new DPs so as to make the number of FRs and DPs equal to each other if a subset of the design matrix containing $n \times n$ elements constitutes a triangular matrix.

3) Theorem 3 [Redundant Design]

When there are more DPs than FRs, the design is either a redundant design or a coupled design.

4) Theorem 4 [Ideal Design]

In an ideal design, the number of DPs is equal to the number of FRs and the FRs are always maintained independently of each other.

5) Theorem 5 [Need for a New Design]

When a given set of FRs is changed by the addition of a new FR, by substitution of one of the FRs with a new one, or by selection of a completely different set of FRs, the design solution given by the original DPs cannot satisfy the new set of FRs. Consequently, a new design solution must be sought.

6) Theorem 6 [Path Independence of an Uncoupled Design]

The information content of an uncoupled design is independent of the sequence by which the DPs are changed to satisfy the given set of FRs.

7) Theorem 7 [Path Dependency of Coupled and Decoupled Design]

The information contents of coupled and decoupled designs depend on the sequence by which the DPs are changed to satisfy the given set of FRs.

8) Theorem 8 [Independence and Design Range]

A design is an uncoupled design when the designer-specified range is greater than

$$\sum_{\substack{j \neq i \\ j=1}}^{n} \left(\frac{\partial FR_i}{\partial DP_j} \right) \Delta DP_j$$

in which case the off-diagonal elements of the design matrix can be neglected from the design consideration.

9) Theorem 9 [Design for Manufacturability]

For a product to be manufacturable with reliability and robustness, the design matrix for the product **A** (which relates the **FR** vector for the product to the **DP** vector of the product), times the design matrix for the manufacturing process **B** (which relates the **DP** vector to the **PV** vector of the manufacturing process), must yield either a diagonal or a triangular matrix. Consequently, when either **A** or **B** represents a coupled design, the independence of FRs and robust design cannot be achieved. When they are full triangular matrices, either both of them must be upper triangular or both must be lower triangular for the manufacturing process to satisfy independence of functional requirements.

10) Theorem 10 [Modularity of Independence Measures]

Suppose that a design matrix **A** can be partitioned into square sub matrices that are nonzero only along the main

diagonal. Then the reangularity and semangularity for **A** are equal to the product of their corresponding measures for each of the nonzero sub matrices.

11) Theorem 11 [Invariance]

Reangularity and semangularity for a design matrix **A** are invariant under alternative orderings of the FR and DP variables, as long as the orderings preserve the association of each FR with its corresponding DP.

12) Theorem 12 [Sum of Information]

The sum of information for a set of events is also information, if proper conditional probabilities are used when the events are not statistically independent.

13) Theorem 13 [Information Content of the Total System]

If each DP is probabilistically independent of other DPs, the information content of the total system is the sum of the information of all individual events associated with the set of FRs that must be satisfied.

14) Theorem 14 [Information Content of Coupled Versus Uncoupled Designs]

When the state of FRs is changed from one state to another in the functional domain, the information required for the change is greater for a coupled design than for an uncoupled design.

15) Theorem 15 [Design–Manufacturing Interface]

When the manufacturing system compromises the independence of the FRs of the product, either the design of the product must be modified or a new manufacturing process must be designed and/or used to maintain the independence of the FRs of the products.

16) Theorem 16 [Equality of Information Content]

All information contents that are relevant to the design task are equally important regardless of their physical origin, and no weighting factor should be applied to them.

17) Theorem 17 [Design in the Absence of Complete Information]

Design can proceed even in the absence of complete information only in the case of a decoupled design if the missing information is related to the off-diagonal elements.

18) Theorem 18 [Existence of an Uncoupled or Decoupled Design]

There always exists an uncoupled or decoupled design that has less information than a coupled design.

19) Theorem 19 [Robustness of Design]

An uncoupled design and a decoupled design are more robust than a coupled design in the sense that it is easier to reduce the information content of designs that satisfy the Independence Axiom.

20) Theorem 20 [Design Range and Coupling]

If the design ranges of uncoupled or decoupled designs are tightened, they may become coupled designs. Conversely, if the design ranges of some coupled designs are relaxed, the designs may become either uncoupled or decoupled.

21) Theorem 21 [Robust Design when the System Has a Non-uniform pdf]

If the probability distribution function (pdf) of the FR in the design range is non-uniform, the probability of success is equal to one when the system range is inside the design range.

22) Theorem 22 [Comparative Robustness of a Decoupled Design]

Given the maximum design ranges for a given set of FRs, decoupled designs cannot be as robust as uncoupled designs in that the allowable tolerances for DPs of a decoupled design are less than those of an uncoupled design.

23) Theorem 23 [Decreasing Robustness of a Decoupled Design]

The allowable tolerance and thus the robustness of a decoupled design with a full triangular matrix diminish with an increase in the number of functional requirements.

24) Theorem 24 [Optimum Scheduling]

Before a schedule for robot motion or factory scheduling can be optimized, the design of the tasks must be made to satisfy the Independence Axiom by adding decouplers to eliminate coupling. The decouplers may be in the form of a queue or of separate hardware or buffer.

25) *Theorem 25 ["Push" System vs. "Pull" System]*

When identical parts are processed through a system, a "push" system can be designed with the use of decouplers to maximize productivity, whereas when irregular parts requiring different operations are processed, a "pull" system is the most effective.

26) Theorem 26 [Conversion of a System with Infinite Time-Dependent Combinatorial Complexity to a System with Periodic Complexity]

Uncertainty associated with a design (or a system) can be reduced significantly by changing the design from one of serial combinatorial complexity to one of periodic complexity.

V. CONCLUSIONS AND DISCUSSIONS

The field of AD is a broad one that transcends specific engineering fields and encompasses such areas as management and business. The basic concept of AD theory is presented as a scientific base. The basic concepts and methodologies of AD include the concepts of domains, mapping, the two design axioms, decomposition, hierarchy, and zigzagging. Several key terms, such as functional requirement (FR), design parameter (DP), and process variable (PV) are defined. The acceptance of these definitions is a pre-requisite in applying the axiomatic

principles for design. Mapping between the domains generates design equations and design matrices. The design equation models the relationship between the design objectives (what the design is trying to achieve) and the design features (how the design goals are to be satisfied).Uncoupled and decoupled designs are shown to satisfy the Independence Axiom and thus are acceptable. Coupled designs do not satisfy Independence Axiom and thus are unacceptable. The Independence Axiom states that the functional requirements must be maintained independent of one another by choosing appropriate design parameters. The Information Axiom deals with information content, the probability of satisfying the FRs, and complexity. To be able to satisfy the functional requirements, the designer must always think in terms of FRs before any solution is sought. Robust design is a design that satisfies the functional requirements easily, although large tolerances are given to DPs and PVs. The various Corollaries and Theorems governing AD are explained.

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A Review on Futuristic Scope of Renewable Energy in SSI's

(Comparison of Solar Thermal & PV Cell application in Small Scale Industry in place of Conventional type Energy Sources)

Amandeep Singh Virdi
Dept. of Mechanical
Engineering,
C.T Group of Institutions,
Jalandhar, India
asvirdi@ymail.com

Sumit Nijjar
Dept. of Mechanical
Engineering
Lovely Professional
University, Phagwara City,
India
sumit.nijjar@gmail.com

Mohit Handa
Dept. of Automobile
Engineering,
C.T Group of Institutions,
Jalandhar, India
mohit.handa89@gmail.com

Satbir Singh Saini
Dept. of Mechanical
Engineering,
C.T Group of Institutions,
Jalandhar, India

Abstract-This paper is review of Technologies which can be implemented in future to save energy, it gives a brief introduction about the fast developing solar technologies, but also how it may help us avoid long term switching cost in the industry. Most of the power generated nowadays is produced using fossil fuels, which emit tons of carbon dioxide and other pollution every second. More importantly, fossil fuel will eventually run out. The solar energy industry is one of the fastest growing forces in the market, which can also be used in industries as well.

Nowadays there are several major directions for solar technology development. Photovoltaic systems directly convert the solar energy into electrical energy while concentrated solar power systems first convert the solar energy into thermal energy and then further convert it into electrical energy through a thermal engine.

In order to choose the right solar system for a specific geographic location, we want to understand and compare the basic and general operation & functions of several solar technologies that are widely studied.

Keywords— SPV-Solar Photo Voltaic, CSP-Concentrated Solar Power, EAI- Energy Alternatives India, CIGS- Copper Induim Gallium Selenide, CdTe- Cadmium Telluride, LED-Light Emiting Diodes, A-SSc- Amorphous Silicon Solar Cells.

I. INTRODUCTION

Our sun produces 400,000,000,000,000,000,000,000,000 watts of energy every second and the belief is that it will last for another 5 billion years. Solar energy is genesis for all forms of energy. This energy can be made use of in two ways the Thermal route i.e. using heat for drying, heating, cooking or generation of electricity or through the Photovoltaic route which converts solar energy in to electricity that can be used for a myriad purposes such as lighting, pumping and generation of electricity. With its pollution free nature, virtually inexhaustible supply and global distribution- solar energy is very attractive energy resource.

The sun is the most plentiful energy source for the earth. All wind, fossil fuel, hydro and biomass energy have their origins in sunlight. Solar energy falls on the surface of the earth at a rate of 120 petawatts, (1 petawatt = 1015 watt). This means all the solar energy received from the sun in one days can satisfied the whole world's demand for more than 20 years.

We are able to calculate the potential for each renewable energy source based on today's technology. Future advances in technology will lead to higher potential for each energy source. However, the worldwide demand for energy is expected to keep increasing at 5 percent each year. Solar energy is the only choice that can satisfy such a huge and steadily increasing demand.

II. EASE OF USE

Over 70% of India's households experience significant power cuts every year. That equates to about 14 Cr households that suffer from darkness at least partially. Of this, about 5 Cr households do not have power most or all the time.

Off grid solar power is a much needed solution for this massive market. With costs of solar coming down to near-affordable levels, EAI estimates the potential for the off grid solar in India to be upwards of Rs 3500 Cr per year. Interestingly, this market has few branded players having robust sales channels, making it an attractive niche for entrepreneurs and businesses.

A. Solar for grid connected electricity:

Grid interactive solar energy is derived from solar photovoltaic cells and CSP Plants on a large scale. The grid connection is chosen due to following reasons:

- Solar Energy is available throughout the day which is the peak load demand time

- Solar energy conversion equipments have longer life and need lesser maintenance and hence provide higher energy infrastructure security

- Low running costs & grid tie-up capital returns (Net Metering)

- Unlike conventional thermal power generation from coal, they do not cause pollution and generate clean power

- Abundance of free solar energy throughout all parts of world (although gradually decreasing from equatorial, tropical, sub-tropical and polar regions). Can be utilized almost everywhere

B. Solar for Off-Grids Solutions

While, the areas with easier grid access are utilizing grid connectivity, the places where utility power is scant or too expensive to bring, have no choice but to opt for their own generation. They generate power from a diverse range of small local generators using both fossil fuels (diesel, gas) and locally available renewable energy technologies (solar PV, wind, small hydro, biomass, etc.) with or without its own storage (batteries). This is known as off-grid electricity. Remote power systems are installed for the following reasons:

- Desire to use renewable - environmentally safe, pollution free

- Combining various generating options available- hybrid power generation

- Desire for independence from the unreliable, fault prone and interrupted grid connection

- Available storage and back-up options

- No overhead wires- no transmission loss

- Varied applications and products: Lighting, Communication Systems, Cooking, Heating, Pumping, Small scale industry utilization etc.

Captive power generation is done mainly considering the replacement of diesel with solar.

III. BASIC TECHNIQUES FOR UTILISING SOLAR ENERGY

Both photovoltaic and solar thermal are the two established solar power technologies. Photovoltaic use semi-conductor technology to directly convert sunlight into electricity. Photovoltaic, therefore, only operate when the sun is shining, and must be coupled either with other power generation mechanisms to ensure a constant supply of electricity. The most common semiconductor materials are mono crystalline silicon, polycrystalline silicon, amorphous silicon, and cadmium telluride and copper indium sulphide. Solar thermal works by using mirrors to concentrate sunlight.

The concentrated sunlight is then used either directly as a source of heat, as in solar water heating, or to drive a heat cycle such as a sterling engine. Additionally, since solar thermal only directly produces heat, it can store thermal energy various mediums. Some plants, in fact, can store enough energy for 7.5 hours of generation in lieu of sunlight. Therefore, solar thermal can potentially generate power 24 hours a day.

A. Solar Photovoltaic

Solar photovoltaic (SPV) cells convert solar radiation (sunlight) into electricity. A solar cell is a semi-conducting device made of silicon and/or other materials, which, when exposed to sunlight, generates electricity. Solar cells are connected in series and parallel combinations to form modules that provide the required power

- Crystalline Silicon solar cells (C-Si): Mono-crystalline and Polycrystalline

- Thin-film solar cells: A-Si, CIGS, CdTe

PV modules are manufactured by assembling the solar cells after stringing, tabbing and providing other interconnections.

Fig. 1.

B. Solar Thermal

Solar Thermal Power systems, also known as Concentrating Solar Power systems, use concentrated solar radiation as a high temperature energy source to produce electricity using thermal route. High temperature solar energy collectors are basically of three types:

Fig. 2.

- Parabolic trough system: at the receiver can reach 400° C and produce steam for generating electricity.

- **Power tower system:** The reflected rays of the sun are always aimed at the receiver, where temperatures well above 1000° C can be reached.
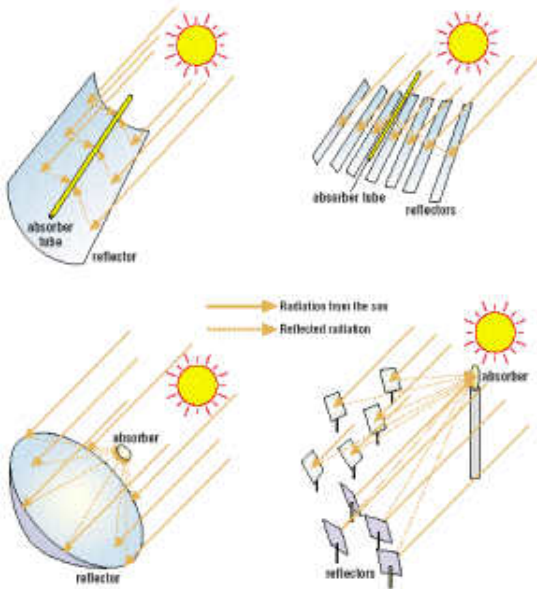
Fig. 3.

- **Parabolic dish systems:** Parabolic dish systems can reach 1000° C at the receiver, and achieve the highest efficiencies for converting solar energy to electricity.

IV. UNIQUE PROPOSITION OF INDIA

- **Economic Value:** The generation of solar electricity coincides with the normal peak demand during daylight hours in most places, thus mitigating peak energy costs, brings total energy bills down, and obviates the need to build as much additional generation and transmission capacity as would be the case without PV.

- **Geographical Location:** India being a tropical country receives adequate solar radiation for 300 days, amounting to 3,000 hours of sunshine equivalent to over 5,000 trillion kWh. Almost all the regions receive 4-7 kWh of solar radiation per sq meters with about 2,300–3,200 sunshine hours/year, depending upon the location. Potential areas for setting up solar power plant can be analyzed using Solar irradiation map of India. Our State wise analysis of Solar resource, Business Opportunities and Latest trends in

- **Power Shortage:** Electricity losses in India during transmission and distribution have been extremely high over the years and this reached a worst proportion of about 24.7% during 2010-11. India is in a pressing need to tide over a peak power shortfall of 13% by reducing losses due to theft. Theft of electricity, common in most parts of urban India, amounts to 1.5% of India's GDP. Due to shortage of electricity, power cuts are common throughout India and this has adversely affected the country's economic growth.

V. CURRENT PROJECTS (INCLUDES BOTH-INSTALLED AND UNDER INSTALLATION PROJECTS)

S.No	State	Photovoltaic Capacity (MW)	Solar Thermal Capacity (MW)
1.	Rajasthan	43	400
2.	Gujarat	722	45
3.	Maharashtra	133	-
4.	Karnataka	10	-
5.	Andhra Pradesh	20.5	-
6.	Uttarakhand	4	-
7.	Punjab	5	-
8.	Haryana	7.8	-
9.	Uttar Pradesh	11	-
10.	Jharkhand	16	-
11.	Chhattisgarh	4	-
12.	Madhya Pradesh	7.25	-
13.	Odisha	11	-
14.	Tamil Nadu	12	-
TOTAL		**1006.55**	**445**

Gujarat, Punjab, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Uttar Pradesh, West Bengal, Andhra Pradesh

A. Solar Comparison

Both photovoltaic and solar thermal are the two established solar power technologies. Photovoltaic use semi-conductor technology to directly convert sunlight into electricity. Photovoltaic, therefore, only operate when the sun is shining, and must be coupled either with other power generation mechanisms to ensure a constant supply of electricity.

Solar thermal works by using mirrors to concentrate sunlight. The concentrated sunlight is then used either directly as a source of heat, as in solar water heating, or to drive a heat cycle such as a sterling engine. Additionally, since solar thermal only directly produces heat, it can store thermal energy various mediums. Some plants, in fact, can store enough energy for 7.5 hours of generation in lieu of sunlight. Therefore, solar thermal can potentially generate power 24 hours a day.

There is a long history of utility scale solar thermal generation. Plants were built in the American Southwest throughout the last 30 years. As of 2004 there is 418 MW of installed solar thermal power capacity installed in the US. All told, solar thermal energy costs between 19-35 cents per KWh. Photovoltaic are a popular energy source both on the utilities side and for residential home use. Photovoltaic

capacity has blown past solar thermal power generation capacity. As of 2008, there was 800 MW of grid-connected photovoltaic capacity, or nearly double the amount of solar thermal generation capacity. Cost per watt for this technology is currently 18-43 cents per KWh.

B. *Basic Applications in SSI's*

1. Water heating solar thermal system

The average cost of a typical home PV system may twice as much as a home solar thermal system. However, the PV system enables a saving of two times more than with the solar system. The decision of which system best suits is dependent of the incentives. There is a range of federal and local incentives in each country, which should be checked before a decision is made. In some countries, such as in the UK, incentives may be of as much as £300 (around USD 480) for the installation of solar thermal panels.(Source: Department of Energy & Climate Change, UK)

Fig. 4.

2. Light Application

Solar driven LEDs lights epitomize the advantages offered by solar technology for domestic, respectively public scale standard applications

Fig. 5.

Advantages: Low-cost installation. No trenching, no heavy cable, quick and easy installation anywhere have lights in days not months. Ultra-low maintenance and long product life. Long warranty on solar panels, LED/Induction lighting

fixture. Green light source. 40-70% less power consumption than traditional light sources. LED/Induction lights emit no light pollution, provides bright white light which improves colour recognition and improves night visibility from 400%-1000% over traditional light sources.

Flexible configuration. Solar lights can be easily configured to suite your requirements with solar module, wind module and battery of various sizes. 3-5 days backup power for rainy, cloudy days.

VI.   CONCLUSIONS

Currently, there is not much difference between photovoltaic and solar thermal energy. Photovoltaic may become more affordable as more photovoltaic move to utility scale installations. Solar thermal power, however, still has the advantage that it can store power and further used in many basic applications in industry which can further reduce the billing cost of electricity.

Another challenge for solar thermal is the amount of space required for efficient production of energy. Not only space, but space that gets a consistent amount of direct sunlight. Solar thermal power plants typically require 1/4 to 1 square mile or more of land.

One silver lining of global climate change and human impact on the land is that more and more farmland is becoming unsuitable for agricultural production. This land presumably originally chosen for its sun exposure, begs to be used for solar thermal energy production. Utilization of desertification can prove to be a boon for solar thermal real estate procurement and growth.

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Variation in the Mechanical Properties with Different Austempering Temperatures of SGI - Alloy

Manjinder Bajwa
Dept. of Mechanical Engineering
Lovely Professional University
Jalandhar, Punjab
Manjinder.14739@lpu.co.in

Pravinraj.EL
Dept. of Mechanical Engineering
Lovely Professional University
Jalandhar, Punjab

Mahipal Singh
Dept. of Mechanical Engineering
Lovely Professional University
Jalandhar, Punjab

Abstract- In this research work, the variation in the mechanical properties with different austempering temperatures was investigated. The SGI alloy was used, known for its good tensile strength but have the low elongation property. The mechanical properties studied were tensile strength, hardness and elongation. The different austempering temperatures of 250^0 and 300^0 C for the quenching time period of 30 minutes were considered. The result showed that the tensile strength and hardness has more value at austempering temperature 250^0 C but the values for elongation were increased at 300^0 C.

Keywords: Spheroidal Cast Iron (SGI); Austempering Temperatur;, Tensile Strength; Hardness; Elongation.

I. INTRODUCTION

The casting is simple and cheapest production method. The cast iron demote to family of ferrous alloy composed of iron, carbon and silicon (up to 3.5%) and also different alloy compositions. Cast iron is usually differing according to their solidification and by their structure ferrite, pearlite, quenched and tempered or austempered (1). Ductile cast iron is widely used alloy due to its properties. It is called spheroidal cast iron or nodular cast iron because the free graphite this metal is in the form of tiny balls (spheroids or nodules) rather than the flakes as present in grey cast iron. The spheroidal cast iron has good tensile and elongation properties. The mechanical property of SGI diverges corresponding to different percentage of alloy addition. The mechanical properties of ductile iron are differing from 350/22 (tensile strength / percentage of elongation) to 900/2 with respect to different alloys presents in molten metal. The percentage of Silicon (Si) affects the impact strength and promote strengthen ferrite in SGI. Manganese (Mn), and Copper (Cu) are pearlite promoters and improves yield strength and hardness. Nickel (Ni) helps in increasing the U.T.S without affecting the impact values. Molybdenum (Mo) is a mild pearlite promoter and increases proof stress and hardness. Magnesium (Mg) works as the modifier in the matrix and nodularizes the graphite so as to increases the ductility and yield strength (2).

Many engineering material can be characterized not by a single set of properties but by an entire spectrum of possibilities that can be selected and varied at will. Heat treatment is the term used to describe the controlled heating and cooling of material for the purpose of altering their structure and properties. The same material can be made weak and ductile for ease in manufacture, and then retreated to provide high strength and good fracture resistance for use and application. Because both physical and mechanical properties (such as strength, toughness, machinability, wear resistance, and corrosion resistance) can be altered by heat treatment and these changes can be induced with no concurrent change in product shape, heat treatment is one of most important and widely used manufacturing process(3). Austempering is a kind of tempering process which consists of holding the iron in a molten salt bath having temperature of 250° to 500° C above the critical temperature when the structure consists purely of austenite. Then it is held at the quenching temperature for a sufficient time to give complete transformation to an intermediate structure referred as bainite followed by a cooling to room temperature. (4).

II. LITERATURE REVIEW

From past few decades, it is found that research on mechanical properties of ductile iron have been carried by many researchers but still a lot of work needs to complete the effect of pearlite structure on mechanical properties of spheroidal cast iron. R.A.Gonzaga et.al, studied the comparison of different pearlite content in pieces with similar shape and dimensions and to analyse the variation of mechanical properties as pearlite content increase. It was concluded that ferrite – pearlite microstructure was obtained without using heat treatment. And also if pearlite formation alloying element are carefully added, a mixture microstructure of ferrite and pearlite or a full pearlite microstructure with good mechanical properties could be obtain (5). Prof. P. M. Ingole et.al, investigated about effect of chemical composition in SGI. It was found that basic alloying element such as C, Si, Mn, Mg, Co etc. plays an important role in SGI casting process. In ductile iron (SGI) these elements plays a different mechanical and chemical properties (6). Carmen Dumitru et.al concluded from their research work that austempered heat treatment process to a temperature situated in austenitic domain, right away after ending of austeninte holding time is an austempered structure finishing factor. Ausforming by pressing in time of heat treatment had a positive effect on austempered ductile irons hardness only for ausforming grade between 20-30% (7). Amar Kumar Das et.al, had found the variation of mechanical properties of austempered ductile iron with the effect of copper along with the process variables on the properties and

microstructure of ductile iron. Austempering ductile iron with copper was showing some higher and lower elongation than the austempered ductile iron without copper. In microstructure ferrite was increasing with increasing austempering time and austenite was increasing with increasing austempered temperature in both the grades (8).

III. EXPERIMENTAL PROCEDURE

A. Chemical Composition:

To attain the required mechanical properties, the chemical composition of the sample was varied. The chemical compositions of the sample used are shown in TableI.

TABLE I.   CHEMICAL COMPOSITION OF SPECIMEN

Alloys	C	Si	Mn	S	P	Mg	Cu
%	3.6	2.7	0.2	0.018	0.03	0.04	0.1

B. Preparation of the specimen:

The casted specimens were austenite at two different temperatures (at 900 and 950°C respectively) in muffle furnace for 2 hours. Then the samples were kept in to muffle furnace only to reduce the temperature up to 600°C by annealing process. Once the temperature reach 600°C the samples were transferred to the salt bath (combination of salt water is 50% $NaNO_3$ and KNO_3) at two different 250°, 300°C temperature for 30 minutes. The Salt water temperature monitor by digital temperature meter. At last, the samples were allowed to cool in still air up to room temperature.

After this operation samples were moved to machine shop. In machine shop, the turning operation was done on the samples as per the international ductile iron testing specimen. Tensile test bar dimensions are given in Figure 1.
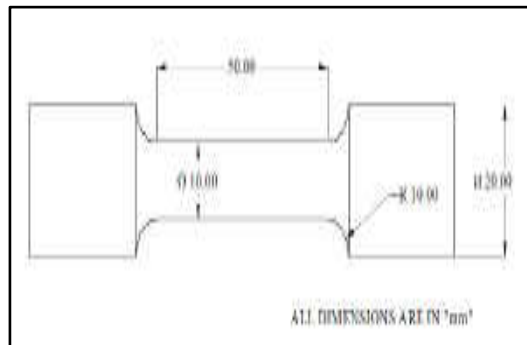
Fig. 1.   Tensile test bar dimension

C. Specimen Testing:

Using a vernier caliper the thickness and the total length of the specimen was measured. The diameter of the specimen and the gauge length which was fixed at 50mm was fed to the testing machine. The distance between the jaws was fixed according to the gauge length of the specimen. The specimen was gripped by the jaws and axial load was applied to it. The broken parts of the specimen are taken and joined together and the length of the specimen was measured.

$$Elongation = \frac{final\ length - initial\ length}{initial\ length} X\ 100$$

The elongation of the specimen was measured and the % elongation calculated by above calculation. The broken specimen after the testing is shown in Figure 2.

Fig. 2.   Specimen after testing

The hardness of the specimen as received as well as that of the entire ADI specimen was measured using Rockwell Hardness tester. Hardness was measured in Rockwell B scale. The Rockwell B scale utilizes a ball indenter and a major load of 50 kg. The hardness testing specimen measuring face was polished with a grinding machine. The measuring face of the specimen which remains in contact with the specimen holder should be parallel to the surface of the holder. Now, a holder lift to the ball indenter until the reading on the display is zero. After that, load of 50 kg is applied on the specimen by lever. After given load should be wait for 30 sec. time measured by stop watch. After 30 sec the lever was released and noted the hardness value. For every specimen, hardness value was found out on three different places and the average value was taken as the hardness of the specimen. The hardness measuring location located on Figure 2.

IV. RESULT AND DISCUSSION

The result of all specimens before and after austempering process tested in laboratory are given below in Table II and III.

TABLE II. VALUES OF SPECIMENS BEFORE AUSTEMPERING PROCESS

Tensile strength (MPa)	Elongation (%)	Hardness (HRB)
567	4.5	48

TABLE III.   RESULT OF SPECIMENS AFTER AUSTEMPERING PROCESS

Austenite temperature (°C)	Austempering temperature (°C)	Tensile strength (MPa)	Elongation (%)	Hardness (HRB)
900	250	951	7	64
	300	922	7.6	61
950	250	943	6.9	62
	300	910	7.3	59
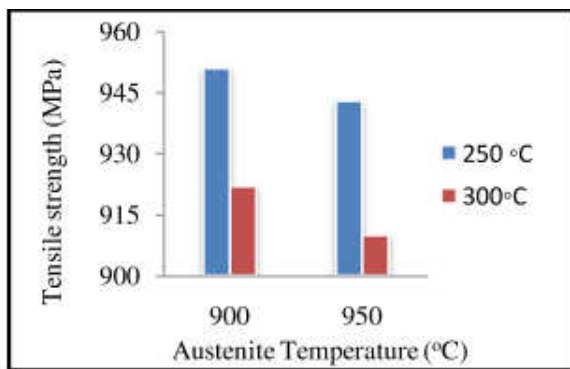
Fig. 3.   Tensile strength with respect to different austenite and austempering temperature
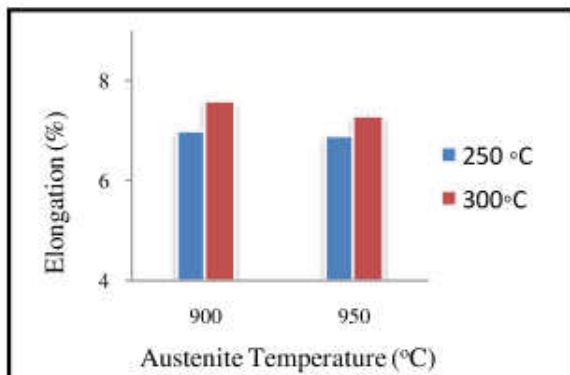
Fig. 4.   Elongation with respect to different austenite and austempering temperature
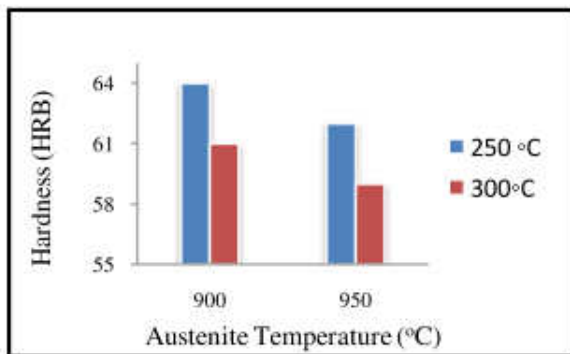
Fig. 5.   Hardness with respect to different austenite and austempering temperature

The figure 3, 4 and 5 shows the variation of tensile strength, elongation and hardness with different austenite and austempering temperature. It is seen that the tensile strength and hardness reduced with increase of the austempering temperature. Because when specimen temperature reduces from muffle furnace temperature $600^{\circ}C$ to salt bath temperature 250^{0} and $300^{\circ}C$, the quenching happened with two different time period. At $300^{\circ}C$ temperature is having low quenching rate than $250^{\circ}C$ temperature so the material get harden immediately. Whereas in case of elongation, it increases with an increment of austempering temperature. Because we kept the specimen in

furnace $900^{\circ}C$ and $950^{\circ}C$ to coolupto $600^{\circ}C$ for annealing. For that annealing process the time taken is more at $950^{\circ}C$, so the material gets soft at high austenite temperature.

V.   CONCLUSION

From this research work it is concluded that when the specimens were examined for austempering temperatures 250^{0} and 300^{0} C respectively under constant time period (30minutes), the tensile strength and hardness has a more values at 250^{0} C whereas the elongation property is more at 300^{0} C.

VI.   FUTURE WORK

Further research can be done with different chemical composition and different austempering temperature (i.e., $350^{\circ}C$ and $400^{\circ}C$) and with different time period (i.e., 45 min and 60 min).

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Friction Stir Welding: Tool Material and Geometry

Chandrashekar.A

Department of Mechanical Engineering

Bangalore Institute of Technology, Bangalore, India

Email-acsmech@gmail.com

B.S Ajaykumar

Department of Mechanical Engineering

Bangalore Institute of Technology, Bangalore, India

Email-ajaykumarmanju@gmail.com

H.N Reddappa

Department of Mechanical Engineering

Bangalore Institute of Technology, Bangalore

Email-reddyhn@gmail.com

Abstract-The friction stir welding is a dynamically developing version of pressure welding processes. High-quality weld can be created by this process. The mixing the material flow conditions specifically affect the quality of the weld, so the tool geometry is very important. Tool design and selection of process variables are critical issues in the usage of FSW process. The development of cost effective and durable tools, which lead to structurally sound welds, is still awaited. Material selection and design intensely affect the performance of the tools. Here we review several important aspects of FSW tools such as tool material selection, its importance, geometry and load bearing ability, mechanisms of tool degradation and process economics for applications in this article.

Keywords: Friction stir welding; Tool material;Toolgeometry;speed.

I. INTRODUCTION

Friction stir welding is a solid state joining process using a rotating tool moving alongthe joint interface, generating heat and resulting in a re-circulating plasticized material flow near the tool surface. This plasticized material is subjected to extrusion by the tool probe rotational and linear movements leading to the formation of stir zone. This stir zone formation is affected by the material flow behavior under the action of rotating tool [1]. It was developed in England by The Welding Institute (TWI) in 1991[2]. The friction stirring tool consists of a pin, or probe, and a shoulder. Contact of the pin with the workpiece creates frictional and deformational heating and softens the workpiece material; contacting the shoulder to the workpiece increases the workpiece heating, expands the zone of softened material, and constrains the deformed material. Figure 1 shows the most important tool parts and Process principle of friction stir welding. Naturally, there are important effects to the tool during welding: abrasive wear, high temperature and dynamic effects. Therefore, the good tool materials have the following properties: good wear resistance, high temperature strength, temper resistance, and good toughness. So there are two important aspects of friction stir welding tool design: tool material and geometry [2].Most important Challenges of Friction Stir Welding are application of high temperature materials, Tool material selection, Development of Tool Materials, Tool design and Complex geometries and dissimilar materials.
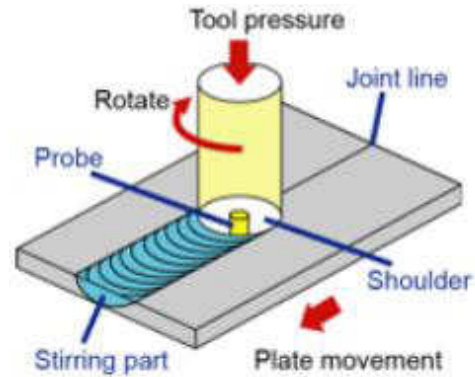
Fig. 1. Schematic drawing of friction stir welding

II. INFLUENCE OF TOOL MATERIAL AND GEOMETRY ON WELD QUALITY

The tool of FSW is composed of two parts: a tool body and a probe. The tool technology is the heart of friction stir welding process. The tool shape determines the heating, plastic flow and forging pattern of the plastic weld metal. The tool shape determines the weld size, welding speed and tool strength. The tool material determines the rate of friction heating, tool strength and working temperature, the latter ultimately determines which materials can be friction stir welded [8]. Two different tool pin geometries (square and hexagonal) and three different process variables, i.e. rotational speeds and welding speeds were selected for the experimental investigation of AA6101-T6 alloy. It was observed that square pin profile gave better weld quality than the other profile. Besides, the electrical conductivity of the material was maintained up to 95% of the base metal after welding [1].Arora et al [3] proposed and tested a criterion for the design of a tool shoulder diameter (considered three Shoulder diameters (mm) 15, 18, 21) based on the principle of maximum utilization of supplied torque for traction. The optimum tool shoulder diameter computed from this principle using a numerical heat transfer and material flow model resulted in best weld metal strength in independent tests and peak temperatures that are well within the commonly encountered range. The optimum shoulder diameter of 18 mm at 1200 rpm has resulted in superior tensile properties in independent tests. Elangovan and Balasubramanian[4] have also reported that the tool with an 18 mm shoulder diameter provided the best weld joint strength at a rotational speed of 1200 rpm, as shown in Table 1.

TABLE I. THE MECHANICAL PROPERTIES OF WELDS MADE USING A CYLINDRICAL PIN PROFILE [4]

Diameter(mm)	Yield strength(MPa)	Ultimate tensile strength (MPa)
15	110.5	131.7
18	130.3	161.7
21	94.0	120.0

TABLE II. WELDING TEMPERATURE RANGE OF VARIOUS ALLOYS [5]

Alloy Group	Temperature range, °C
Aluminium alloy	440 to 550
Magnesium alloys	250 to 350
Copper alloys	600 to 900
Carbon and low-alloy steels	650 to 800
Titanium alloys	700 to 950
Stainless steel	600 to 875

TABLE III. TOOL MATERIALS USED IN FSW FOR SOFT ALLOYS [5]

Tool Material	Work Piece Material
Mild steel	Magnesium alloy
High carbon steel	Magnesium alloy
Stainless steel	Magnesium alloy
Armour steel	Magnesium alloy
AISI Oil hardened Tool steel	Al matrix composite materials
AISI 4140	dissimilar materials
Tool Steel	Aluminium alloy, dissimilar materials
High speed steel	Magnesium alloy
SKD 61 Tool steel	dissimilar materials
H13 steel	Magnesium alloy
High Carbon high chromium Steel	Magnesium alloy, Al matrix composite materials, dissimilar materials

Materials such as aluminium or magnesium alloys, and aluminium matrix composites (AMCs) are commonly welded using steel tools. Steel tools have also been used for the joining of dissimilar materials in both lap and butt configurations. Tool wear during welding of metal matrix composites is greater when compared with welding of soft alloys due to the presence of hard, abrasive phases in the composites. Total wear was found to increase with rotational speed and decrease at lower traverse speed, which suggests that process parameters can be adjusted to increase tool life [5]. LakshmanRao et al [6] highlight the role of tool geometry in their investigation, because tool geometry plays a major role in FSW. Proper selection of a tool material and shape of the pin reduces number of trials and tooling cost. In addition this study also highlights the wear effect due to

friction between sliding surfaces. The effect of Friction Stir Welding process parameters on the mechanical properties of the AA 2014-T6 alloy joints produced by friction stir welding have been discussed by Vagh and Pandya [7]. Effects of tool design, tool rotation speed & tool travels speed on mechanical properties have been analysed using Taguchi orthogonal array design of experiments technique. There are three different tool rotation speeds (1000, 1400 & 2000 rpm) and three different tool traverse speeds (14, 20, 28 mm/min). For each combination of tool rotation speeds and tool traverse speeds three different types of tool pin profiles (threaded cylindrical pin, Stepped pin and Threaded cone pin) have been used. The study indicates that Tool design is the main process parameter that has the highest statistical influence on mechanical properties.
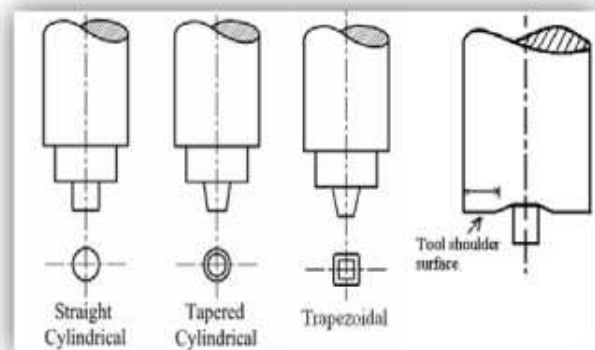
Fig. 2. Different FSW tool geometries used in the experiment [8]

Prasanna et al [9] studied the effect of four different tool pin profiles on mechanical properties of AA 6061 aluminum alloy. Four different profiles have been used to fabricate the butt joints by keeping constant process parameters of tool rotational speed 1200rpm, welding speed 14mm/min and an axial force 7kN. Different heat treatment methods like annealing, normalizing and quenching have been applied on the joints and evaluation of the mechanical properties like tensile strength, percentage of elongation, hardness and microstructure in the friction stirring formation zone are evaluated. Of the four tool profiles, the maximum tensile strength and % of elongation of 210 MPa and 20.9 respectively was observed on Hexagonal pin profile tool with annealing process. The tensile strength and percent of elongation of the hexagonal tool profile with annealing process has reached about 90% and 80% respectively of the parent metal. Lee et al[10] welded Al–Mg alloy with low carbon steel in lap joint configuration using tool steel as tool material without its excessive wear by placing the softer Al–Mg alloy on top of the steel plate and avoiding direct contact of the tool with the steel plate. Tungsten based alloys have also been used for the welding of both low and high melting point alloys [11].For example, Edwards and Ramulu [12] used a W–La alloy tool to study FSW of Ti–6Al–4V alloy. Tools made of a tungsten alloy Densimet (composition not reported) were used by Yadava et al [13] to weld AA 6111-T4 aluminium alloy.

TABLE IV.   PROPERTIES OF COMMON TOOL MATERIALS [11]

	Coefficient of thermal expansion/10-6 K-1	Thermal conductivity/ W m-1 K-1	Yield strength/MPa	Hardness/HV	Remarks
pcBN	4.6–4.9 [14]	100–250 [14]		2600–3500	Pros: high hardness; high temperature strength; Cons: susceptible to crack; wear may be enhanced by chemical reactions with Ti; high cost
cp-W	~4.6 at 20–1000C [17]	167 at 20uC [17] 111 at 1000C	~100 at 1000C [15]	360–500 [17]	Pros: high temperature strength; Cons: low toughness at room temperature; less strong than W alloys, WC, or pcBN
W–25 wt-%Re		55–65 [15]	~500–800 at 1000C [15]		Pros: higher strength than W; tougher and easier to machine than ceramics
WC	4.9–5.1[14]	95 [14]		1300–1600 [14]	Pros: high temperature strength; high hardness; Cons: wear due to oxidation at high temperatures; addition of Cr3C2 prevents oxidation
TiC	8.31 [18]	5–31 [18]	20 000 [18]	2800–3400 [18]	Pros: high hardness; high temperature strength; Cons: susceptible to crack
4340 Steel	11.2–14.3 [14]	48[14]		280 [14]	Pros: low thermal conductivity; Cons: high temperature strength is not very high; possible alloying with Ti
Si3N4	3.9 at 20C 6.7 at 1000C [20]	20–70 [19]		1580	Pros: high hardness; high temperature strength; Cons: susceptible to crack; decomposes at high temperatures

A. Tool geometry

Tool geometry affects the heat generation rate, traverse force, torque and the thermo-mechanical environment experienced by the tool. The flow of plasticised material in the workpiece is affected by the tool geometry as well as the linear and rotational motion of the tool. Important factors are shoulder diameter, shoulder surface angle, pin geometry including its shape and size, and the nature of tool surfaces [11]. It was also observed from the previous data that the friction stir weld tool geometry has a significant effect on the weldment reinforcement, microhardness, and weld strength.

B. Shoulder diameter

In order to determine the optimum tool geometry, thetwo components of the torque are plotted inFigure 4 forvarious shoulder diameters. As the shoulder diameter increases, the sticking torque, MT, increases, reaches amaximum and then decreases[3]. This behavior, which shows that two main factors affect the value of the sticking torque. First, thestrength of the material, τ decreases with increasing temperature due to an increase in the shoulder diameter.Second, the area over which the torque is applied increases with shoulder diameter. As a result, the productof these two components shows the trend indicated inthe figure. The sliding torque, ML, increases continuously with increasing shoulder diameter due to the largercontact area. With the increase in shoulder diameter thetotal torque increases continuously even when the sticking torque decreases for large shoulder diameters.
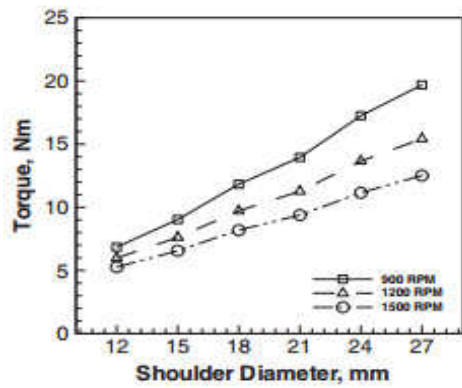
Fig. 3.   Total torque required during FSW of AA6061 as a function of the tool shoulder diameter for rotational speeds of 900,1200 &1500rpm[3]
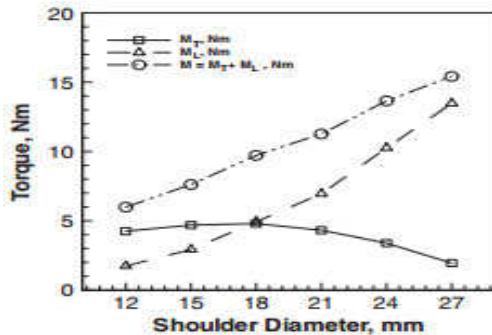
Fig. 4.   The computed values of sticking, sliding and total torque for various shoulder diameters at 1200rpm[3]

C. Pin (probe) geometry

Friction stirring pins produce deformational and frictional heating to the joint surfaces. The pin is designed to disrupt the faying, or contacting surfaces of the workpiece, shear material in front of the tool, and move material behind the tool. In addition, the depth of deformation and tool travel speed are governed by the pin design [2].

D. Tool cost

While the energy cost for the FSW of aluminium alloys is significantly lower than that for the fusion welding processes [24]the process is not cost effective for the FSW of hard alloys. Tools made of pcBN are often used for the welding of hard materials. However, pcBN is expensive due to high temperatures and pressures required in its manufacture [11]. Santella et al[21] did an approximate cost benefit analysis for FSW with a pcBN tool versus resistance spot welding (RSW) of DP 780 steel. The equipment and utility costs for FSSW were assumed to be 90 and 30% respectively of the costs in RSW; however, they did not report the dollar amounts of these costs.They further assumed that a typical RSW tool tip lasts 5000 welds and costs $0.65 per tip [11]. Considering the costs involved with equipment, utility and the tool, they estimated

that in order for the FSSW to be cost competitive with respect to RSW, each FSSW tool, costing ~$100, needs to make 26 000 spot welds. Since the cost of each pcBN tool was significantly greater than $100 and typical tool life was between 500 and 1000 welds, they suggested lowering tool costs as an important need. Feng et al [23] produced over 100 friction stir spot welds on dual phase steel (ultimate tensile strength 600 MPa) and martensitic steel (ultimate tensile strength 1310 MPa) without noticeable degradation of the pcBN tool. The costs of Si3N4 and TiB2 tools were less than 25% of the cost of pcBNtools [22]. Tools of W–Re or W–La alloys are relatively less expensive than that of pcBN tool but suffer considerably more wear compared with super abrasives due to their relatively lower high temperature strength and hardness [11].Mohanty et al [8] investigated the effects of different friction stir welding tool geometries on mechanical strength and the microstructure properties of aluminum alloy welds. Three distinct tool geometries with different types of shoulder and tool probe profiles were used in the investigation according to the design matrix. The effects of each tool shoulder and probe geometry on the weld was evaluated.
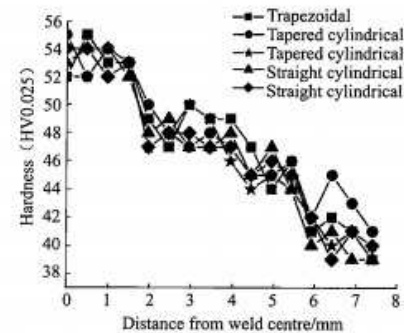
Fig. 5.   Micro hardness profile for various tool geometry [8]

The microhardness of weld nugget TMAZ obtained with different tool profiles is shown in Fig.3. It is observed that the weld nugget exhibits a higher microhardness compared to the thermo-mechanically affected zone (TMAZ) and the base metal [8].

III. CONCLUDING REMARKS

The joints of different tool pin profiles like straight cylindrical, Taper cylindrical, triangular, square, trepezoidal and hexagonal tool etc., with different rotational speeds, weld speeds and axial force were reviewed in this paper. The following important conclusions were made:Based on the literature survey, Tool shoulder-to-pin diameter ratios play an important role in stir zone development. The diameter of the pin is equal to the thickness of the parts to be welded and its length is slightly shorter than the thickness of the part.Tool material properties such as strength, fracture toughness, hardness, thermal conductivity and thermal expansion coefficient affect the weld quality, tool wear and performance. Heat generation rate and plastic flow in the workpiece are affected by the shape and size of the tool shoulder and pin. Although the tool design affects weld properties, defects and

the forces on the tool. The pin cross-sectional geometry and surface features such as threads influence the heat generation rates, axial forces on the tool and material flow. Tool wear, deformation and failure are also much more prominent in the tool pin compared with the tool shoulder. There is a need for concerted research efforts towards development of cost effective durable tools for commercial application of FSW to hard engineering alloys.

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Advancements and Automation in Sinking Electrical Discharge Machining Process: A Review

Guriqbal Singh
Dept. of Mechanical
Engineering
Amritsar College of
Engineering & Technology
Amritsar – 143001, India
guriq_ghumman@yahoo.co
m

Paramjit Singh
Dept. of Mechanical
Engineering
Amritsar College of
Engineering & Technology
Amritsar – 143001, India
er_pannu266@yahoo.com

Gaurav Tejpal
Dept. of Mechanical
Engineering
Amritsar College of
Engineering & Technology
Amritsar – 143001, India
gaurav_tejpal@acetedu.in

Vikas Kumar
Dept. of Mechanical
Engineering
Amritsar College of
Engineering & Technology
Amritsar – 143001, India
vikas_cadcam@rediffmail.c
om

Abstract—**Electrical Discharge Machining (EDM) is a non conventional machining process, especially used for the manufacturing of intricate, complex and hard material parts. These materials are extremely difficult-to-machine with conventional machining processes. The main intention of this paper is to present the reviewed research work carried out by various researchers for the automization of EDM technology & to highlight it's advances in terms of applications. Various processes are suggested for the EDM technology to improve the machining characteristics and to achieve high-level automation. Clearly die sinking EDM can be easily integrated with the environment of Computer Integrated Manufacturing System (CIMS) as a need of futuristic manufacturing systems. This integration of computer systems with EDM technology broadens the applicability and efficiency of the process.**

Keywords—**EDM, automation, CNC devices**

I. INTRODUCTION

EDM is a non-conventional process originally observed by English Scientist Joseph Priestly in 1770. In 1943, Lazarenko and Lazarenko [1], soviet scientists presented and also further optimize the reversal process for the removal of metal with electric circuit breakers. Generators used in 1950s were of relaxation type which have charging condensers in which discharge energy can be stored and further defined. Simple servo control circuits were developed so that to find and hold the given gap in between the tool electrode & work piece automatically and to control pulse times through these circuits. Technological advancement of EDM had significantly affected by the utilization of CNC devices with advanced power supplies. 3D shapes should be developed by CNC EDM machines so that motion of servo controlled tool on four axis should be generated with the help of part programs. According to a market survey, 'toolmakers' do not use these strong CNC machining capabilities as to much extent. Multi-axis CNC capabilities are overlooked by using Traditional EDM machines in which plunging formed tool along Z-axis is responsible for the designing and making of 3D shaped work pieces. Multi-axis CNC capabilities of CNC EDM machines includes the X, Y, Z and rotational directions. According to the published work till today, four types of tooling i.e. 3D form, ball ended cylindrical, frame and plate can be functional. CNC EDM utilizes these four types of tooling to manufacture 3D shaped work piece cavities.

A. Mechanism of EDM process

EDM is known as spark machining. Spark discharge takes place between tool electrode and work-piece to form a replication of desired shape of tool on work-piece. During the process, there is no physical contact between tool electrode and work piece as erosion is produced by electrical discharge. A liquid dielectric is used in this process. Dielectric breakdown is initiated when tool electrode moves towards work-piece and form plasma channel [2]. Breakdown generally occurs in between the inter electrode gap. Voltage falls and current rises because of dielectric breakdown which causes numerously repeated spark ignitions, which help to form the crater on work piece. Due to ionization the plasma channel has been created, this leads the conductivity of gap and because of applied current heat is generated around a range of 8000 to 20,000°C [3,4,5]. The size of a crater is determined by discharge energy, which can be set on the machine by setting the discharge current and the discharge duration [6,7,8,9]. Heating of the work piece and tool material occurs, which rapidly creates a small molten metal pool at the surface [10,11,12]. A small quantity of metal is vaporized and flushed by dielectric in the form of debris.

B. Some applications and characteristics of EDM

Since EDM is a thermal process, it can also machine hard materials i.e. quenched steel, cemented carbide, and electrically conductive ceramics. Complicated shapes can also be machined by EDM. Rotation of tool electrode does not required for material removal processes such as milling, grinding; which facilitates easy machining of irregular contours & holes with sharp corners, as well insignificant reaction forces are generated in the EDM gap due to which there is ease in machining of difficult to machine components (i.e. thin and flexible parts, deep grooves and holes) by milling. In general, we can say that EDM has very high accuracy in machining in several micrometers and improvement in surface roughness i.e. Rz 0.4μm. However, when compared to other machining processes the MRR of EDM is low. EDM is used to machine complicated shapes of

hard materials with high precision in the processes of die and mold making. In spite of the development & advancement in the technology of high-speed milling, EDM applications are preferred & expanded applications in the field of micro-parts.

C. Influence of flushing

For steady machining, the flushing of debris particles & the cooling of the working gap is required so that they cannot be concentrated on the discharge locations. For this, the contaminated dielectric fluid is replaced periodically with fresh di-electric fluid periodically. Masuzawa et al. [13] introduced rotary electrode movement during the lifting motion to improve the pumping motion of dielectric fluid. Cetin et al. [14] considered the suspended debris particles to calculate the 3-D fluid flow in the gap and the relationship in between the tool lifting velocity and height and the flushing capability is generated. Sinking EDM machines equipped with linear motor [15] realized the increase in material removal rate particularly in the machining of narrow and deep grooves. As the lateral gaps of the groove became narrower and more uniform, machining accuracy was also enhanced. Nozzles can be placed adjacent to the discharge gap from which a fresh dielectric fluid jetted to flush the working gap. Masuzawa et al. [16] proposed that flushing from both sides (alternate flushing and sweep flushing) is preferable, as flushing from one side by jetting of di-electric fluid causes increased density of debris particles in downstream which results in uneven distribution of gap width which effects the accuracy of machining process. As the holes are provided in the electrode or work-piece, the pressure or suction flushing through these holes is considered one of the most efficient methods which prevents harm to the work-piece. Also, it can be stated that one from both (pressure and suction flushing) can examine larger gap width at the outlet point compared with the inlet point, and also it facilitates lower electrode wear [17]. Tsukahara et al. [18] realized the fact that when oxidized dielectric oil is used, this oxidized oil reacts with the metal elements in the tool electrode and work piece, thus form organometallic compounds. So to make the process more stable they presented a dielectric liquid mixed with a fatty acid containing carboxylic acid, by which debris particles are dissolved as organometallic compounds to some extent instead of releasing in the gap anymore.

II. ADVANCED EDM APPLICATIONS

A. Coating and alloying by EDM

EDM is considered to be a removal process. But EDM is also sometimes utilized as a method of surface treatment and/or an additive process. When EDM is done to machine steel work piece uses hydrocarbon as dielectric, white layers generated have high resistance to abrasion and corrosion than base material due to high carbon content on those layers [19-22]. These white layers absorb the carbon emitted by gases produced from the hydrocarbon dielectric in the discharge column at high temperature. High oxygen and carbon content built up the discharge column, as WEDM usually takes place in deionized water. Density of alloys (i.e. chromium and nickel) should be enhanced by the decarbonisation of the surface of the material metal caused due to oxygen. It provides

assistance to the surface to resist corrosion [20]. Narumiya et al. [21] proposed that machining of work piece by using powdered (Si, SiC or Al) particles have improved surface finish as well as better resistance to corrosion compared to the machining done without powder. Masui et al. [23] concluded that an alloyed layer is formed over the surface of positive polarized work piece by mixing dielectric fluid with fine tungsten powder. This alloyed layer enhances surface properties such as hardness and resistance to corrosion along with improved surface roughness. Mohri et al. [24] studied that using tool electrode of partially sintered or green compacted materials (Cu, Al, WC-Co and Ti) shows great positive impact on alloying speed due to high wear ratio of such materials. Similar results were concluded by Goto et al. [25]. Ti eroded from the electrode is carbonized in the oil dielectric, thus forming a hard layer of TiC over the work piece material [27]. Coating of hard and thick layer having high bond strength should be done in less time by the usual EDM like processes compared to conventional methods i.e. CVD and PVD. Cross-section of a TiC layer is practically formed on carbon steel in 8 minutes [26]. Longer tool life is indicated by the applications of this process towards cutting and blanking of tools [25,27]. Work piece materials and alloyed layers propose variety of powders and compact for different applications like steel rolls, molds, dies, cutting tools, turbines and aero engine components [28-30]. Tool electrode which is polarized negatively and long discharge duration are essential for the successful implementation of this process. By these circumstances, we can say that, the MRR of the anode (work piece) is lower than MRR of the cathode (tool electrode), as there is deposition of carbon on anode which comes from the hydrocarbon dielectric. TiC coating is formed from the reaction in between the deposited carbon and the material removed from electrode (Ti). Hayakawa et al. [31] used deposition of EDM in air and create a micro structure. Short analysis on the temperature of the tool electrode and work piece concludes conditions which make suitable discharge in this process. The polarity was set to the positive to increase the wear of tool electrode than negative polarized coating and alloying methods. It is because the anode has high removal rate compared to cathode in the air.

B. Colouring by EDM

By using WEDM process, a new method of coloring titanium alloys was proposed by Minami et al. [32]. WEDM normally uses deionized water, so, due to electrolysis there is a formation of an oxide layer over the surface of anode work piece. It is recognized that the coloring of stainless steel and the surface of titanium alloy is done by anodic oxidation, occurred by the interference of light in the oxide film formed by electrolysis. During the process of cutting finish on the WEDMed surface, the surface is given an arbitrary colour. Oxide layer thickness determines the colour, so, by varying the open voltage or by controlling the wire-electrode's feed rate the colour can be changed. On products of titanium, fine and multicolored pattern can be drawn in sinking EDM by using a simple electrode controlled by an NC system [33].

C. EDM of non conducting materials

It has been supposed that EDM can machine only electrically conductive materials. However, EDM can also machine diamond by introducing the coating of graphite on it. Diamond should be heated in a pyrolitic atmosphere comprised with a carbon compound or in a non oxidizing flame, until it reaches the temperature of conversion to graphite. The discharge spot's temperature should be greater than the conversion temperature of diamond-graphite's conversion temperature when there is the occurrence of discharge between the coating of graphite and the tool electrode, as the newly formed graphite-coating is done on the bottom of the crater, then there is repetition of this same process [34,35]. Fukuzawa et al. [36-38] discovered a way by which nonconductive ceramics are EDMed totally. For machining, a metal plate/ mesh is placed over the ceramics. Initially, in between the metal plate and tool electrode, there is production of discharge. There is erosion of metal plate and thermal decomposition of working oil and deposition of pyrolitic carbon on the positive polarized work-piece. As, in die sinking the carbon is deposited on tool electrode by the above mentioned phenomenon. Further, electrically conductive carbon layer covers the ceramics surface after the erosion of metal. Hence, till discharge maintains the carbon deposition, there is continued occurrence of discharge on the ceramics. 3D shapes of materials such as Si3N4, ZrO2, SiC, Al2O3, AlN, glass, old ceramics, and diamond are machined by EDM process with this method. WEDM facilitates the machining of a chair-shaped product of Si3N4 [38]. Taniguchi et al. [39] machine diamond and alumina ceramics by using micro wave. Work pieces of these materials were placed in the gap between a pair of needle electrodes and the axis of these electrodes was oriented parallel to the electric field of the micro wave standing in a micro wave tube. Dielectric heating inside the material melts the alumina ceramic, whereas the discharge column developed between the surface of diamond and the tip of the needle electrode generates the heat flux which evaporates the diamond as the dielectric hysteresis loss of diamond was insignificant. The high electric resistivity of the silicon single crystal generates a large voltage drop which is one of the difficulties produced during the process of EDM slicing of silicon wafers [40-42]. One of these authors also stated that this large voltage drop is also produced by the high contact resistance at the point of contact in between the silicon wafer and metal electric feeder. In general, when two smooth surfaced plates are made to be in contact with each other, the area of real contact is very small, and as in this small area density of concentrated electric current is very high which signifies the voltage drop. Hence, there would be enormous drop in voltage when interface is developed between metal and high-electric-resistivity material, while voltage drop due to interface by the contact of two different metals is ignorable when it is compared with the voltage drop in the discharge channel. Thus it is concluded that to improve the machining rate, formation of a low electric resistivity layer over the silicon wafer service is done. The contact resistance is caused by the small area of real contact along with the differences in work function between contacting materials due to which the Schottky barrier is created. The effects of the Schottky barrier in metal-silicon contact was eliminated by the process of electroplating the silicon surface with metal like Ni, Al and Sb-Au [42,43]. This was done to minimize the contact resistance in the EDM of the silicon single crystal and to alter the rectifying contact to an ohmic one.

D. Cutting non linear holes

To reduce the forming cycle time, it is essential to cool the mold surface in plastic injection molding and aluminum die-casting. Curved surfaces of the mold are provided with proper channels for the passage of coolant. However, mechanical processes such as cutting, grinding, etc. are unable to effectively machine curved holes. Thus, curved holes are effectively machined by performing several novel electrical machining methods [44-47]. Hollow space of a straight pipe was introduced by a coil spring made as similar to the curvature of the hole in order to guide the coil. The end of the coil spring is attached with a spherical tool electrode. Initially, both the coil spring and the guide pipe were fed together to a certain depth by machining the work piece. Then the coil spring is allowed to feed alone as the position of the guide pipe is fixed. Goto et al. [45] proposed the curved hole. Uchiyama et al. [47] also introduced an electrochemical machining method.

E. Surface integrity machining for EDM

In sinking electrical discharge machining (EDM) while processing cemented carbide, low surface integrity is resulted due to typical surface defects such as cracks, micro-craters and recast layer, which causes shortening of tool life. To overcome this problem, basically re-polishing of the damaged layer is done, but alongside there is increase in production cost and duration of the machining. Thus, a method of on-the-machine surface modification technology in EDM was introduced to overcome these surface defects. To eliminate those surface defects, sinking electrical discharge machine was introduced with surface integrity machining for EDM (SIME) [48]. SIME is performed by the application of voltage to the de-ionized water to the constant gap between electrode and work-piece, as the removal of recast layer along with other surface defects is done by the disbanding of cobalt based on the electrolytic action. So by the incorporation of SIME into EDM, there could be a complete elimination of surface defects generated by EDM.

III. RESEARCH APPROACH

Fig. 1 shows, the current trends of reviewed research publications performed in various areas of EDM process. 21% of the research is done to describe the working principle of EDM, 20% research is carried out to describe abrasive powder mixed EDM in dielectric, 18% work is done to describe the process parameter optimization, 16% work is carried out towards servo control, 8% reviewed research is done on pulse discrimination, 5% on multi-spark for the improvement of performance of the machine.
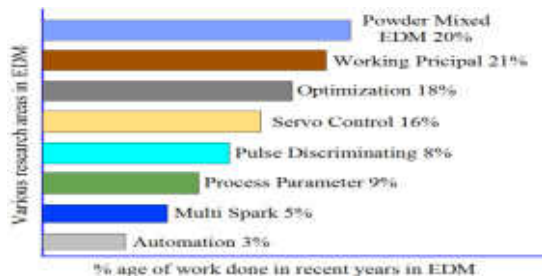
Fig. 1. Percentage Distribution of Reviewed Research Publications.

As, it can be observed from this figure very less (3%) work is attempted towards high level automation of EDM process. It is the need of the generation to integrate the CIM environment to die sinking EDM with a flexible machine controller to minimize the dependency on operators to minimize the errors.

A. Why automation?

Zeng et al. [49] presented a case study in which 4500 – 7500 electrodes are used for different cavities of mould, in the making of mobile phone mould. To perform various finishing operations on each cavity, different tools are required. Single machine operator has to perform various tasks such as i.e. machining, program editing, feeding of parameters, changing of tool, tool off set, etc. To ease this process or to avoid human errors, automated systems are essentially useful which can be operated by skilled operators. The concept of CIM integrated EDM have been proposed by many [50,51] authors. Moreover, Rajurkar & Wang [52] utilized the capability and ability of CAD/CAM resources and high level automation to share with manufacturing facilities incorporation with EDM into future agile manufacturing systems which requires the EDM control system. Operator's skill is responsible for the performance of die sinking EDM, as its increased use in manufacturing industries. Data base (of all EDM process parameters) is to be prepared for eliminating the dependency on operator's skill. Chakrabarti et al. [53] has introduced a minimal management information system (MIS) through design and implemented it for handling AWJM, EDM and WEDM data with suitable design enhancements to handle different manufacturing systems. For other non conventional machining process developed MIS system recommended by the author. To develop MIS, various experimentations would be carried out by different combinations of materials of work piece & tool electrode to generate statistical data. Further from this statistical data, there is determination of optimized process parameters (i.e. discharge current, pulse on time and pulse off time) which would further be validated. Controller is needed to simplify optimized parameters in process from MIS to EDM. Die sinking EDM integrated with flexible controller (PLC) is introduced to minimize the dependency on the operator and to successfully implement automation.

B. Automization with PLC

Programmable logic controllers (PLCs) are used extensively in each and every aspect of industry for the expansion and enhancement of production [54]. A single PLC can be programmed or preferably used over the older automated system in which hundreds or thousands of relays are used. The functions of PLCs include sophisticated motion control, process control, distributive control systems, and complex networking. PLCs are implemented with controllers/computers to improve the communication capability so as to get effective performance of functions i.e. supervisory control, data gathering, monitoring devices and process parameters also it helps to reduce response time and effective troubleshooting. Other benefits of PLCs are increase in reliability and flexibility and reduction in cost. As shown in Fig. 2, in EDM-PLC interface, inputs to PLS are given by capacitor bank in the form of D.C. Power supply and die sinking EDM's tool position. Discharge current, pulse on and pulse off time are used as process parameters, which is fed in PLC with the use of computers. RS232 cable is used to connect PLC with computer serial port, as system used to communicate with PLC is named as Supervisory Control and Data Acquisition (SCADA). LAN and WAN are distributed according to their functions by the standard protocols used for communication by SCADA. Electrodes require surface finish and finishing depth which will be selected/fed manually by machine operator on the user screen designed specially using Human-Machine Interface. Three machining operations i.e. rough, semi-finish and finish operations are assisted with optimized EDM process parameters generated from database of SCADA which is linked with HMI. Parameters will be changed according to the requirement by the operator. A single button is used to feed the parameters to the controller. Depending upon the depth of incursion of tool electrode in work piece material, Operations from rough machining regime – semi finish – finish regime will be switched over automatically by controller. CAD/CAM software and CIM system is linked with separate die-sinking EDM in subsequent research work.
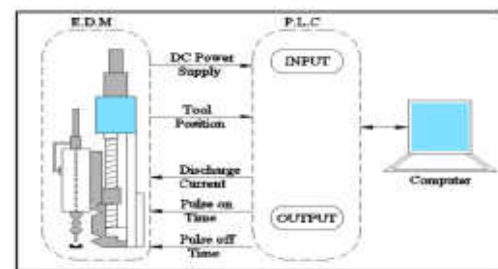
Fig. 2. Schematic diagram of EDM-PLC interface.

C. Five axis NC machines

Rapid developments are noticed in the technology of EDM in last years [55,56]. Five-axis NC machine was introduced which have character of discharging machining & Multi-spindle linkage, by which this machine can get hold of complex spatial trace i.e. aerospace, automotive industry and surgical components [57]. Thus the problem of intervening flexibly was solved. Five-axis NC machine also facilitates the machining of complex curved surface work pieces along with the machining of difficult-to-machined materials.

D. Servo scanning EDM

A servo-scanning 3D micro EDM (SS-3D MEDM) method [58-60] is proposed to compensate micro electrode wear at high discharge rate. In this (SS-3D MEDM) method, 3D scanning process is integrated with servo control of discharge

gap to compensate micro electrode wear [61]. By this, the varying electrode wear can be adjusted by feeding modified speed of micro electrode, thus, high machining efficiency is expected. Furthermore, scanned paths designed by CAM software such as Pro/Engineer can be used by SS-3D MEDM for complex micro cavities. In this method, depth errors for complex 3D cavities are reduced by proposing a layer depth constrained algorithm (LDCA) and an S-curve accelerating algorithm (SCAA). The main objective of the algorithms are as follows: LDCA is used to avoid the errors occurred by over-cutting by monitoring the depth of machining of every scanned spot, & SCAA is used to reimburse the inadequate machining errors by accelerating the start and end of scanned paths [61].

IV. CONCLUSIONS

- Use of PLC based flexible controller reduces operator dependency during EDM.
- Today high level configuration computers can be used to achieve high level automation in EDM.
- CAD/CAM software may be developed to simulate and optimized rate of flushing.
- Automization system may be developed to adjust input parameters (current, voltage, etc.) to achieve highest surface finish.
- Automatic system by the use of computers may be developed to achieve high productivity without compromising surface quality in EDM.

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Fusion of Metal Powder using Microwave Hybrid Heating for Joining of Metals – A review

Shivinder Singh
Dept. of Production Engineering
PEC University of Technology
Chandigarh, India
shivinder519@gmail.com

NM Suri
Dept. of Production Engineering
PEC University of Technology
Chandigarh, India

RM Belokar
Dept. of Production Engineering
PEC University of Technology
Chandigarh, India

Abstract: Selective heating in microwave processing of materials is relatively new technology. Microwave heating receives considerable attention due to its major advantages such as high heating rates, reduced processing time, and low power consumption and less environmental hazards. This paper presents a review of microwave technologies for fusion of metal powder using fixed and variable frequency microwave applicators for metal joining. Joining was effected through fusing and metallurgical boding of the sandwich layer of metal powder slurry between the metal pieces. It is observed that the porosity measurement in the joint are revealed negligible porosity and mechanical properties of joint such as tensile strength are compared on the bases of literature.

Keywords: Microwave heating; Metal powder; Joining.

I. INTRODUCTION

Microwave processing of materials is a relatively new technology that provides a new approach to improve the physical properties of materials, an alternative method for processing materials that are hard to process, a reduction in the environmental impact of materials processing, economic advantages through energy, space, and time savings, and an opportunity to produce new materials and microstructures that cannot be achieved by other methods. Use of microwave irradiation for materials processing has the potential to offer similar advantages in terms of reduced processing times and energy savings [1]. In many cases, the energy consumption in microwave heating is less than that of other heating processes and the processing time is shorter [2]. Microwave assisted processes are shown to have a high heating rate as well as a high reaction rate whereas it is not so for samples subjected to conventional processes [3]. Recently, there is an interest in characterizing the process of metals such as sintering [4], brazing [5], joining [6] and melting using microwaves [7,8]. Conducting materials such as metals do not efficiently convert microwave energy to heat since they reflect microwaves [9]. Microwave processing of materials has emerged as one of the fastest material processing techniques and is being recently investigated in surface engineering applications [10-12].

Microwave processing of materials is different from the conventional thermal processing methods. In microwave heating, the electromagnetic energy is transferred at molecular level by dipole rotation and ionic conduction. Hence, there is an energy conversion rather than energy transfer as in the conventional processing of materials [13–15].which eventually leads to uniform bulk heating. As the heating originates at the molecules through-out the bulk, the heating process is essentially faster than the known modes heating in which heating of the entire volume of the material depends on the conventional modes of heat transfer .In conventional heating systems, the material gets heated from the surface to the interior with associated thermal gradient [16, 17] which results in changes in microstructure with varying mechanical properties. Microwave heating, on the other hand, is well characterized by volumetric heating owing to which reduced thermal gradient, less residual stresses and thermal distortion on the target material have been observed while compared to other thermal processes. Thus, application of microwave energy as a source of heating in joining, sintering, cladding could be a cost effective option in the material processing industry. Studies on processing of ceramics and ceramic composites using microwave energy have been widely reported edges of microwave processing of such materials over conventional processing techniques have also been well illustrated [18–22]. Such processing includes several surface engineering applications as well [10]. Microwave processing of materials is mainly used for ceramics, ceramic composites, polymers and semiconductors because they are good absorbers of microwave [23, 24]. Osepchuk has explained the basics of microwave heating and presented a brief history of the applications of microwave energy [25]. Later, the same author further explored the possible areas of applications of microwave power in details [26]. Significance of microwave heating and its applications in processing of ceramics were then analyzed by Sutton in a landmark publication in 1989 [27]. The unique features of processing materials with microwave were lucidly presented. Later, Clarke et al. have

shown the potentials and challenges of using microwave energy in materials processing [18]. Subsequently, application of microwave energy in material processing was reported in many areas including the new and unusual application like glazing of sprayed ceramic composite surfaces [16]. Microwave energy has been effectively used in the processing of different materials. However, majority of these applications was limited to processing of microwave absorbing materials (mostly, bio-materials, hydrocarbons etc.), ceramics and ceramic composites. Successful sintering of alumina with nearly full density at 1350°C after 50 min has been achieved using 2.45 GHz microwave and its comparison with conventional heating shows only 62% density at this temperature [28].

II. MICROWAVE PROCESSING

Microwaves are a segment of the electromagnetic (EM) wave spectrum, which comprises forms of energy that move through space, generated by the interaction of electric and magnetic fields [29]. In the EM spectrum, microwaves in the frequency band from 300 MHz to 300 GHz are found to be very effective in material processing applications [31]. In microwave processing, heating is not dependent on surface area but rather upon volume; hence, an inverse heating profile is present [32] Industrial applications of heating by microwave radiation such as in melting, smelting, sintering, drying, and joining have been prompted, and a large amount of research carried out [33] Bulk materials reflect microwave at room temperature because of low skin depth .The metallic materials can be processed using microwave in powder form by making powder particle size equal to skin depth of microwave. Roy et al. [34] reported that in a powdered and un-sintered form all metals and alloy can be processed very efficiently and effectively using microwave energy. The characteristics of microwave processing of materials include: (a) selective heating, (b) rapid heating, (c) controllable electric field distribution, (d) penetrating irradiation, and (e) self-limiting reactions [30]. Heating a material using EM energy is based on a material's capacity to absorb the applied energy efficiently [36]. However, using EM energy, it is possible to heat a range of materials more quickly than using conventional heating methods, since the efficiency of conversion of EM radiation to heat is 100 % [37]. In microwave processing, by transferring energy via EM waves, heat transfer is not limited to the surface of a material but is transferable to all particles, which increases the heat transfer rate [38]. Many commercial powder metal components and their alloys have been sintered using microwaves. It has been reported that the powders with a composition of iron (Fe), copper (2%) and graphite (0:8%) have been sintered in a microwave field at 1200 °C for 30 min with excellent density [39]. The same authors also reported microwave sintering of cobalt metal powder in pure H2

environment with one atmospheric pressure at various temperatures-ranging from 900 to 1200 °C for 10 min. The densities reported were 8700 kg/ m3 at 900 °C to 8880 kg/m3 at 1000–1050 °C and near theoretical density of 8890 kg/m3 at 1100–1200 °C. Rodiger et al. had carried out sintering of hard metals through 2.45 GHz microwave heating and reported sintering temperature of 1300 °C in microwave process was achieved in 1.5 h with 1 kW power whereas conventional process took nearly 5 h to reach 1400 °C with 4.5 kW. Platelets microstructure embedded in a fine-grained hard metal matrix with an average size of 0.6 lm was obtained [34]. Prabhu et al. had examined the comparative sinterability of as received powder and activated tungsten powder in microwave. It was observed that the activated tungsten powder shows better densification because of reduced particle size and higher specific surface energy [40].Gupta and Wong reported the two-directional microwave assisted rapid sintering of aluminum, magnesium and lead free solder. The results revealed that the density of the microwave sintered and conventionally sintered samples are same whereas the marginal increase in microhardness with superior ultimate tensile strength of the microwave sintered aluminum and magnesium [41]. Microwaves have been efficiently employed for joining of ceramic materials. It has been reported that sintered alumina and 30% zirconia ceramic composites were successfully joined by microwave hybrid heating at 2.45 GHz frequency and power 700W [42]. The joints were fabricated with and without sodium silicate glass powder as an interlayer. The flexural strength of such joints (with interlayer) was reported in the range of 28 MPa. However, adaptability of microwave energy in processing metallic material is challenging owing to the fact that microwave absorption coefficient for metals at 2.45 GHz radiation is significantly less at room temperature [43]. This makes it extremely difficult to achieve heating in metallic materials without using hybrid-heating (conduction and/or convection + microwave) technique [44,45]. In microwave hybrid heating (MHH), a passive heating is used through microwave absorbing material, called susceptor. In 1999, an US research group reported sintering of metallic materials. Later, several authors have reported sintering of metallic materials through microwave heating [42,46-48]. Cho and Lee [49] reported metal recovery from stain-less steel mill scale using microwave heating. Takayama et al. [51] have reported production of pig iron by microwave processing of mixed magnetite and carbon powder at 2.45 GHz and 30 GHz microwave frequency. Sharma et al. [52] have reported joining of bulk metallic materials using microwave irradiation. Borneman and Saylor reported coating of friction reducing alloys using CuNiIn powder on Ti–6Al–4V substrate using microwave radiation. Borneman and Saylor's [53] work has been the pioneering work in processing metal-based materials using microwave energy for surface engineering application.

The microwave joining of thin metallic sheet having a thickness of 0.1 to 0.3 mm was successfully reported by Siores and Rego[54] using microwave heating. The authors reported that the localized arcing was enough to melt such thin sheets by using a 2 kW multimode microwave magnetron. Bulk metallic material however cannot be processed using this method due to reflection of microwaves by metal and spark produced is large which is harmful to waveguide of microwave. The joining of bulk metallic materials was first reported by Sharma et al. [55] in the form of a patent using MHH. Srinath et al. [56–57] reported joining of similar as well as dissimilar metallic materials using MHH. The authors reported joining of Cu to Cu by placing Cu powder between two interfacing surfaces, SS to SS by placing Ni powder between two interfacing surfaces, and mild steel (MS) to stainless steel (SS) by placing Ni powder between the interfacing surfaces. In general, the best properties in a welded joint can be achieved by using filler metal of the same composition as that of base metal to be joined. In this work, joining of SS-316 to SS-316 has been successfully achieved by using SS-316 powder of approximately same composition using MHH. The developed joints were characterized through X-ray diffraction (XRD), field emission scanning electron microscopy (FE-SEM), Vicker's microhardness tester and universal testing machine.

III.   TESTING AND MATHEMATICAL MODELING

In microwave based surface engineering methods, uniformity in processing including homogeneous microstructure, reduced porosity, reduced level of stress cracking, and enhanced microhardness have been reported by many authors]. Srinath et al. [57] investigated the microstructural and mechanical properties of stainless steel (SS-316) joined to mild steel by microwave processing under atmospheric conditions using a multimode applicator at 2.45 GHz and 900 W. A nickel-based metallic powder was used as a sandwich layer between the bulk pieces. The resulting joints were characterized using field-emission scanning electron microscopy (FESEM), X-ray diffractometry, Vickers microhardness testing, and tensile testing. Microstructure study showed that the faying surfaces were well fused and were bonded on either side of the base material, and formation of cementite and metallic carbides was also observed. The average Vickers microhardness of core joint area was observed to be 133 HV with 0.58 % porosity. The ultimate tensile strength of the joint was found to be 346.6 MPa with percentage elongation of 13.58 %. Microwave joining of 48% alumina–32% zirconia–20% silica ceramics through suitable temperature control has also been reported which yielded joint strength in excess of about 107% of the base material [58]. Bartmatz et al. in the year 2000 have reported in the form of patent on brazing of titanium carbide tip to diamond cutter to

enhance the properties of the cutter [59]. Braze powder was used as interface layer with microwave temperature upto 1000°C. In continuation of the previous study, Sallom et al. have reported the brazing of Gamma TiAl with Ag-based filler metal by microwave heating between 925 °C to 1050 °C in 5 min with 1 MPa load [60]. Budinger have reported brazing of nickel based superalloys with nickel based metallic powders in a multimode microwave cavity [61]. Particle size used in this work was about 44 lm. Results show the finer particle attained maximum temperature of 1140° C, whereas coarser particles were heated upto 827°C. This evidence shows that microwaves have greater susceptibility towards finer particle size. Successful joining of thin steel sheet in the thickness range of 0.1–0.3 mm using microwave was reported by Siores and Rego [54]. The authors showed that the localized arcing was enough to melt such thin test sheets by using a 2 kW multimode magnetron. Agrawal, on the other hand, has reported joining of regular steel and cast iron in a microwave field within 2–3 min using a braze powder [62]. Srinath et al. [6] also presented a new approach for joining of bulk copper using microwave energy under conditions similar to those mentioned above. A sandwich layer of copper powder with approximately 0.5 mm thickness was introduced between the two candidate surfaces (copper in coin and plate forms), which were successfully joined by microwave heating within 900 s exposure time. Near-complete melting of the powder particles in the sandwich layer took place during the microwave exposure, leading to metallurgical bonding of the bulk surfaces. Characterization of the joints was carried out by microstructure study, elemental analysis, phase analysis, microhardness and porosity measurements, and tensile testing. The X-ray diffraction (XRD) pattern indicated that some copper powder particles were transformed into copper oxides. A dense uniform microstructure with good metallurgical bonds was obtained between the sandwich layer and the interface. The hardness of the joint area was observed to be 78 ± 7 HV, while the porosity in the joint was observed to be 1.92 %. Colombini et al. [63] applied microwave energy to ignite combustion synthesis (CS) of Ni , Al (50:50 at.%) powder mixtures to join dissimilar materials at high temperature. Experimental and numerical simulation results demonstrated that joining can be obtained rapidly by microwave ignition of CS, characterized by minimum extension of heat-affected zones in the joined substrates. Gupta et al. [64] joined mild steel and stainless steel by microwave welding at 2.45 GHz and 900 W. The joint was formed in 600 s exposure time. Ni-based powder was used to join the metals. Joint characterization was carried out through microstructural analysis and tensile strength, elongation, and microhardness measurements. The tensile strength, elongation, and microhardness were observed to be 340.16 MPa, 11.67 %, and 130 HV, respectively. E. Colombini, R. Rosa performed numerical simulation of the MW ignited CS of Al–Ni powders

compacts by using the commercial software Comsol Multiphysics 3.5a.

IV. CONCLUSION

It is expected that use of metal powder for joining by using microwave energy improves mechanical and micro-structural properties of the joint. It is also expected that by varying the particle size of powder it directly affect the heat transfer rate, strength, porosity at the joint surface. The use of microwave energy for melting of metal powder used for joining consumes less energy as compare to other joining process and also less environmental hazards.

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Fundamental Aspects into the Electrical Discharge Machining Technology with Current Innovative Techniques: A Review

Vikas Kumar
Dept. of Mechanical Engineering
Amritsar College of Engineering and Technology, Amritsar, Punjab, India
vikas_cadcam@rediffmail.com

Paramjit Singh
Dept. of Mechanical Engineering
Amritsar College of Engineering and Technology, Amritsar, Punjab, India
er_pannu266@yahoo.com

Gaurav Tejpal
Dept. of Mechanical Engineering
Amritsar College of Engineering and Technology, Amritsar, Punjab, India
gaurav_tejpal@acetedu.in

Guriqbal Singh
Dept. of Mechanical Engineering
Amritsar College of Engineering and Technology, Amritsar, Punjab, India
guriq_ghumman@yahoo.com

Abstract—**Electrical discharge machining (EDM) is a non-conventional machining process widely used for manufacturing complex geometry or hard to cut materials e.g. (super alloys, ceramics, and composites). These materials are very difficult-to-machine with conventional machining processes. Many researchers have showed a significant amount of research interests in EDM process due to its wide application in defense, automotive, aerospace, and manufacturing of tool and dies and tremendous role in the progress of least cost products with more trustworthy quality assurance. The main intention of this paper is to presents the scenario of the EDM technology with newly developed advanced application technologies through the achievements in the fundamental aspects on EDM process.**

Keywords—**EDM; Fundamental aspects; New techniques**

I. INTRODUCTION

All Last five decades technology of EDM process has played an essential role in manufacturing industries and became crucial in manufacturing applications such as die and mold making, micro-machining, machining of composite ceramics and prototyping, etc. The phenomena of Electrical discharge or spark machining in EDM process takes place over a very short period of time in a very narrow space (10-100µm) known as inter electrode gap between electrode and work piece, which is filled with dielectric liquid involving melting and evaporation of the tool electrode as well as work piece material. However, an EDM gap phenomenon is very complex and hence not yet fully understood. Earlier in 1770, Joseph Priestly an English scientist discovered the erosive effect of electrical discharges. In 1930s, attempts were made for the first time to machine metals and diamonds with electrical discharge.

A Disintegrator was developed by V.E. Matulaitis and H.V. Harding [1] of Elox US to remove the broken taps from expensive work piece materials e.g. (high speed steel and cemented carbide) through erosion process which was caused by arc discharges occurring in inter electrode gap connected to a D.C. power supply. Short mechanical contacts initiated the arc discharges like welding arcs which was interrupted by retraction using vibration of the tool electrode. An equipment was developed by AEG [2] capable of eroding diamond using the heat generated by arc discharges occurring at high frequencies in the inter electrode gap. In 1943, soviet scientists B. R. Lazarenko and N. I. Lazarenko [3] reversed the effect of metal removal from electric circuit breakers and optimized this phenomenon for material removal purposes. In 1950s, relaxation type generators (resistance–capacitance charging condensers to store and define discharge energy) were used. It became possible to make a simple servo control circuit to automatically find and hold a given gap between electrodes (Tool electrode & work piece) and moreover to control pulse times through these circuits. In 1980s, Computerized Numerical Control (CNC) machines came into the picture and the efficiency of EDM process is further enhanced. In the last two decades, researchers have carried out a lot of research work to enhance the productivity of EDM process. EDM machine tools are able to work round the clock under the monitoring of adaptive control systems. Moreover, latest developments in computer technology, measuring and analyzing instruments are enhancing new findings and conclusions. Furthermore, applications of the phenomena of EDM process other than material removal are also being developed. This paper presents the scenario of the EDM technology by linking recent achievements in fundamental aspects with newly developed advanced application technologies. The mechanism of erosion of material from work piece mainly conversion of electrical energy into thermal energy through a series of sparks occurring into inter electrode gap between tool electrode and work piece immersed in a dielectric fluid [4]. Generation a plasma channel between the cathode and anode is done by the thermal energy [5] at a temperature in the range of 8000 to 12,000 °C [6] or as high as 20,000 °C [7] resulting in a significant amount of heating and melting of material at the surfaces of work piece
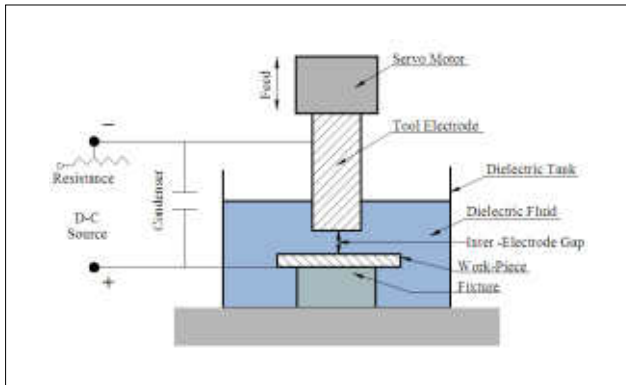
Fig. 1. Schematic diagram of sinking EDM process.

Fig. 2. Gap phenomenon of EDM [10].

Fig.3. Schematic of discharge gap [13-14].

and tool electrode shown in figure 1. The plasma channel breaks down when the pulsating DC supply is turned [8] resulting in rapid cooling allowing the circulating dielectric fluid to flush the molten material from the inter electrode gap in the form of debris. The range of volume of material removed per discharge is typically lie between 10_6 to 10_4 mm3 and the material removal rate (MRR) is usually between 2 and 400 mm3/min [9] since the shape of the tool electrode defines the area in which the spark erosion will occur.

II. FUNDAMENTAL ASPECTS IN EDM TECHNOLOGY

A. Phenomena of Inter Electrode Gap

1) Single pulse discharge columns

The diameter of arc column is shown in figure 2, which is smaller than the width of inter electrode gap and surrounded by the debris particles like dust and minute bubbles. The inter electrode gap is occupied with tar and size of debris particles shown in figure 3. The boundary between bubbles is occurred due to breakdown of dielectric by consecutive pulse discharges where debris particles are condensed or inside the bubble as well. The area of discharges spots where the diameter of arc column is considered to increase with the passage of time [10-12] and became equal to the generated discharge crater's diameter [10]. Somehow if it happens then the arc column diameter is observed larger than the gap width. At this stage the material of tool electrode and dielectric liquid are evaporated, molecules are dissociated, and atoms are ionized hence resulted in a rapid bubble expansion. The inertia and viscosity of the dielectric liquid restricts the expansion of bubbles, the extremely high pressure inside the bubble expands the boundary between the bubble and liquid with the velocity of several tens m/s [13, 14]. Dielectric liquid plays an important role in material removal because the high pressure and velocity field in the bubble may serve as the dynamics of the material removal in EDM process [15, 16]. Ions and electrons are recombined after the end of the discharge duration and the dielectric breakdown strength is recovered. Hydrogen and methane gas which are generated by the dissociation of the working oil are left to form a bubble and the evaporated atoms and molecules are solidified or condensed to form debris particles. The sizes of the bubbles are in several tens of times larger than the gap width.
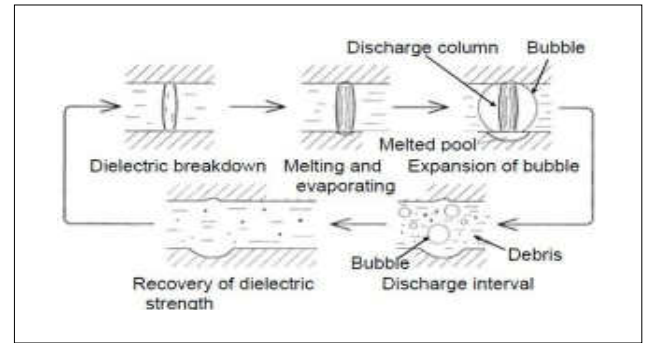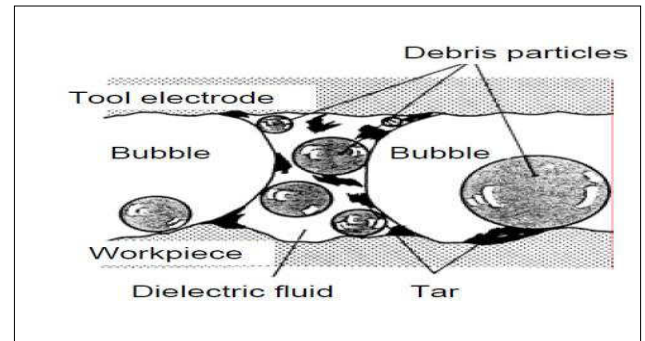
The gap becomes filled with gas in typical EDM processes since pulse discharge occurs several thousand times or more per second [16]. Debris particles are generated per single pulse discharge stops at the boundary of the bubble due to the viscosity of the dielectric liquid and blown off through the bubble generated by the discharge [17]. Debris particles melted, evaporated and cooled by the dielectric liquid and solidified to form spherical. Thus dielectric liquid flushes the debris particles from the inter electrode gap and further not reattached on the electrode surfaces. Furthermore the surfaces of tool electrode and work piece cooled by heat convection in the boundary layers of the dielectric liquid and maintain the machining stability.

2) Plasma in EDM Process

Earlier the ultraviolet ray, x-ray, cosmic ray and radiation from the earth crust generated the initial electrons. These electrons were accelerated by the electric field and ionize the neutral species due to collision resulting in an electron avalanche. Thus discharge was established by distorting the electric field, Hence streamers are developed toward both the anode and cathode [18]. In EDM process, the established discharge becomes an arc discharge when the discharge duration reaches over several µs and current density is 108 - 109A/m2. An electron emission sustains the arc discharge from the cathode spot which is due to the both secondary emission, thermionic and field emissions. Until the temperature and electrical field both are strong, this emission process is fully dependent on both variables (T-F theory) [19]. Thus the high current densities depend on highly ionized plasma with comparatively low discharge voltage of about 20 V. The value of discharge voltage is slightly changed

depending on type of dielectric fluids, materials of tool electrode, gap width and pulse conditions. Discharge voltage composed of an anode, cathode and channel voltage drop. Precise analysis of the EDM plasma is quite difficult just because of the complex physical phenomena occurring in the inter discharge gap. Eubank et al. [20] investigated the cylindrical plasma expansion considering the water dielectric's evaporation and the increase in enthalpy in plasma due to dissociation and ionization of water as dielectric. The subtracting of the fractions of the energy transfer developed the distribution of plasma to the anode and cathode. Comparison between the measured material removal per pulse discharge and molten material volume and expansion of circular heat-source on anode model calculated using the point heat-source on cathode model creates the fractions of the anode and cathode [21, 22]. However, the analysis of plasma was not done. Hayakawa et al. [23-25] analyzed the magneto hydrodynamics between parallel plane copper electrodes using the steady state of a DC arc assuming in air under a constant discharge current and gap width as used in EDM process. They also assumed that the species in high-temperature air copper electrode vapor are (N2, O2, NO, N, O, Cu, NO+, N+, O+, Cu+, N2+, O2+, Cu2+) and electrons. The temperature dependence of the thermo physical properties of the plasma also Considered, the calculation of electromagnetic field, temperature, pressure, and velocity distributions was done for the regions including both the electrodes and discharge gap and solved the conservation equations of mass, momentum and energy, Ohm's law and Maxwell's containing the Joule heating, conduction, convection, and radiation terms. It was investigated that the discharge power is almost negligible when distributed in the electrodes, and heat transfer due to convection and radiation. It was also found that after the end of the discharge duration the plasma extinguishes within a few microseconds [23, 25].

3) Distribution of Energy

The removal of material from anode and cathode quite different and depends on the discharge duration even the materials of tool electrode and work piece are the same. The amount of removal of material per pulse and discharge duration while using copper for both (anode and cathode) [26]. The material removal amount of anode is more for discharge duration shorter than 20μs and lesser with the discharge duration longer than 20μs as compare to cathode. Motoki and Hashiguchi [27], and Van Dijck [28] described on the basis of the T-F electron emission theory that this phenomenon is caused by the variation of the energies distributed into the anode and cathode with the discharge duration and also proposed the importance of energy distribution measurement between the anode, cathode and dielectric fluid. Koenig et al. [29] measured the temperatures of the electrodes and dielectric fluid for the measurement of the energy distribution. Xia et al. [26, 30, 31] experimented using calculation model for the measurement of the energy distribution by comparing the temperatures of the electrodes with the calculated results obtained under the assumed ratio of the energy distributed. The

estimated energy distribution was correct when the calculated temperature agreed with the measured one. The energy distribution was obtained by Xia et al. Copper was used for both anode and cathode under the same pulse conditions. They reported that the energy distribution to anode and cathode is about 40% and 25% respectively and rarely affected by the discharge duration, in both single discharge [26] and continuous pulse discharges [26]. It was also reported that the energy distribution cannot fully explain the difference in amount of material removal between electrodes. Xia et al. [26, 30] and Natsu et al. [32] studied the effect of carbon adhesion on the material removal amount under different machining conditions i.e. (discharge duration, polarity, and flushing flow rate of dielectric) at anode. It was concluded that the phenomenon of carbon adhesion onto the anode surface causes the difference in material removal amount between anode and cathode not by energy distribution with hydrocarbon dielectrics for both anode and cathode with same material i.e. copper. Motoki et al. [33] and Ikai et al. [34] explained that the rate of reduction of material removal of tool electrode is less due to the protective effects of carbon layer with high boiling temperature and high thermal resistance. The catalysis and structure of the carbon layer generated in the EDM process were examined by Mohri et al. [35]. Kunieda et al. [36] used spectroscopic analysis for the measurement of copper vapor density in the arc plasma. It was concluded that the copper anode was protected by carbon layer from wear based on the fact that the deposition of thicker carbon layer on the copper anode. This was resulted in lower copper vapor density. Xia et al. [31] measured the energy distribution in the inter electrode gap in the continuous pulse discharge. Van Dijck [28] explained that ratio of energy used for removal of electrodes is significantly low (1%), moreover 90% of the heat is conducted into anode and cathode and that the ratio of the volume of metal ejected to the volume of metal melted is only 1 to 10%. In the magneto hydrodynamics analysis of the steady state arc The 18% of the energy goes to the discharge gap, however, Hayakawa et al. [25] investigated that almost all the discharge power is conducted into the anode and cathode and the negligible heat dissipated by convection and radiation. This is because convection and radiation both are insignificant in the narrow gap between parallel plane electrodes and arc column is established in steady state. When discharge duration was several thousand times longer than the duration actually used in EDM. This result agrees with the distribution measured [25]. The distribution of power into the inter electrodes gap is considerably higher than that in the steady arc with the actual discharge duration. It was concluded that during the actual discharge duration in EDM process, the gap condition is not in equilibrium and 18% of the discharge power is consumed in the formation of plasma through ionization, excitation, dissociation, and polymerization.

III. EXTENDING EDM TECHNOLOGIES

A. Magnetic Field Assisted EDM

A new technique of Magnetic Field Assisted EDM has been introduced by R. Teimouri et. al [37] in which researchers

improved flushing of the debris from the inter electrode gap in electrical discharge machining (EDM) process by a rotary tool with rotary magnetic field. Moreover they designed two adaptive Neuro-fuzzy inference system (ANFIS) models to compare the EDM parameters to material removal rate (MRR) and surface roughness (SR) by using the data generated based on experimental observations. Further, to select the best process parameters for maximum MRR and specified SR, a technique of continuous ant colony optimization (CACO) has been used. The process parameters are used (magnetic field intensity, rotational speed and product of current and pulse on-time). Moreover, the objective and constraint functions for CACO are ANFIS models of MRR and SR, respectively. Three main regimes of low energy, the middle energy and the high energy have been divided for Experimental trials. The results proposed successful optimization for the input conditions of the magnetic field assisted rotary EDM process by using the CACO technique which used the ANFIS models as objective and constrain functions. Teimouri and Baseri [38,39] investigated the effects of rotation of tool and various intensities of magnetic field on EDM performance of X210Cr12. Researchers proposed that the MRR and SR and increase the EWR and overcut by the applying a rotational magnetic field around the inter electrode gap. Researchers proposed that magnetic field has encouraging effects on MRR and SR.

B. EDM of non-conducting materials

EDM can also machine diamond by introducing the coating of graphite on it. Diamond should be heated in a pyrolitic atmosphere comprised with a carbon compound or in a non oxidizing flame, until it reaches the temperature of conversion to graphite. The discharge spot's temperature should be greater than the conversion temperature of diamond-graphite's conversion temperature, when there is the occurrence of discharge between the coating of graphite and the tool electrode, as the newly formed graphite-coating is done on the bottom of the crater, then there is repetition of this same process [40, 41]. Fukuzawa et al. [42-44] discovered a way by which nonconductive ceramics are EDMed totally. For machining, a metal plate/ mesh is placed over the ceramics. Initially, in between the metal plate and tool electrode, there is production of discharge.

C. Strip EDM

Strip EDM is basically a similar process like wire EDM. In strip EDM a continuously moving brass strip Brass strip (width: 10 mm, thickness: 0.1 mm) is provided as an electrode. The waste or worn strip is removed by winding reel and a new one is supplied continuously. Hence no tool electrode wear happens during the machining process. The strip EDM method was applied to EDM milling as well as EDM turning. Author has used a commercial wire EDM machine. The strip electrode can move relatively to the work-piece material. The power source generated bipolar pulses that consisted of +140 V and -80 V. The pulse conditions were 12.8 kHz with a duty ratio of 36%. De-ionized water used as a working fluid and a nozzle

injected into a machining gap. Problem of corrosion caused by water to work-piece during the EDM process can be prevent by the bipolar pulse due to the low average voltage between the work-piece and the electrode [45].

IV. CONCLUSION

- EDM physics involved transitions like solid, liquid, gas, and plasma, chemical reactions, mass transfer etc. occurring in inter-electrode gap at a very fast rate. Theoretically analyzing these mechanisms are very complicated. However, researchers are still trying to elaborate these mechanisms. This needs further work to elaborate these fundamentals.

- A rotary tool with rotary magnetic field improves the flushing rate of debris. Hence, higher MRR can be achieved.

- Earlier, EDM process was used to machine conductive materials. But now a day, non-conducting material like diamond can also be machined through EDM process by introducing coating of graphite on the surface of non-conductive material.

- In strip-EDM, no cusp is produced due to flat strip electrode as compare to EDM turning process in which wire electrode is used. Moreover the large area of the strip electrode increases MRR as compare to wire electrode, which is small in diameter.

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Effect of Heat Input and Post Weld Heat Treatment on the Mechanical Properties of GTA Welded AISI 410 SS Joints

Mandeep Singh
Dept. of Mechanical Engineering
CTIEMT; Jalandhar; India
gne.deep@gmail.com

Sikandar Singh
Dept. of Welding Engg.
Cheema Boilers Limited, Kurali; India

Abstract- Experimental investigations were carried out to study the influence of heat input and post-weld heat treatment on the tensile and impact properties of gas tungsten arc welded 5 mm thick martensitic stainless steel (AISI 410 SS) joints. Metallurgically compatible filler was used to weld these plates using a suitable combination of gas tungsten arc welding parameters such that sound quality in these joints was achieved. Corresponding to each joint two heat inputs from the operating envelope of the GTA (gas tungsten arc welding) process were used to fabricate joints. These welded joints were further subjected to post weld heat treatment (PWHT) of 740°C for 90minutes each followed by furnace cooling. Experimental results obtained from this research work indicate that variation in the heat input exerts a significant influence on the tensile and impact energy absorption behaviour of these joints. It was found that in the post weld heat treatment condition, weld joint made using low heat input possessed maximum UTS.

Keywords- Heat input, post weld heat treatment, tensile test, impact test, GTAW.

I. INTRODUCTION

Martensitic stainless steels have good mechanical strength and moderate corrosion resistant. Because of their excellent corrosion resistance and mechanical strength, martensitic stainless steels are used for manufacturing the steam turbine blades, heat exchangers, automotive components and structures, petrochemical & process piping. Properties of martensitic stainless steel can be changed by the heat treatment. Increasing productivity of any welding process while maintaining or even improving the weld quality has been the task of researchers in the field of development of welding processes. Over the years welding methods and techniques have developed to great extent [3]. Now it is feasible to weld starting from thin metal sheets of fraction of mm to very thick plates of virtually any thickness. The quality of welding is not restricted only to work done by the welder but depends on many other factors, viz. welding technique and its parameters, welding equipment shielding medium, working environment, etc.

The heat input rate is one of the most important variables in fusion welding, since it governs heating rates, cooling rates and weld pool size. In the welding of steel, this is important relationship since increased cooling rates increase the risk of hydrogen-induced cracking. The other metallurgical feature that is directly affected by the heat input rate is grain size in the heat affected zone (HAZ) and in the weld metal. In steel welding it is necessary to seek a heat input rate that gives the optimum combination of grain size and cooling rate [11]. Before the actual welding is done, all the earlier steps such as layout, plate edge preparation, fit up and alignment should be well planned with regard to achieving desired product quality.

II. EXPERIMENTATION

Experimentation section discusses about the procedural steps that were used for experimental investigation in a systematic manner so that the formulated objectives of this work could be achieved, thus leading to clear and meaningful conclusions.

A. Base metal and fillers used

In the present research work rolled plates of Martensitic stainless steel (AISI 410 SS) were cut to length from the flats and each plate was cut to dimensions length 200mm, width 75mm and thickness 5mm. During welding of the base plates metallurgically compatible filler wire AISI 410 SS was used to fill the groove volume. AISI 304L SS solid filler wire was used for giving root pass for each plate and the welding parameters for giving root pass were kept same for each joints. The composition of base metal and filler wires is shown in Table I.

TABLE I. CHEMICAL COMPOSITION OF BASE METAL AND FILLER WIRES

Elements	C	S	Mn	Cr	Ni	Si	P	Fe
Base Metal (AISI 410 SS)	0.031	0.004	0.341	12.263	-	0.344	0.021	Balance
Filler Metal (AISI 304LSS)	0.026	0.029	1.352	17.629	9.12	1.002	0.039	Balance
Filler Metal (AISI 410 SS)	0.119	0.035	0.582	12.603	-	0.432	0.029	Balance

B. Pre-cleaning and Joint design

Prior to welding, pre-cleaning of the surface of the base plates and groove edges was done so that dust, oil, rust and other unwanted particles could be removed from the weld area, otherwise these particles may lead weld metal contamination thus resulting into some kind of weld defect. Figure 1 shows the single V-groove design used in the present work, which was

selected according to the thickness of the base material.
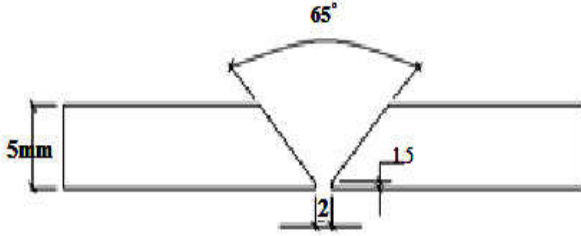
Fig. 1. Schematic showing the geometry of the single-V groove design used

C. Welding of base plates

The root pass was made with the help of AISI 304L SS solid filler wire in each joint. The diameter of the filler wire is 1.6mm and the welding parameters used for each joint during the root pass were kept constant. After the root pass to fill the groove volume three main weld passes were made with 1.6 mm diameter AISI 410 SS (ER 410) filler wire on each joint. Welding parameters are mentioned in the Table 2. Preheating was done before starting the welding operation so as to reduce the cooling rate and consequently the chances of cracking or distortion during welding. Preheating was done with the help of gas burners and temperature maintained was 150ºC approximately. During the deposition of weld beads the inter-pass temperature was 250°C approximately.

TABLE II. WELDING PARAMETERS

Condition	Weld pass	Welding Current (Ampere)	Arc Voltage (Volt)	Heat input per unit length of the weld (kJ/mm)
Root pass/ER-304L	Root pass	70	12	0.865 kJ/mm
Cover pass/ Low heat input	1st	120	12	0.972
	2nd	120	12	0.972
	3rd	120	12	0.972
Cover pass/ High heat input	1st	160	13	1.435
	2nd	160	13	1.435
	3rd	160	13	1.435

D. Post Weld Heat Treatment

The welded specimens were then subjected to post weld heat treatment (PWHT) to analyze the effect of post weld heat treatment on the mechanical performance of the welded joint. In post weld heat treatment the specimens were heated at 740°C for 90min. in insulated muffle furnace followed by the slow cooling in furnace.

E. Mechanical Testing of the Welded Joints

This section discusses the details about the mechanical testing of different welded samples in as welded as well as post weld heat treatment condition. In order to determine the mechanical properties of the welded specimen two types of tests were used viz. tensile testing and impact testing. All the specimens were prepared using a wire-cut EDM process.

III. RESULTS

This section presents the results of the experimentation, mechanical testing (tensile test and impact test) of different welded specimens. The results thus obtained have been analyzed and discussed under appropriate headings.

A. Transverse tensile testing

The results of the transverse tensile testing of different welded specimens are mentioned in Table III. These specimens were prepared according to ASTM E-08 (Tension testing of metallic materials). The values reported correspond to the average of three tensile specimens for each joint in the as welded and subjected to post weld heat treatments. The observations recorded after carrying out tensile testing on these specimens were ultimate tensile strength (UTS), percentage elongation and location of fracture. Each specimen was tested on a hydraulically controlled universal testing machine. It is observed from the results of transverse tensile testing that the location of fracture in all the specimens was in the base metal which indicates that the joint efficiencies of more than 100%.

TABLE III. TRANSVERSE TENSILE TESTING RESULTS

Heat input	Specimen condition	UTS value (MPa)	% Elongation
Low	As welded	791.56	13.15
	PWHT	829.67	7.04
High	As welded	718.81	16.22
	PWHT	732.87	9.07

However the maximum UTS value obtained was 829.67MPa but with a reduced % elongation of 7.04% corresponding to low heat input welded specimen in post weld heat treatment condition. Maximum ductility was 16.22% recorded of the high heat input welded specimen in as welded condition with 718.81 MPa UTS value. The main trend as indicated by these joints is that low heat input and PWHT as used in the present work improves the tensile performance of these joints. However this strength increase occurs at the expense of reduced ductility. The main reason for this trend followed by the joints is that, corresponding to joint fast cooling rate, thus resulting into fine grained microstructure of the weld zone which increases the UTS value of this joint. Further, tempering effect is induced into the welded joint by the PWHT which forms the tempered martensite.

B. Analysis of Charpy impact testing results

Charpy V-notch impact test was conducted at room temperature. Specimens (three specimens in the as welded condition and three specimens subjected to post weld heat treatment) were taken from each welded plate and were prepared in accordance with ASTM E-23 standard (Impact toughness testing for notched bar specimens) which is used for Charpy V-notch testing of metallic materials. V-notch was prepared in the weld metal on the cover pass side (top side) so as to make an assessment of the impact toughness of the weld metal. The Charpy V-notch (CVN) values indicating the impact energy absorption by each of the welded specimens were recorded.

The results obtained from this testing are mentioned in Table IV.

TABLE IV. IMPACT TESTING RESULTS

Heat input	Specimen condition	CVN Value at room temp. (Joules)
Low	As welded	115
	PWHT	127
High	As welded	107
	PWHT	112

The maximum CVN value was 127 Joules recorded, which is possessed by low heat input welded specimen in post weld heat treatment condition. And the high heat input joint in as welded condition possessed by the minimum CVN value of 107 Joules.

IV. CONCLUSIONS

Based upon the present research work the following conclusions could be drawn:

- The weld joint made using the low heat input possessed the maximum ultimate tensile strength (791.56 MPa).

- It is investigated that in the present experiment work, maximum UTS increased by 38.11 MPa for the joints fabricated with low heat input and subjected to post weld heat treatment.

- Percentage elongation (ductility) of the joint decreased due to the post weld heat treatment.

- From the results of the Charpy V-notch impact test, it is found that the maximum CVN value in as welded condition of low heat input combination is 115 Joule, and it is increased with the post weld heat treatment.

- Comparing the joints welded with two different heat inputs, concluded that the ultimate tensile strength (UTS) and impact toughness of the welded joints decreases with increases the heat input.

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Recent Development in PVD Coatings for High Performance Cutting Tools- A Review

Sanjeev Kumar	Manpreet Singh	Amandeep Singh
Dept of Mechanical Engineering	Dept of Mechanical Engineering	Dept of Mechanical Engineering
CT Institute of Engineering	CT Institute of Engineering	CT Institute of Engineering
Management and Technology,	Management and Technology,	Management and Technology,
Jalandhar, India.	Jalandhar, India.	Jalandhar, India.
sanjeev144211@gmail.com	preet_020@yahoo.com	er.amandeepbansal@gmail.com

Abstract—Now a days the manufacturing industries are trying to decrease the cutting costs, increase the quality of the machined parts and machine more difficult materials. For that different methods of machining are used along with new inventions in the cutting tool materials. Present paper gives an insight about the latest PVD coatings that are being used in the industries to improve the overall quality of the product along with reduced cost of machining. Paper gives a brief survey of different types of coatings and their effects on cutting tools. New type of coatings called Triple coatings[3®] are being used in the industries and are performing well as compared to simple, multilayered and in some cases to nano coatings as well.

Keywords—PVD; nano coating; triple coating; tool; tool life.

I. RECENT TRENDS IN MANUFACTURING BY MACHINING

The recent developments in science and technology have put tremendous pressure on manufacturing industries. The manufacturing industries are trying to decrease the cutting costs, increase the quality of the machined parts and machine more difficult materials. Machining efficiency is improved by reducing the machining time with high speed machining. When cutting ferrous and hard to machine materials such as steels, cast iron and super alloys, softening temperature and the chemical stability of the tool material limits the cutting speed. The majority of cutting tools in use today employ chemical vapor deposition (CVD) or physical vapor deposition (PVD) hard coatings.

II. PHYSICAL VAPOR DEPOSITION

Physical vapor deposition (PVD) describes a variety of vacuum deposition methods used to deposit thin films by the condensation of a vaporized form of the desired film material onto various work piece surfaces (e.g., onto semiconductor wafers).The coating method involves purely physical processes such as high-temperature vacuum evaporation with subsequent condensation, or plasma sputter bombardment rather than involving a chemical reaction at the surface to be coated as in deposition. The term physical vapor deposition originally appeared in the 1966 book Vapor Deposition by C. F. Powell, J. H. Oxley and J. M. Blocher Jr., (but Michael Faraday was using PVD to deposit coatings as far back as 1838). Physical vapor deposition coating is a product that is currently being used to enhance a number of products, including automotive parts like wheels and pistons, surgical tools, drill bits, and guns. The current version of physical vapor deposition was completed in 2010 by NASA scientists at the NASA Glenn

Research Center in Cleveland, Ohio. This physical vapor deposition coating is made up of thin layers of metal that are bonded together through a rig that NASA finished developing in 2010. In order to make the coating, developers put the essential ingredients into the rig, which drops the surrounding atmospheric pressure to one torr (1/760 of our everyday atmosphere). From there, the coating is heated with a plasma torch that reaches 17,540.33 degrees Fahrenheit. In the automotive world, it is the newest alternative to the chrome plating that has been used for trucks and cars for years. This is because it has been proven to increase durability and weigh less than chrome coating, which is an advantage because a vehicle's acceleration and fuel efficiency will increase. Physical vapor deposition coating is gaining in popularity for many reasons, including that it enhances a product's durability. In fact, studies have shown that it can enhance the lifespan of an unprotected product tenfold. Variants of PVD include, in alphabetical order:

A. Cathodic Arc Deposition: In which a high-power electric arc discharged at the target (source) material blasts away some into highly ionized vapor to be deposited onto the work piece.

B. Electron beam physical vapor deposition: In which the material to be deposited is heated to a high vapor pressure by electron bombardment in "high" vacuum and is transported by diffusion to be deposited by condensation on the (cooler) work piece.

C. Evaporative deposition: In which the material to be deposited is heated to a high vapor pressure by electrically resistive heating in "low" vacuum.

D. Pulsed laser deposition: In which a high-power laser ablates material from the target into a vapor.

E. Sputter deposition: In which a glow plasma discharge (usually localized around the "target" by a magnet) bombards the material sputtering some away as a vapor for subsequent deposition.

PVD is used in the manufacture of items, including semiconductor devices, aluminized PET film for balloons and snack bags, and coated cutting tools for metalworking. Besides PVD tools for fabrication, special smaller tools (mainly for scientific purposes) have been developed. They mainly serve the purpose of extreme thin films like atomic layers and are

used mostly for small substrates. A good example is mini e-beam evaporators which can deposit monolayer's of virtually all materials with melting points up to 3500 °C. Common coatings applied by PVD are Titanium nitride, Zirconium nitride, Chromium nitride, nitride. The source material is unavoidably also deposited on most other surfaces interior to the vacuum chamber, including the fixturing to hold the parts.Some of the techniques used to measure the physical properties of PVD coatings are:

- Calo tester: coating thickness test

- Nanoindentation: hardness test for thin-film coatings

- Pin on disc tester: wear and friction coefficient test

- Scratch tester: coating adhesion test

A. Advantages:

- PVD coatings are sometimes harder and more corrosion resistant than coatings applied by the electroplating process. Most coatings have high temperature and good impact strength, excellent abrasion resistance and are so durable that protective topcoats are almost never necessary.

- Ability to utilize virtually any type of inorganic and some organic coating materials on an equally diverse group of substrates and surfaces using a wide variety of finishes.

- More environmentally friendly than traditional coating processes such as electroplating and painting.

- More than one technique can be used to deposit a given film.

B. Disadvantages:

- Specific technologies can impose constraints; for example, line-of-sight transfer is typical of most PVD coating techniques, however there are methods that allow full coverage of complex geometries.

- Some PVD technologies typically operate at very high temperatures and vacuums, requiring special attention by operating personnel.

- Requires a cooling water system to dissipate large heat loads.

C. Application:

As mentioned previously, PVD coatings are generally used to improve hardness, wear resistance and oxidation resistance. Thus, such coatings use in a wide range of applications such as:

- Aerospace

- Automotive

- Surgical/Medical

- Dies and moulds for all manner of material processing

- Cutting tools
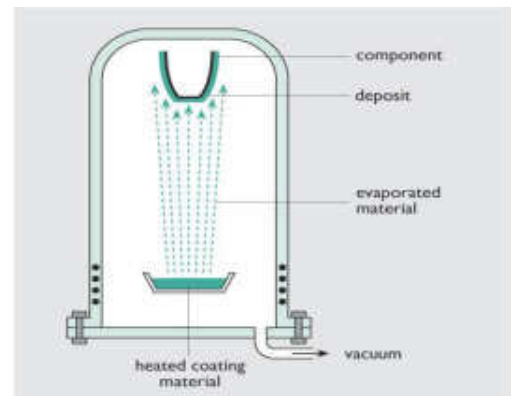
Fig. 1. PVD Coating

III. PERFORMANCE OF COATED TOOLS IN MACHINING

S. PalDey et al [1] have discussed the wear resistant properties of (Ti,Al)N for various machining applications as compared with coatings such as TiN, Ti(C,N) and (Ti,Zr)N. They have found that the high hardness (28_32 GPa), relatively low residual stress (/5GPa), high oxidation resistance, high hot hardness, and low thermal conductivity make (Ti,Al)N coatings most desirable in dry machining and machining of abrasive alloys at high speeds. Multicomponent coatings based on different metallic and nonmetallic elements such as, Cr and Y drastically improve the oxidation resistance, Zr and V improve the wear resistance, whereas, Si increases the hardness, boron improves the abrasive wear behavior and resistance to chemical reactivity of the film. The presence of a large number of interfaces between individual layers of a multilayered structure results in a drastic increase in hardness and strength. So it is possible to design new wear resistant or functional coatings based on a multilayer or a multi component system to meet the demanding applications of advanced materials.

J.G. Lima et al [2] have evaluated the machinability of hardened steels at different levels of hardness and using a range of cutting tool materials. They have proved in their result that turning of AISI 4340 steel using low feed rates and depths of cut, the forces were higher when machining the softer steel and that surface roughness of the machined part was improved as cutting speed was elevated and deteriorated with feed rate.

J.A. Arsecularatne et al [3] described an experimental investigation on machining of a difficult-to cut material, AISI D2 steel of hardness 62 HRC with PCBN tools. They have found that most of the tested PCBN tools reached the end of life mainly due to flank wear. The highest acceptable values of tool life and volume of material removal were obtained at the lowest speed tested (70 m/min) but the highest feed used resulted in the highest volume of material removal, lower feeds resulted in higher tool life values.

C.H. Che Haron et al [4] investigated the tool life and wear behavior at various machining parameters. Coated carbide (KC 9125) and uncoated carbide (K 313) were used in turning tool steel AISI D2 bar with hardness of 25 HRC and have found that the wear progression for both type of carbide tools experienced three stages of wear rate, namely; initial, gradual and abrupt stages of wear mechanism. Slow wear rate and

uniform flank wear were observed at low feed rate of 0.05 mm/rev. Generally, coated tool performed better as compared to uncoated tool. A good surface finish and longer tool life were achieved using coated tool.

Vishal S Sharma et al [5] investigated the machining AISI 52100 steel using a carbide-coated tool. It was found that the cutting force increases with the feed rate and depth of cut. The approach angle has little effect on the cutting force, and increasing the speed causes the cutting force to decrease slightly. The feed force increased with increasing depth of cut and decreased with increasing approach angle, speed, and feed rate.

CH.R. Vikram Kumar et al [6] studied the comparative performance of TiCN and TiAlN coated tools in machining of AISI 4340 hardened steel under dry, wet and minimum fluid application conditions. Both the tools performed better with minimum fluid application when compared with wet and dry machining. The performance of the TiAlN tool was observed to be better; this is particularly true with reference to wear resistance of the tools and better surface finish on the components.

P. Roy et al [7] studied the compatibility of cutting materials in dry machining of Aluminum and Al–Si alloys. They have shown that chemical inertness of diamond towards aluminium was principally responsible for outperforming an uncoated tool along with other tools coated with hard coatings like TiC, TiN, TiB2, Al2O3, and AlON.

M.A. El Hakim et al [8] They have presented the performance of four cutting tool in the machining of medium hardened HSS: polycrystallinec-cBN (c-BN-TiN), TiN coated polycrystallinec-cBN (c-BN-TiN), ceramic mixed alumina (Al2O3-TiC), and coated tungsten carbide (TiN coated over a multilayer coating (TiC/TiCN/Al2O3)) and have found that the high chemical and thermal stability of Al2O3 tribo-films protects the tool substrate because it prevents the heat generated at the tool/chip interface from entering the tool core.

IV. SINGLE AND MULTI LAYER COATED CUTTING TOOLS

J. Rech [9] found out that various coatings deposited on a carbide insert has shown the sliding properties of the TiN and (Ti, Al)N+MoS2 coatings, compared to uncoated tools in the context of high-speed dry turning of steels. TiN and (Ti, Al)N+MoS2 coatings reduce the tool–chip contact area, the thickness of the secondary shear zone and the temperature at this interface, which reduce the heat flux transmitted to the cutting tool substrate.

Renato Franc oso de A vila et al [10] tested the performance of uncoated and coated carbide tools (ISO grade K10) with a 3 _m thick monolayer of TiN (produced by PVD) when continuous turning AISI 8620 steel. Their results indicate that two distinct crater wear rates are present when machining using coated cutting tools, whereas a higher and single wear rate was identified for the uncoated inserts.

J. Rech [11] found out that coatings exhibit to the best tribological improvements compared to uncoated tools. Four complementary methods were used to qualify the performance of the tribological system with the purpose of reaching a better global understanding of the capability of coatings, chip formation mechanisms, cutting forces, and interface temperature. TiN and (Ti,Al)N+MoS2 coatings have shown the best tribological improvements compared to uncoated tools.

A. Devillez et al [12] studied the elementary orthogonal cutting process by taking different coated tools and different cutting conditions. They have used the energy dispersive X-ray analysis and white light interferometer to observe the wear mechanisms and the AlTiN coating was seems to be the best coating. Its good tribological behaviour limits welding and unstable built-up-edge phenomena, abrasive wear is also reduced by its very high hardness due to its ultra-fine crystallinity.

Recep Yigit et al [13] have done an experimental investigation on the effect of cutting speed in turning nodular cast iron with coated and uncoated cutting tools. The test showed that uncoated WC/Co tool was the worst performing tool with respect to tool wear and the worst with respect to surface finish. The multilayer TiCN+TiC+TiCN+Al2O3 +TiN-coated carbide tool with external TiN layer is the most suitable one for turning nodular cast iron, especially at high cutting speeds.

A.K. Chattopadhyay et al [14] studied the wetting characteristics of aluminum towards different cutting tool materials by using uncoated carbide (94%WC+6%Co) and mono or multi-layer coated carbide tools with top coating of TiC, TiN, Al2O3 and diamond. observed that aluminum had a tendency to wet uncoated carbide (94% WC+6%Co) inserts. However, wetting was more pronounced when surface was enriched with cobalt. Coatings like TiC, TiN or Al2O3 could not show pure non-wetting characteristics for aluminum. Turning test with aluminum indicated heavy material built up on uncoated (94%WC+6%Co) tool. Abhay Bhatt et al [33] presented the results of an experimental investigation on the wear mechanisms of uncoated tungsten carbide (WC) and coated tools (single-layer (TiAlN) PVD, and triple-layer (TiCN/Al2O3/TiN) CVD) in oblique finish turning of Inconel7 18. It was found that the abrasive and adhesive wear were the most dominant wear mechanisms, controlling the deterioration and final failure of the WC tools and the triple layer CVD coated tools exhibited the highest wear resistance at high cutting speeds and low feeds and the uncoated tools outperformed the single and multi-layer coated tools in the low range of cutting speeds and intermediate feeds.

Kyung-Hee Park et al [15] have analyzed the flank wear on the multi-layer (TiCN/Al2O3/TiCN) coated carbide inserts while turning AISI 1045 steel using advanced microscope and image processing techniques including wavelet transform, they have obtained the flank wear profiles and analyzed the surface roughness and groove sizes on the coating layers. The dominant wear mechanism was found to be the abrasion by the cementite phase in the work material. They concluded that the hardness of the coating is the most important requirement to resist flank wear due to its high wear resistance against abrasion.

R. Suresh et al [16] have analyzed the effects of process parameters on mach inability aspects by using multilayer hard

coatings (TiC/TiCN/Al2O3) on cemented carbide substrate for machining of hardened AISI 4340 and have found that the optimal combination of low feed rate and low depth of cut with high cutting speed is beneficial for reducing machining force. Higher values of feed rates are necessary to minimize the specific cutting force. The machining power and cutting tool wear increases almost linearly with increase in cutting speed and feed rate. The combination of low feed rate and high cutting speed is necessary for minimizing the surface roughness. Abrasion was the principle wear mechanism observed at all the cutting conditions.

G. Strnad et al [17] has compared thr performance of different types of PVD coatings in case of drilling in heat treated steel with different types of coatings deposited on tool. After comparison with the standard coatings the hardness decreases upon annealing to 500.....7000Cbut monoblock coatings,multilayer coatings and nanocomposite coatings remain stable up to high temperatures of 11000.they find that

V. EFFECT OF COATINGS ON TOOL LIFE

Yong Huang et al [18] have evaluated tool performance in terms of tool life based on the flank wear criterion as a function of cutting conditions, that is, cutting speed, feed, and depth of cut. They found out that cutting speed plays a dominant role in determining the tool performance in terms of tool life, followed by feed and depth of cut, and overall tendencies agree with predictions from the general Taylor tool life equation as well as experimental observations.

Reginaldo T. Coelhoa, et al [19] analysed tool wear, when turning hardened AISI 4340 with coated PCBN tools using finishing cutting conditions. They have shown the results of tool wear, cutting force and surface finish obtained from the turning operation on hardened AISI 4340 using PCBN coated and uncoated edges. Due to a combination of high hardness in the cutting temperature range and the presence of an oxidizing layer, TiAlN-nanocoating performed better in terms of tool wear and surface roughness.

R.F. Avila et al [20] analyzed cutting tool life used for cemented carbide tools is the depth of the crater (KT) located on the rake face, given as a function of the feed rate. The result brought a new approach and confirms the importance of the coating to the crater wear resistance, even if the coating has already been delaminated on the rake face.

Jeong Suk Kim et al [21] investigated that hard coatings improve the performance of cutting tools in aggressive machining applications, such as high-speed machining. Additionally, the relationship between the machining characteristics and the Si contents were investigated under various high-spindle speeds. It has shown that the tool life was improved up to 50% for the Si content

VI. TRIPLE COATINGS[3®]

T.Cselle et al [22] has introduced a new generation of Physical Vapor Deposition coatings . These coatings have the advantages of conventional and nanocomposite coatings. These are applicable for general purpose use, but particularly for high performance cutting tools. They have compared the performance of Triple coatings3® in industry for turning,

milling ,drilling and hobbing and found that for turning at traditional cutting speed Triple coatings[3®] nACo® shows similar result to different versions of AlTi-based coatings and at higher speeds TiAl-Based coatings are no longer usable. For milling cutting inserts with Cr based coating are successful for milling, for drilling the triple structure makes greater thickness possible, which is extremely useful for drilling and low scatter of the results improves the reliability of the production. In hobbing the hobs must be heated up fast and homogenously. The hobs which are expensive are normally re-ground, re-coated and re-used. To improve the coating process the coaters must make use of all advantages of all important components.

VII. CONCLUSIONS

From the literature review, it may therefore be concluded that

- Multicomponent coatings based on different metallic and nonmetallic elements improves the oxidation resistance, wear resistance, and hardness, boron improves the abrasive wear behavior and resistance to chemical reactivity.

- Most of the PCBN tools reached the end of life mainly due to flank wear. The highest acceptable values of tool life and volume of material removal were obtained at the lowest speed tested (70 m/min) but the highest feed used resulted in the highest volume of material removal, lower feeds resulted in higher tool life values.

- Hard coatings improve the performance of cutting tools in aggressive machining applications .also the tool life was improved up to 50% for the Si content.

- For turning at traditional cutting speed Triple coatings[3®] nACo® shows similar result to different versions of AlTi-based coatings and at higher speeds TiAl-Based coatings are no longer usable. For milling cutting inserts with Cr based coating are successful for milling, for drilling the triple structure makes greater thickness possible, which is extremely useful for drilling and low scatter of the results improves the reliability of the production

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A Review of Effect of Shielding Gases on Mechanical Properties of Low Carbon Steel in GMAW Process

Nischal Chhabra
Dept. of Mechanical Engineering
CT Polytechnic College, Shahpur,
Jalandhar, India
nischalchhabra@gmail.com

Surinder Kumar
Dept. of Mechanical Engineering
CT Polytechnic College, Shahpur,
Jalandhar, India

Jatinder Kumar
Dept. of Mechanical Engineering
CT Institute of Engg., Management and
Technology, Jalandhar, India

Abstract- Gas metal Arc Welding (GMAW) process is widely used for fabrication of wide variety of materials. This process is versatile because it can be applied for all welding positions. Industries as well as researchers are in full swing to improve the properties and quality of the welded joint. The selection of the shielding gas is a very tedious work because it effect the mode of metal transfer, arc heat, melting rate of electrode, current setting etc. Lot of research work has been done regarding the effect of shielding gases on the welded joint characteristics on the GMAW process. Based on the study of various works, the present paper provides a review of the effect of Ar+CO_2 and Ar+CO_2+O_2 (different proportions) on the mechanical properties, inclusion and microstructure.

Keywords: GMAW process; shielding gas; mechanical properties; inclusion and microstructure.

Nomenclature			
GMAW	Gas Metal Arc Welding	CO_2	Carbon Dioxide
UTS	Ultimate tensile strength	O2	Oxygen
YS	Yield Strength	FZ	Fusion zone
Ar	Argon	HAZ	Heat affected zone

I. INTRODUCTION

The gas metal arc (GMA) welding process is a welding process that yields coalescence of metals by heating with a welding arc between continuous filler metal (consumable) electrode and the work piece. Molten weld pools and electrode wire are protected from contaminants in the atmosphere by a shielding gas obtained from various combinations (Kim et al.).

The quality, efficiency and overall operating acceptance of the welding operation are strongly dependent on the shielding gas, since it dominates the mode of metal transfer. The shielding gas not only affects the properties of the weld but also determines the shape and penetration pattern as well. The shielding gas also affects the residual contents of hydrogen, nitrogen and oxygen dissolved in the weld metal (Liao et al.).

Various techniques such as gas, slag, gas and slag, vacuum and self-protection can be used to protect the weld pool during the fusion welding. Obviously, different protection techniques provide different degrees of weld pool protection (Kacar et al.).

The composition of a shielding mixture in arc welding depends mostly on the kind of material to be welded. The selection of the shielding gas should, by all means, take into account chemical–metallurgical processes between the gases and the molten pool that occur during welding (Ates et al.).

Increasing the parameters value of welding current increased the value of depth of penetration. Other than that, arc voltage and welding speed is another factor that influenced the value of depth of penetration (Ebrahimnia et al.).

The neural networks can be used as an alternative way for calculating the gas mixture according to the presented conventional calculation method. Gas mixtures (Ar, O_2 and CO_2) were used in the input layer and, tensile strength, impact strength and elongation of the weld metal hardness were used in the output layer (Karadeniz et al.).

From the previous study with an MIG or GMAW welding process, it observed that the depth of penetration increased when the welding current is increased but decreased with decrease in voltage and the penetration increased when arc travel rate decreased until it attained a minimum value depends on the arc power (Ibrahim et al.).

The experimental results showed that activating flux aided GMAW increased the weld area and penetration and tended to reduce the angular distortion of the weldment. The $MgCO_3$ flux produced the most noticeable effect. Furthermore, the welded joint presented better tensile strength and hardness (Huang et al.)

Lot of search work has been done in this area. The present paper provides a review on the effect of combined shielding gases on the mechanical properties after study of various research works done in the field. An effect of shielding gas compositions (Ar+CO_2+O_2) on HSLA steel determines the inclusion characteristics, microstructure and mechanical properties. The influence of variation in the shielding gas composition (Ar + CO_2) on the weld properties of the steel ST 37-2 was investigated. The compositions of the test materials are presented in the table 1. Four shielding gas compositions were 97.5% Ar + 2.5% CO_2, 90% Ar +

10% CO_2, 82% Ar + 18% CO_2, 75% Ar + 25% CO_2 used for ST 37-2 material. For HSLA steel the composition of the shielding gas was 80% Ar + 18% CO_2 +2%O_2, 80% Ar + 17% CO_2 +3%O_2, 80% Ar + 16% CO_2 +4%O_2, 80% Ar + 15% CO_2 +5%O_2. For both of the base metal materials, ER70 S-6 filler metal was used whose composition is given in table 2.

TABLE 1 COMPOSITION OF TEST MATERIALS

Designat-ion	Chemical Composition, max wt%					
	C	Mn	P	S	Si	Fe
ST 37-2	0.113	0.417	0.007	0.01	0.024	Bal
HSLA	0.14	1.33	0.026	0.005	0.44	Bal

TABLE 2 CHEMICAL COMPOSITIONS OF ER 70S-6

Designat-ion	Chemical Composition, max wt%				
	%C	%Mn	%Si	%P	%S
ER 70S-6	0.06-0.15	1.40-1.85	0.80-1.15	0.025 max	0.035 max

TABLE 2 CHEMICAL COMPOSITIONS OF ER 70S-6 (CONTINUOUS)

Designat-ion	Chemical Composition, max wt%				
	%Ni	%Cr	Mo	V	Cu
ER 70S-6	0.15 max	0.15 max	0.15 max	0.03 max	0.5 max

For welding of ST 37-2, the flow rate of the shielding gas was set steadily at 10 L/min. The welding was performed in constant voltage mode with automatic wire feeding. Welding voltage, welding current and arc travel speed were 20 V, 180 A, 30 cm/min respectively.

II. EFFECT OF CO_2 ADDED TO THE SHIELDING GAS ON THE WELD METAL TOUGHNESS

According to the fig 1, toughness of the samples first increases for both of the temperature and then remains constant at room temperature but there is a slight fall in value at -10°C. This variation in charpy absorbed energy by the samples corresponds to the microstructure and inclusion and porosity in the weld metal.
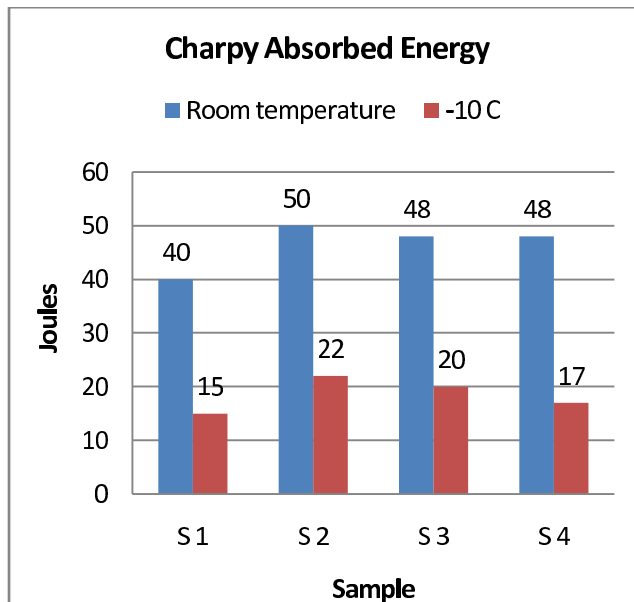
Fig 1 Charpy absorbed energy

Oxide inclusions are the reasons for promoting accicular ferrite and it leads to improvement for the toughness of the material. The energy absorbed by the specimen increases with the increase of volume fraction of accicular ferrite in the weld metal. There are three types of phase structures were formed namely accicular ferrite (AF), widmanstatten ferrite (WF) and polygonal ferrite (PF). Among these AF has the higher toughness. The interlocking nature of accicular ferrite together with its fine grain size provides the maximum resistance to crack propagation by cleavage. Increasing of CO_2 tend to reduction in the amount of inclusion compensates the effect of decreasing of the accicular ferrite.

III. EFFECT OF CO_2 TO THE SHIELDING GAS ON MICRO HARDNESS

Fig 2 shows that all the samples have higher toughness in the Heat affected zone (HAZ) compared to fusion zone (FZ) and base metal. As the percentage of the CO_2 increased, the value of micro hardness lowered successively. Sample numbered 1 has shown maximum hardness compared to sample 2 and this trend was followed for the sample 3 and sample 4. Decrease in the value of hardness is due to lower amount accicular ferrite and more amount of WF and PF. As the percentage of CO_2 increased, it leads to lower amount of inclusion which can be the reason for lower hardness of fusion zone for sample 3 and 4.
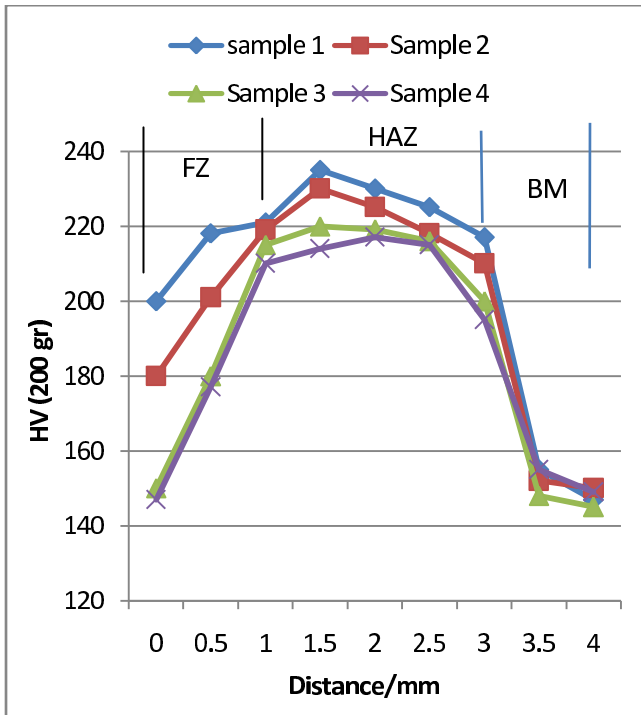
Fig 2 Hardness profile along the cross section

IV. EFFECT OF CO_2 ADDED TO THE SHIELDING GAS ON THE WELD POOL SHAPE

The picture of depth of weld pool depicts that with the increase of amount of CO_2 of the shielding gas, it is stated that depth of penetration increases with the increase of carbon dioxide.
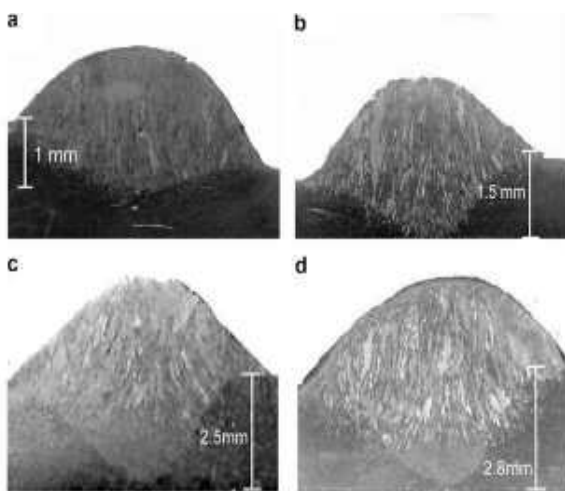
Fig 3 Cross-section of the weld pool samples

The temperature of the arc will increase due to higher dissociation and ionization potential of the carbon dioxide in the shielding gas.

V. EFFECT OF CO_2 & O_2 ADDED TO THE SHIELDING GAS ON INCLUSION

In micrograph of unetched samples, the black spot are inclusions and porosity. It decreases with increase of carbon dioxide in the shielding gas composition.
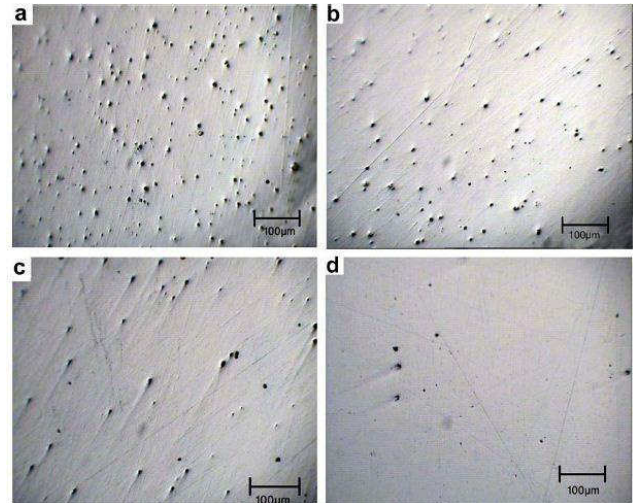
Fig 4 Comparison between the amounts of inclusion in different samples

The volume fractions of inclusion in four samples which are welded by solid filler wire are presented in the fig 5. The figure elaborates that increasing the oxygen percentage in the shielding gas from 2% to 5%, the size of the inclusion increased from 0.4 to 0.8 µm and volume
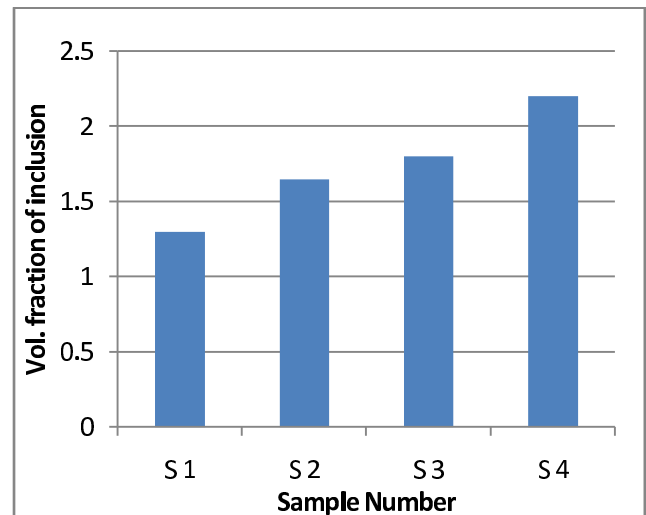
Fig 5 Volume fraction of inclusion of weld metals

fraction increased from 0.0012 to 0.0022. The varying levels of manganese, silicon, aluminium, titanium, etc. in the inclusions are evident. Increasing the oxygen activity of the shielding gas increased the weld metal shielding content, as represented by the volume fraction of inclusion. Since most of the oxygen will combine with other elements to form oxides due to its low solubility in iron.

VI. EFFECT SHIELDING GAS MIXTURE ON TENSILE PROPERTIES OF THE WELD

The yield strength of the weld metal progressively increased with increasing oxygen content (up to 5%) in the shielding gas. On the other hand, Ultimate tensile strength (UTS) increased with increasing oxygen content up to 4% oxygen

and then decreased with further increasing oxygen content. A similar pattern can be observed for the toughness that when the oxygen content is increased up to 4% promotes toughness at both of the temperature and then its values falls at 5% oxygen content.

Sample No.	YS MPa	UTS MPa	%EL	Charpy impact toughness (J) At 27° C	At -30° C
S1	265	504	12	84	31
S2	277	543	14	87	32
S3	287	600	14	98	37
S4	289	567	10	88	31

Increase in YS and UTS with oxygen content increasing from 2% to 4% could be attributed to the increase in the proportion of AF due to its fine grain size and high dislocation density. However, a decrease in UTS and % elongation at 5% oxygen content, despite having a high proportion of AF, probably indicates that long ferrite veins which decorate the prior austenite grain boundary acts as a preferential crack path through the microstructure

VII. CONCLUSION

In view of the results presented, the following points can be concluded

- The value of toughness first increases and then remains constant with the increase in the amount of carbon dioxide in the shielding gas. The oxygen content has also increased the toughness but up to 4% oxygen and thereafter its value went down. Oxide inclusions considered to be the reasons for higher toughness because it promotes accicular ferrite.
- The weld metal micro hardness decreases with the increase of carbon dioxide content. Decrease in the value of micro hardness accompanied by the lower amount of accicular ferrite.
- The depth of penetration increases with the increase of carbon dioxide content and this is due to increase of temperature of an arc.
- Increase the content of oxygen increases the amount of inclusion but decreases with increase of carbon dioxide.
- Yield strength and UTS increases with increasing oxygen content from 2% to 4%. However, a decrease in UTS at 5% oxygen content.

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Optimization of Multiple Performance Characteristics in EDM using Taguchi Method: An Experimental Investigation

Jatinder Kumar
Dept of Mechanical Engineering
CT Institute of Engineering Management
and Technology,
Jalandhar, PB.
jatinderbahal@gmail.com

Harjit Singh
Dept of Mechanical Engineering
CT Institute of Engineering Management
and Technology,
Jalandhar, PB
harjit_juneja@yahoo.co.in

Rahul Joshi
Dept of Mechanical Engineering
CT Institute of Engineering
Management and Technology,
Jalandhar, PB
rahul9599mech@rediffmail.com

Abstract- Machining is a flexible shaping process of major importance for component manufacturing industries. The importance of machining in modern automated manufacturing systems has in fact increased due to the significant increases in the production times and the need to offset the high capital investment in these modern systems. When accuracy is of major factor in machining components, Electrical Discharge Machining (EDM) is widely used in to machine conductive materials in desired shape. Selection of optimum machining parameter combinations for obtaining higher accuracy is a challenging task in EDM due to the presence of large number of process variables and intricate stochastic process mechanisms. In this paper, the effects of various process parameters of die EDM like peak current (IP), pulse on time (TON), machining time (MT) and polarity have been investigated to reveal their impact on material removal rate of HCHCr (D2 steel) using Taguchi's L 18 Orthogonal Array (OA) designs. The optimal set of process parameters has also been predicted to maximize the material removal rate. The experimental result reveals that the significance factors of material removal rate (MRR) are Polarity, Peak Current and Machining Time whereas Pulse on time is not much significant.

Keyword: EDM, MRR, T_{ON}, T_M, Peak Current, polarity.

I. INTRODUCTION

Extensive study, analysis and research work has been done in the field of EDM. The basis of EDM can be traced as far back as 1770, when English chemist Joseph Priestly discovered the erosive effect of electrical discharges or sparks. However, it was only in 1943 at the Moscow University where Lazarenko and Lazarenko exploited the destructive properties of electrical discharges for constructive use. They developed a controlled process of machining difficult-to-machine metals by vaporizing material from the surface of metal. The Lazarenko EDM system used resistance–capacitance type of power supply, which was widely used at the EDM machine in the 1950s and later served as the model for successive development in EDM.
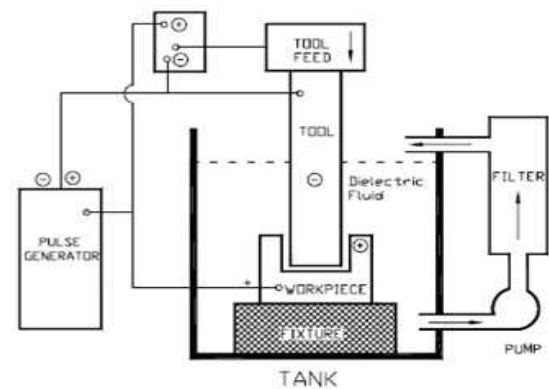
Fig. 1.   Material Removal Mechanism

There have been similar claims made at about the same time when three American employees came up with the methods of using electrical charges to remove broken taps and drills from hydraulic valves. Their work became the basis for the vacuum tube EDM machine and an electronic-circuit servo system that automatically provided the proper electrode-to-work piece spacing (spark gap) for sparking, without the electrode contacting the work piece. Since then a lot of research has been done in this field. Various theories have been put to explain the process thoroughly, but mechanism of EDM is still arguable. In the following the important work related to the surface quality improvement, surface alloying in EDM process has been reviewed.

A two-dimensional axi-symmetric numerical (FEM) model of single spark EDM process developed based on more realistic assumptions such as Gaussian distribution of heat flux, time and energy dependent spark radius, etc. to predict the shape of crater, material removal rate (MRR) and tool wear rate (TWR). A comprehensive ANN based process model was proposed to establish relation between input process conditions (current, discharge voltage, duty cycle and discharge duration) and the process responses (crater size, MRR and TWR) .The ANN model was trained, tested and tuned by using the data generated from the numerical (FEM) model. It was found to accurately predict EDM process responses for chosen process conditions.

The developed ANN process model was used in conjunction with the evolutionary non-dominated sorting genetic algorithm II (NSGA-II) to select optimal process parameters for roughing and finishing operations of EDM (Joshi and Pande (2011). Regular cutting experiments were carried out on die-sinking machine under different conditions of process parameters. The system model was created using counter-propagation neural network using experimental data. This system model was employed to simultaneously maximize the material removal rate as well as minimize the surface roughness using simulated annealing scheme. Finally consistency of the method was tested with several initial trail values. (Seung et. al.(2009). The model and optimization of process parameters in Electro-Discharge Machining (EDM) of tungsten carbide-cobalt composite (Iso grade: K10) using cylindrical copper tool electrodes carried out. Four independent input parameters, viz., discharge current (A: Amp), pulse-on time (B: μs), duty cycle (C: %), and gap voltage (D: Volt) were selected to assess the EDM process performance in terms of material removal rate (MRR: mm3/min), tool wear rate (TWR: mm3/min), and average surface roughness (Ra: μm). Response surface methodology (RSM), employing a rotatable central composite design scheme, was used to plan and analyze the experiments. For each process response, a suitable second order regression equation was obtained applying analysis of variance (ANOVA) and student t-test procedure to check modeling goodness of fit and select proper forms of influentially significant process variables (main, two-way interaction, and pure quadratic terms) within 90% of confidence interval (p-value≤0.1) It was mainly revealed that all the responses are affected by the rate and extent of discharge energy but in a controversial manner. The MRR increases by selecting both higher discharge current and duty cycle which means providing greater amounts of discharge energy inside gap region. The TWR can be diminished applying longer pulse on-times with lower current intensities while smoother work surfaces are attainable with small pulse durations while allotting relatively higher levels to discharge currents to assure more effective discharges as well as better plasma flushing efficiency. The outcomes of present research prove the feasibility and effectiveness of adopted approach as it can provide a useful platform to model and multi-criteria optimize MRR, Ra, and TWR during EDMing WC/6%Co material. (S. Assarzadeh and M. Ghoreishi (2013). Authors studied metal transfer from the powder compact tool electrode in EDM by cross-sectional examination, electron spectroscopy for chemical analysis and X-ray diffraction analysis of the work surface. The associated changes in the surface topography were analyzed by scanning electron microscopy and the harmonic contents of the surface profiles. (Gangadhar A., et al 1991). Authors presented a new method of surface modification by electrical discharge machining using composite structured electrode. Surface modifications on work pieces of carbon steel or aluminum were carried out in hydrocarbon oil using composite electrodes. Copper, aluminum, tungsten carbide and titanium were used as electrode material. It was revealed that there is electrode material

in the work surface layer and the characteristics of the surface of work material remarkably changed. These surfaces have fewer cracks, higher corrosion resistance and wear resistance.(Mohri N., et al 1993). Authors investigated the effect of Titanium Nitride (Ti-N) coating by physical vapor deposition (PVD) on the fatigue life of AISI D2 tool steel. The specimen coated by Ti-N exhibited considerably increased hardness, a better surface finish, and decreased super facial tensile residual stress on the surface, increasing their fatigue limit (Guu Y.H., et al.2005). Authors described a new method of surface modification by EDM. By using an ordinary EDM machine tool and kerosene fluid, a hard ceramic layer can be created on the work piece surface with a Ti or other compressed powder electrode in a certain condition. This revolutionary new method is called electrical discharge coating (EDC). The process of EDC begins with electrode wear during EDM, and a kind of hard carbide is created through the chemical reaction between the worn electrode material and the carbon particles decomposed from kerosene fluid under high temperature. The carbide is piled up on a work piece quickly and becomes a hard layer of ceramic of about 20 μm thickness in several minutes. This paper studies the principle and process of EDC systemically by using a Ti powder green compact electrode. Experiments and analyses show that a compact Ti-C ceramic layer can be created on the surface of the metal work piece. The hardness of the ceramic layer is more than three times higher than that of the base body, and the hardness changes gradually from the surface to the base body. This method can find wide application in the fields of surface modification, such as the surface repairing and strengthening of cutting tools and molds (Wang Z. L., et al., 2002). Authors reviewed published work on deliberate surface alloying of various work piece materials using EDM and have given the details of operations involving PM tool electrodes and use of powders suspended in the dielectric fluid, typically aluminum, nickel, titanium, etc (Simao J., et al., 2002). in this paper the author has studied the surface characteristics and machining damage caused by EDM on AISI D2 tool steel work piece. This indicates that thickness of recast layer and surface roughness are proportional to the power input.(Guu Y.H. et al., 2003). A multiple regression model and modified Genetic Algorithm model were developed as efficient approaches to determine the optimal machining parameters in electric discharge machine. In this , working current, working voltage, oil pressure, spark gap, Pulse On Time and Pulse Off Time on Material Removal Rate (MRR) and Surface Finish (Ra) were studied. Empirical models for MRR and Ra were developed by conducting a designed experiment based on the Grey Relational Analysis. Genetic Algorithm (GA) based multi-objective optimization for maximization of MRR and minimization of Ra carried out by using the developed empirical models. Optimization results were used for identifying the machining conditions. For verification of the empirical models and the optimization results, focused experiments were conducted in the rough and finish machining regions. (R. Rajesh and M. Dev Anand (2012). Authors optimized the surface roughness of die sinking electric discharge

machining (EDM) by considering the simultaneous affect of various input parameters. The experiments were carried out on Ti6Al4V, HE15, 15CDV6 and M-250. Experiments were conducted by varying the peak current and voltage and the corresponding values of surface roughness (SR) were measured. Multiperceptron neural network models were developed using Neuro Solutions package. Genetic algorithm concept is used to optimize the weighting factors of the network.. Sensitivity analysis was also done to find the relative influence of factors on the performance measures. It was observed that type of material effectively influences the performance measures. (Krishna Mohana Rao 2009).

The most important research work in EDM is related to metal removal rate, surface roughness, TWR and MRR. They depend on machining parameters like discharge current, pulse duration, pulse frequency, pulse off time, machining time and dielectric flow rate. In setting the machining parameters of present work, particularly in rough cutting operation, the goal is the maximization of MRR.

II. EXPERIMENTAL DETAIL

A. Workpiece material

The work piece material was high carbon high chromium steel in the form of cube of 20 mm^3 for each experiment. Table 1 indicates the chemical composition of the work material.

TABLE I. COMPOSITION OF WORK MATERIAL

Element	C	Si	Mn	Cr	W	V	Mo.
%age	1.7	0.30	0.30	12	0.5	0.10	0.60

B. Tool Material

The tool material used for each experiment is copper rod of 8 mm diameter and 12 mm length.

C. Experimental Setup

The experiment is performed at Electronica Sprincut EDM. The basic parts of the EDM machine consists of a worktable, a servo control system, a power supply and dielectric supply system. Workpiece samples as well as tool samples were weighed before and after the experiment using high precision balance machine.

D. Methodology

Taguchi (1990) design of experiment is robust and coupled with orthogonal arrays to study the entire parameter space with fewer numbers of experimental runs. This method utilizes loss function to calculate the deviation between the experimental value and the desired value. The loss function is then transformed into a signal-to-noise (S/ N) ratio. Taguchi recommends three categories of performance characteristics for the analysis of S/N ratio. They are the lower-the-better, the higher-the-better, and the nominal-the-better. The mean S/N ratio for each level of process parameters of performance

characteristics is found out and larger S/N ratio yielded the better performances. The optimal combination of process parameter is obtained taking higher S/N ratios. Finally, the optimal parameters are verified by some confirmation run to predict the improvement. The characteristic that higher value represents better machining performance, such as MRR, is called 'larger is better'. Inversely, the characteristic that lower value represents better machining performance, such as tool wear rate and surface roughness, are called 'lower is better'. Therefore, S/N ratio function for objective of larger is better and lower is better is defined in equation 1 and 2.

$$S/N_{(larger\ is\ better)} = -10\log[1/n\sum_{i=1}^{n}Y_i^{-2}] \text{----------} \quad 1$$

$$S/N_{(smaller\ is\ Better)} = -10\log[1/n\sum_{i=1}^{n}Y_i^{2}] \text{----------} \quad 2$$

Where S/N denotes the Signal and Noise ratios calculated from observed values, Y_i represents the experimentally observed value of the i^t experiment and n=1 is the repeated number of each experiment in L-18 OA is conducted.

The experimental work which consisted about formation of the Taguchi's L-18 (2*1-3*3) orthogonal array design. Design of experiment by orthogonal array reduced the total no of experiment, in this experiment total 18 run were carried out to determine the effective operating parameters on EDM. Levels for various control factors were tabulated in Table 2 through review of literature, experience and pilot study.

TABLE II. LEVELS FOR VARIOUS CONTROL FACTORS

Factor	Name	Symbol	Units	Nos. of Levels	Level Values		
					1	2	3
A	Polarity			2	Straight	Reverse	
B	Peak Current	I_P	A	3	3	5	7
C	Pulse On Time	T_{ON}	μs	3	20	40	60
D	Machining Time	T_M	mins	3	25	30	35

To evaluate the effects of machining parameters on performance characteristic (MRR), and to identify the performance characteristic under the optimal machining parameters, Taguchi's L-18 orthogonal array design is chosen.

III. OBSERVATION

The response observation table for MRR is shown in Table 3 along with the control factors.

TABLE III. CONTROL LOG OF EXPERIMENT AND RESPONSE TABLE

S.No.	Polarity (A)	Peak Current	Pulse On Time	Machining Time	MRR mg/min

		(B)	(C)	(D)	
1	S	3	20	25	39
2	S	3	40	30	43
3	S	3	60	35	44
4	S	5	20	25	35
5	S	5	40	30	53
6	S	5	60	35	59
7	S	7	20	30	48
8	S	7	40	35	65
9	S	7	60	25	46
10	R	3	20	35	49
11	R	3	40	25	31
12	R	3	60	30	35
13	R	5	20	30	34
14	R	5	40	35	29
15	R	5	60	25	32
16	R	7	20	35	41
17	R	7	40	25	43
18	R	7	60	30	48

Fig. 2.   Main effect plot for SN ratios for MRR

Average S/N ratio for every level of experiment is calculated by Taguchi method for the recorded value as shown in Table IV. Different values of S/N ratio between maximum and minimum are also shown. The factor A (peak current) and factor B (Pulse On time) are two factors that have highest different values are 2.03, 1.88 and 1.82 respectively. Based on the Taguchi prediction that the bigger different value (delta) of S/N ratio will gives a more effect on MRR or more significant. So, it can be concluded that with straight polarity increase the Machining Time and Peak current will increased the MRR significantly.

TABLE IV.   RESPONSE TABLE FOR SIGNAL TO NOISE RATIOS LARGER IS BETTER

Level	A	B	C	D
1	33.48	31.98	32.17	31.43
2	31.45	31.79	32.53	32.65
3	33.61	32.69	33.31	
Delta	2.03	1.82	0.52	1.88
Rank	1	3	4	2

In order to study the significance of the parameters in effecting the quality characteristic of interest i.e. MRR ANOVA was performed. It is found from Table V that. The significant factor of polarity is 0.031 i.e. P values less than 0.05.

TABLE V. ANALYSIS OF VARIANCE FOR MRR

Source	DF	Seq SS	Adj SS	Adj MS	F	P	%age Contribution.
A	1	18.4811	18.4811	18.4811	30.99	**0.031**	**28.76%**
B	2	12.0503	12.0503	6.0251	10.10	0.090	**18.75%**
C	2	0.8550	0.8550	0.4275	0.72	0.582	1.33%
D	2	10.9557	5.5455	2.7727	4.65	0.177	17.05%
A*B	2	5.8310	5.8310	2.9155	4.89	0.170	9.07%

IV. RESULT AND ANALYSIS

During the process of EDM, the influence of various machining parameter peak current (IP), pulse on time (T_{ON}), machining time (T_M) and polarity on MRR has shown in main effect plot for S/N ratios of MRR (Larger is better) in Fig. 2. It is clear that MRR is maximum at the 1st level of factor A and 3rd level of parameters B, C and D. The S/N ratio analysis suggests the same levels of the parameters (A_1, B_3, C_3 and D_3) as the best levels for maximum MRR.

A*C	2	4.3028	1.7649	0.8825	1.48	0.403	6.69%
B*C	4	10.6004	10.6004	2.6501	4.44	0.192	16.49%
Residual Error	2	1.1927	1.1927	0.5964			1.86%
Total	17	64.2690					
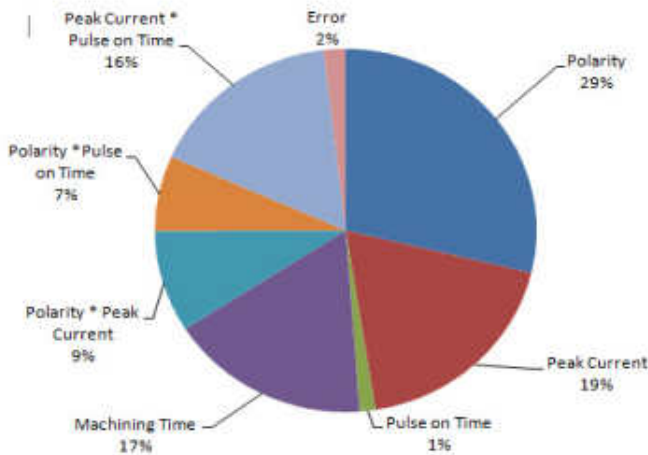
Fig. 3.   Percentage contribution for maximum MRR

V. CONCLUSION

This paper has presented an application of parameter design of the Taguchi method in the optimization of EDM process. The following conclusions can be drawn based upon the experimental results of the study:

- The maximum value of material removal rate can be obtained at different setting i.e. with straight polarity at 7 mA peak current, 6 s pulse on time with machining upto 35 mins.

- The contribution of input parameters for maximum MRR is – polarity (28.76%), Peak Current (18.75%) and machining time (17.5%)   with least contribution of pulse on time (1.79%) as shown in Fig. 3.

- The experimental results show that polarity is the main parameter among the four controllable factors that influence MRR followed by peak current and machining time. Depth of cut has no significant effect on the surface roughness.

- The experimental results also indicates that polarity is treated as the significance factor(P values less than 0.05) whereas peak current is less significant and pulse on time is least significant factor for maximization of MRR.

- The confirmatory experiment was conducted as per the best settings of maximum MRR   and result of study shows percentage increase in MRR is 4.46%.

VI. ACKNOWLEDGEMENTS

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Track 3
Technical Session : 1
Pharmaceutics

Novel Therapies for the Treatment of Amoebiasis

Sukhbir Kaur
CTIPS
Jalandhar (Punjab) India
sukhbir.ctips@gmail.com

R K Narang
ISF College of Pharmacy,
Moga, Punjab, India

T R Bhardwaj
ISF College of Pharmacy,
Moga, Punjab, India

Abstract- Amoebiasis is a gastrointestinal disease caused by one celled microscopic parasitic amoeba called Entamoeba histolytica. Worldwide approximately 50 million cases of invasive E. histolytica disease occur each year, with up to 70,000 deaths. Entamoeba histolitica exists in two forms as active parasite is trophozoite and dormant parasite is cyst. It is transmitted by the fecal-oral route. The cyst passes through the stomach unharmed and reaching the alkaline medium of the intestine and reside and multiply in the colon. The most of the conventional drug delivery system available do not release sufficient amount of the drug for the eradication of the infection so novel drug delivery system are to be designed to local and systemic clearance of the protozoal infection.

Key words: Amoebiasis, Entamoeba histolytica, colon delivery, nanoparticles, mucoadhesive.

I. INTRODUCTION

Amoebiasis is a gastrointestinal disease caused by one celled microscopic parasitic amoeba called Entamoeba histolytica. Entamoeba histolytica exists in two forms i.e. infective cyst and more fragile pathogenic trophozoite. The cyst lives in the colon (Mulla et al., 2010). Worldwide approximately 50 million cases of invasive E. histolytica disease occur each year, with up to 70,000 deaths. Amoebiasis is second to malaria in terms of mortality due to protozoan parasites. Which represent only 10-20% of infected individuals become symptomatic? Prevalence rates of amoebiasis are highest in developing countries. In Asia particularly India, Indonasia, Africa and Central America are most affected. The incidence reported from different parts of India varies from 0.2-10.8% .These difference may be either due to variation in incidence in different areas or in the availability of expertise in stool examination of the children those below the age of 6 years are much less frequently infected than those between 6 to 12 years [1]. The occurrence is worldwide, but high group includes (URL-1) Patients in institutions for the intellectually disabled, male homosexuals, People living in area with poor sanitation and travelers returning from developing countries.

A. Transmission:

Amoebiasis is usually transmitted by the fecal-oral route (as shown in Fig. No.1). Infection is spread through ingestion of the cyst form of the parasite, a semi-dormant and hardy structure found in feces. The non-encysted amoebae, or trophozoite, die quickly after leaving the body they are rare the source of new infections [2].
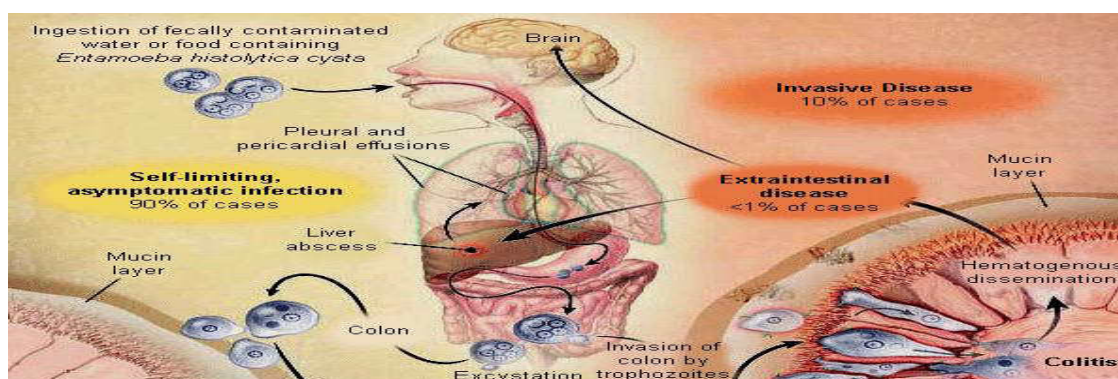
Figure No. 1: Transmission of Entamoeba histolica in human body

B. Morphology:

E. histolitica exists in two forms as active parasite is trophozoite and dormant parasite is cyst:

Table No. 1: Differences between trophozoite and cyst

S. No	Trophozoite	Cyst
1	Non infective	Infective
2	Exist inside the host & in fresh feces	Exist outside the host
3	Consist one nuclei	Consist four nuclei
4	Motile	Non- motile

C. Pathophysiology:

The cyst passes through the stomach unharmed. Upon reaching the alkaline medium of the intestine, the metacyst begins to move within the cyst wall, which rapidly weakens and tears. The quadrinucleate amoeba emerges and divides into amebulas that are swept down into the ceacum. Mature cyst in the large intestines leaves the host in great numbers and the host remains asymptomatic. The cyst can remain viable and infective in moist and cool environment for at least 12 days and in water for 30 days.

D. Clinical Manifestation:

90% of the infected people with Entamoeba histolytica infection do not have any symptoms of the disease and spontaneously clear their infection while remaining 10% develop invasive disease (Stanlay, 2003). About 3-10% of untreated people with asymptomatic infection coming from areas endemic for amoebiasis develop symptoms of invasive amoebic disease within one year of infection. Intestinal amoebiasis commonly present as ulcer or inflammation of the colon. This result in complete spectrum of colonic signs and symptoms ranging from non bloody diarrhea to dysentery (acute diarrhea with bloody stool) to necrotizing colitis with intestinal inflammation and peritonitis which is infection of abdominal cavity membrane .

Amoebic dysentery is diarrhea with visible blood and mucus in stool and presence of trophozoites with ingested red blood cells. Sigmoidoscopic examination shows inflamed mucosa with or without distinct ulcers.

Non dysenteric amoebic colitis presents as recurrent bouts of diarrhea with or without mucus but no visible blood and presence of E. histolytica cyst or trophozoites in stool. Sigmoidoscopic examinations are usually normal.

The most sever Complication of amoebic colitis is fulminant or necrotizing colitis. It occurs in 0.5% of the cases. In necrotizing colitis, there is perfuse bloody diarrhea, fever, abdominal pain, severe injury of bowel wall, intestinal hemorrhage and perforations [3] .Young children, mal-nutrition individual, pregnant woman are at more risk to invasive diseases.

E. Diagnostic Methods:

(a) Microscopic tests.

(b) Molecular tests.

(a) Microscopic tests: Stool sample strongly suggests Entamoeba histolytica infection.

(b) Molecular diagnostic tests: Two new test methods that involve ELISAs to detect antigens in stool samples. PCR and Serological method are able to distinguish accurately between infection with Entamoeba histolytica and Entamoeba dispar.

F. Control of amoebiasis:

The control of amoebiasis can be achieved by national and international programs for the improvement of sanitation, water supply and food safety, until such programs become reality in regions endemic for amoebiasis, it is not possible to control the disease.

G. Preventive Measuress:

The preventive measures to control this disease require comprehensive approach. Successful prevention could be achievable through:

- Public education on public and individual hygiene, sanitary dumping of feces and food usage

- Provision of potable water devoid of fecal contamination.

- Chemoprophylaxis focused mainly on the treatment of chronic cyst passers.

- Education of high threat group on sexual and other consistent practice that support oral fecal transmission.

- Washing of fruits and vegetables using efficient disinfectants before consumptions.

II TREATMENT AVAILABLE FOR AMOEBIASIS

Table No. 2: Drugs used in the treatment of amoebiasis

S. No	Class of amoebiasis	Drugs used
1	Luminal amoebicides (a) Direct acting luminal or contact amoebicides. (b) Indirect acting amoebicides	Halogenated hydroquinolones e.g. diodoquine and clioquinol. Dichloroacetamides e.g. mebinol and mantomide. Pentavalent arsenicals e.g. stovarsol Antibiotics such as paromomycin Tetracycline
2	Tissue amoebicides (a) Intestinal wall, liver and other metastatic lesions. (b) Liver and lungs	Emetine and Dehydroemetine 4-aminoquinolones
3	Luminal and tissue amoebicides Drugs acting on trophozoites and cysts in the lumen and trophozoites in the tissues.	Niridazole, ornidazole, Metronidazole and Tinidazole.

These drugs are to be delivered to the colon for their effective action against E. histolytica where the trophozoites reside in the lumen of the caecum and large intestine and adhere to the colonic mucus and epithelial layers.

III Marketed drugs available for the treatment of amoebiasis

Table No. 3

S.No	Brand Name	Manufacturers	Type	Dose
1	Aldezol	Albert David	Capsule/ Tablet	200mg & 400 mg
2	Aldezol	Albert David	Liquid	200mg per 5ml
3	Aristogyl	Aristo Pharmaceutical	Capsule/ Tablet	200mg & 400 mg
4	Aristogyl	Aristo Pharmaceutical	Liquid	100mg per ml
5	Avimet	Moraceae Lab	Liquid	100mg per 5ml
6	Balgyl Gel	Bal Pharma	Cream/ Gel/ Ointment	0.01%
7	Compeba	IDPL	Capsule/ Tablet	200mg
8	Flagyl	Nicholas Piramal	Capsule/ Tablet	200mg & 400 mg
9	Flagyl	Nicholas Piramal	Liquid	200mg per 5ml
10	Largyl	Lark Laboratories	Capsule/ Tablet	200mg & 400 mg
11	Largyl Gel	Lark Laboratories	Cream/ Gel/ Ointment	0.5%w/w
12	Metgyl	Jagsonpal Pharmaceuticals	Capsule/ Tablet	200mg & 400 mg
13	Metrogyl	J.B Chemicals & Pharmaceuticals	Capsule/ Tablet	200mg & 400 mg
14	Metrogyl	J.B Chemicals &	Infusion	500mg per 5ml

		Pharmaceuticals		
15	Metrogyl	J.B Chemicals & Pharmaceuticals	Liquid	200mg per 5ml
16	Metrogyl V Gel	Lekar Pharma	Cream/ Gel/ Ointment	0.01
17	Metron	Alkem Laboratories	Capsule/ Tablet	200mg & 400 mg
18	Metron	Alkem Laboratories	Infusion	5mg per 5ml
19	Metron	Alkem Laboratories	Liquid	200mg per 5ml
20	Pdzole - D	Parenteral Drugs	Infusion	500ml
21	Sprot - P	Lark Laboratories	Capsule/ Tablet	400mg
22	Sprot - P	Mapra Labs	Liquid	100mg per 5ml

II.   RECENT ADVANCES

The E. histolytica resides in the colon so specific delivery gained increasing importance for the treatment amoebiasis. Different strategies are used for targeting drugs to the colon include enzymatically degradable polymers, prodrug based approach, coating with time or pH-dependent polymers, osmotically controlled and pressure-controlled drug delivery systems. Polysaccharides that are precisely activated by the physiological environment of the colon hold great promise, as they provide improved site specificity and meet the desired therapeutic needs. The pH and transit time can vary depending on the individual and the particular disease state. The conventional approaches give rise to premature drug release. The combination/ chemically modified forms of polysaccharides eliminated the drawbacks associated with the use of single polysaccharide [4].

Mucoadhesive dosage forms may be designed to enable prolonged retention at the site of application, providing a controlled rate of drug release for improved therapeutic outcome [5]. Mucoadhesive liposomes offer a potential for improved residence time of liposomal systems targeting contact with mucosal tissues, such as in buccal, oral, colon, and vaginal drug delivery [6]

Mucus-penetrating particles[7] that may avoid rapid mucus clearance mechanisms, and thereby provide targeted or sustained drug delivery for localized therapies in mucosal tissues. Nanoparticles as large as 500 nm, if sufficiently coated with a muco-inert polymer, can rapidly traverse physiological human mucus with diffusivities as high as only 4-fold reduced compared to their rates in pure water. mucus-penetrating particle" (MPP) systems offer the prospect of sustained drug delivery at mucosal surfaces and, thus, provide hope for improved efficacy and reduced side effects for a wide range of therapeutics. The

generation of MPP loaded with nucleic acids may also greatly enhance the efficacy of this critical family of therapeutic agents. PEG being mucoadhesive, a dense PEG coating, as characterized by a near-neutral surface charge and negligible protein adsorption, improved the transport of nanoparticles by up to 3 orders of magnitude for particles in the range of 100–500 nm in size Nanoparticle (NP) Delivery Systems as carriers: NPs allowing numerous goals to be achieved: first, shielding the entrapped drugs from the harsh GI environment enabling them to reach intact the site of absorption (the gut wall), second, enhancing drug apparent water solubility being encapsulated inside colloidal nanocarriers , third, enhancing intestinal permeability of drugs once carried by NPs that are chiefly taken up by M cells known for their high transcytotic capacity and low lysosomal hydrolase activity and fourth, reducing dosing frequency [8] Solid lipid nanoparticles (SLN) novel drug delivery carriers, can be utilized in enhancing both intestinal permeability and dissolution of poorly absorbed sulpiride [9]drug. The most commonly used lipids include triglyceride esters of hydrogenated fatty acids such as tristearin, partial glycerides such as Imwitor®, and fatty acids such as stearic acid or hydrogenated palm oil.

III.   CONCLUSION

Large numbers of people are dying worldwide because of this deadly disease due to lack of proper drug delivery system for the local and systemic treatment of the infection. Currently available antiamoebic drugs suffer from drawback of less bioavailability at the site of action. This manuscript is a sincere attempt to provide latest information which may help researchers for the deve human lives.Delovepment of better drug delivery system for efficient treatment of this lethal infection to save valuable.

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Vesicular Formulation Development for Topical Delivery of Herbal Drugs for Treatment of Acne

Bhupinder Kaur
BIS College of Pharmacy,
Moga, Punjab

Mahendra Singh Rathore
MM College of Pharmacy,
MM University, Mullana,
Ambala, Haryana

Anil Kumar Sharma
CT Institute of Pharmaceutical
Sciences,
Jalandhar, Punjab

ABSTRACT: Objective: Objective of the present study was to develop an anti-acne herbal ethosomal formulation for curcuminiod with high permeability that does not already exist in the market. Methods: Nine formulations (EF1 to EF9) were developed using varying concentrations of aqueous ethanolic solutions, cholesterol, and lecithin. The developed formulations were evaluated for vesicle morphology and size, entrapment efficiency, In -vitro drug release studies through semi-permeable membrane and from isolated rat skin. Results: Results of studies showed that Formulation EF2 (30% v/v aqueous ethanolic concentration) having high entrapment efficiency that
was found to be 80.10% , cumulative release rate through semi-permeable membranes 78.28% and through rat skin was found to be 83.78%. Optimized formulation was than incorporated into gel for better patient compliance and studied for stability and was found stable. Conclusion: Results of studies suggest that herbal ethosomal formulation carries lot of potential for high permeability because the use of ethanol in formulation that is act as penetration enhancer and reach into deeper layer of skin for their better effectiveness.
Keywords: ethosomal formulation, curcuminiod, high permeability

I. INTRODUCTION

The transdermal delivery of drug presents a major challenge in formulation development, because of their absorption profile through the skin fail to deliver the drug into deep skin layer and unable to go into systemic circulation and treat the disease superficially. For such drugs ethosomal vesicular formulation provides a good alternative. The use of these vesicles (ethosomes) in transdermal drug delivery is based on the fact that they act as drug carriers to deliver entrapped drug molecules across the skin[1,2]. Ethosomes enhanced the penetration of drug due to their small size and soft, malleable structure that can easily pass through small skin pores and use of ethanol in its composition increase penetration by increasing the fluidity of lipid membrane and lipid layer of vesicle having similar structure to skin membrane and get fuse with skin lipid after penetration into skin and release the drug into systemic circulation [3]. Currently curcumin is used in number of acne formulations to treat the acne, but all these formulation are unable to deliver the drug into deep skin layer. Curcuminoid loaded ethosomes overcome this problem by penetrating into deep skin layer and cure the disease completely topically as well as superficially [4].

II. MATERIALS AND METHODS

Curcuminoid was obtained as gift sample from Natural Remedies Pvt.Ltd,Bangalore. Lecithin and Cholesterol were purchased from Hi Media Lab, Bombay, while other reagents were obtained from local market of good quality and having analytical grade.

A). PREPRATION OF ETHOSOMAL FORMULATIONS

The ethosomal formulations were prepared by dissolving the lecithin and cholesterol in equal perportion of diethyl ether : chloroform (1:1) and after that aqueous phase was added into above organic phase by maintaing the ratio of aqueous and organic phase (5:1 ratio). Then above mixture was sonicated for 10 minutes and emulsion was produced. This solvent was remevoed by using rotary evaporator while maintaining temprature at 55°C, thin film was formed and kept under vacuum to elminate the traces of organic solvent. Film hydrated with aqueous ethanol solution containing drug, then sonicated for 20 minutes. Ethosomal suspension was formed and stored under refregirator at 4±2°C[4,5,6].

Table No 1: Prepration of ethosomal formulations

Formulation Batches	Lecithin (mg)	Cholesterol (mg)	Ethanol(%ov/v)	Drug (mg)
Control 1	_	_	_	10
Control 2	_	_	30%	10
EF1	60	20	20%	10
EF2	60	20	30%	10
EF3	60	20	40%	10
EF4	60	20	50%	10
EF5	60	30	30%	10
EF6	60	40	30%	10
EF7	50	20	30%	10
EF8	70	20	30%	10
EF9	70	40	30%	10

III. RESULT AND DISCUSSION

The entrapment efficiency of curcuminoid in ethosomes was ranging from 63.57% to 80.10%. EF2 formulation showed highest entrapment efficiency that is 80.10% as compared to all other formulations (Table no.2, Figure no.1).

Table No 2: Entrapment efficiency of different formulation batches.

S.No	Formulation batches	Entrapment efficiency percentage (MEAN ± SD, n= 3)
1	EF1	75.12 ± 0.7
2	EF2	80.10± 0.2
3	EF3	45.01±4.6
4	EF4	41.49± 3.0
5	EF5	71.44±1.6
6	EF6	78.24±1.6
7	EF7	79.94±0.9
8	EF8	71.81±1.8
9	EF9	63.57±1.6
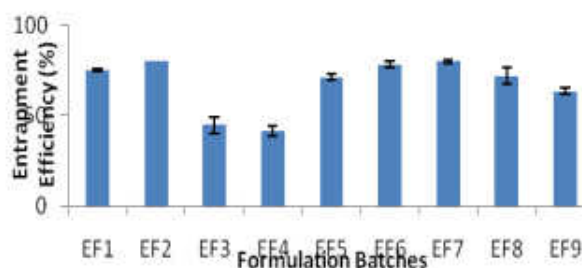
Figure No 1: Comparitive graph of entrapment efficiency of different formulations.

Table No 3: Comparative in-vitro permeation of curcuminoid

Time in hours	Control 1	Control 2	EF1	EF2	EF3	EF4	EF5	EF6	EF7	EF8	EF9
1	5.7±0.09	6.08±0.16	8.85±0.18	15.52±0.1	5.38±0.09	5.44±0.16	6.56±0.1	11.2±0.1	10.56±0.3	9.89±0.2	8.26±0.3
2	7.53±0.16	7.22±0.27	12.74±0.16	20.51±0.2	10.13±0.09	6.88±0.15	8.83±0.1	19.05±0.1	19.73±0.2	15.44±0.24	14.27±0.2
3	12.16±0.09	10.13±0.26	19.04±0.33	28.86±0.2	15.81±0.1	10.28±0.15	15.88±0.09	26.85±0.09	28.47±0.2	24.66±0.23	21.96±0.1
4	15.02±0.09	12.93±0.16	25.89±0.09	35.40±0.1	22.59±0.09	14.32±0.09	21.00±0.2	31.45±0.09	34.54±0.2	31.39±0.32	29.81±0.3
5	19.19±0.64	18.35±0.24	31.48±0.16	47.81±0.2	28.34±0.4	19.72±0.24	31.28±0.2	39.37±0.1	45.86±1	44.33±0.52	36.71±1.6
6	20.87±0.16	25.17±0.48	42.20±0.16	59.44±0.3	32.99±0.1	26.07±0.1	42.14±0.59	47.12±0.2	58.03±0.5	49.78±0.3	43.52±1.2
7	22.63±0.15	29.00±0.24	51.10±0.25	67.60±0.3	38.08±0.1	30.25±0.35	53.81±0.5	56.41±0.1	64.42±0.3	59.16±0.25	48.90±0.6
8	23.54±0.33	36.42±0.24	61.49±0.17	78.34±0.2	42.22±0.08	37.52±0.16	62.90±0.5	65.54±0.2	72.28±0.3	64.50±0.23	56.62±0.5

The in vitro drug permeation of different formulation batches through semipermeable membrane was observed after 8 hours and EF2 batch shows maximum permeation that was 78.34% as shown in Table no.3, Figure no.2.
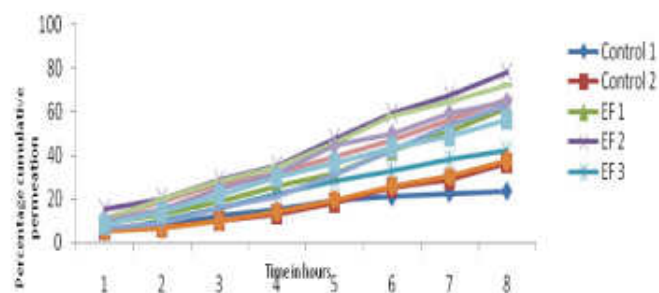
Figure No 2: Comparative in-vitro permeation of curcuminoid.

Table No 4. Comparative in-vitro permeation of different formulations through rat skin

Time in hours	Percentage Cumulative permeation of different formulation batches (MEAN ± SD, n= 3)			
	Control 1	Control 2	EF2	EF2 Gel
1	5.86±0.24	6.02±0.18	15.52±0.32	16.53±0.24
2	7.09±0.09	7.54±0.16	20.73±0.34	22.30±0.25
3	12.52±0.16	10.24±0.09	29.72±0.15	32.60±0.25
4	15.19±0.33	12.72±0.49	40.23±0.15	43.73±0.34
5	19.05±0.33	18.87±0.42	53.60±0.09	59.52±0.98
6	21.19±0.32	25.78±0.37	61.89±0.16	65.10±0.18
7	23.33±0.16	30.73±0.08	69.38±0.24	75.39±0.24
8	26.28±0.15	40.52±0.24	83.78±0.15	89.67±0.09
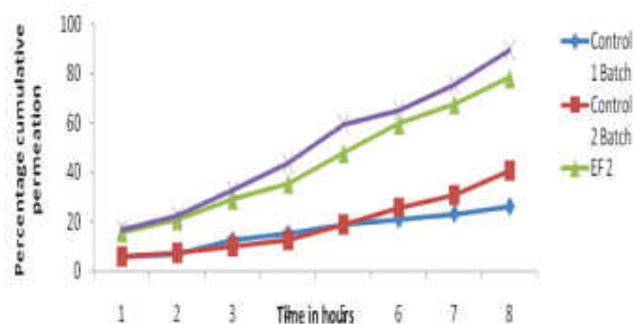
Fig.3. Comparative in-vitro permeation of different formulations through rat skin

IV. CONCLUSION

On the basis of the studies performed with respect to development of curcuminoid ethosomal formulation for the topical delivery of drug to treat the acne it could be concluded that formulation no.2 (EF2) is the best with respect to drug entrapment efficiency (80.10%) and in-vitro percentage cumulative permeation through a semi permeable membrane (78.28%). This formulation was selected further for percentage cumulative permeation through rat skin (83.78%) and for better patient compliance EF2 formulation batch was incorporated into gel then the ethosmal gel percentage cumulative permeation was checked through rat skin (89.72%) and was found stable for at least 30 days in accelerated stability studies. On the basis of comparison of different parameters of curcuminoid from EF2 formulation, it may also be inferred that curcuminoid ethosomal formulations could be good alternative to the other available marketed anti-acne formulations to treat the acne disease systemically as well as topically. However, in- vivo studies are needed to comment more in this aspect.

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Comparative Study of Regulatory Requirements for Drug Master Filing in USA and Europe

Jaspreet Kaur
Department of Pharmaceutical
Management and Regulatory Affairs
CT Group of Institutions
Jalandhar, India
jaspreet1602@gmail.com

Shrey Sharma
Delhi Institute of Pharmaceutical
Science and Research
New Delhi, India

Anil Kumar Sharma
CT Institute of Pharmaceutical Sciences,
Jalandhar, India

Abstract: A Drug Master File is a classified document prepared by a pharmaceutical manufacturer and submitted to the appropriate regulatory authority in the deliberate drug market. DMF is also containing complete information on an Active Pharmaceutical Ingredient (API) / drug substance, intermediate of drug substance, packaging material, Excipients or drug product. This document may provide detailed information about facilities, processes or articles used in the manufacturing process, packaging and storing of one or more human drug.

The Drug Master File may be utilized either by the holder who establishes the file, or by one or more additional parties in support of their application. The Drug Master filing allows a firm to protect its intellectual property from its partner while complying with regulatory requirements for disclosure of processing details. There is no regulatory requirement to file a DMF. DMF is never Approved or Disapproved. A DMF is NOT a substitute for an IND (Investigational new drug), NDA (New Drug Application), ANDA (Abbreviated New Drug Application), or Export Application. In Europe, it is known as European Drug Master File (EDMF) or Active Substance Master File (ASMF) whereas in US, it is United State Drug Master File (US-DMF).

Key Words: United State Drug Master File (US-DMF), European Drug Master File (EDMF), Drug Master File (DMF), Active Pharmaceutical Ingredient (API)

I. INTRODUCTION

Regulatory Affairs plays a crucial role in the pharmaceutical industry and is involved in all stages of drug development and also after drug approval and marketing. The drug development process is a lengthy, complex and extremely costly albeit necessary process. Regulatory affairs as the interface with health agencies and as a link between different departments in the company and also ensures the maintenance of the marketing licence and leads life cycle extension activities such as augmentation the indication of the drug, change of formulation, changes in the dosage etc.[1]

This department mainly involved in the registration of the drug products in respective countries prior to their marketing as below:

1.   Domestic Regulatory Affairs (DRA) - Country of origin

2.   International Regulatory Affairs (IRA) – Other than country of origin

A). Global Market is divided into:

1.   Regulated Market: US, EU (UK, Germany, France, Ireland, Sweden etc.), Japan, Canada, Australia, New Zealand, South Africa

2.   Semi regulated Market: (ROW Countries): Asia, African countries, Middle East countries, Latin America, CIS (common wealth of independent states) [2]

B). Introduction about Drug Master Filing

It is a document prepared by a pharmaceutical manufacturer DMF contains confidential and factual information about facilities, processes(includes drug product's chemistry, manufacture, stability, purity, impurity profile etc.) or articles used in the manufacturing, processing, packaging, and storing of one or more human drugs.DMF helps the manufacturer to keep relevant information secret and at the same time to sell the product to different customers using this drug within their final application. The information contained in the DMF may be used to support an Investigational New Drug Application (IND), a New Drug Application (NDA), an Abbreviated New Drug Application (ANDA), A DMF is NOT a substitute for an IND, NDA, ANDA, or Export Application. DMF contains complete information on an Active Pharmaceutical Ingredient (API) or finished drug dosage form.

In Europe it is known as European Drug Master File (EDMF) or Active Substance Master File (ASMF) and in US it is known as US-Drug Master file (US-DMF).

TABLE1: Overview of Common Technical Documentation (CTD) Format

Section	Particulars		
3.2.S.1	General information	3.2.S.4	Control of Drug Substance
3.2.S.1.1	Nomenclature	3.2.S.4.1	Specification
3.2.S.1.2	Structure	3.2.S.4.2	Analytical procedures
3.2.S.1.3	General properties	3.2.S.4.3	Validation of analytical procedures
3.2.S.2	Manufacture	3.2.S.4.4	Batch analysis
3.2.S.2.1	Manufacturer(s)2	3.2.S.4.5	Justification of specification
3.2.S.2.2	Description of Manufacturing Process and Process controls	3.2.S.5	Reference standards or materials
3.2.S.2.3	Control of Materials	3.2.S.6	Container Closure System
3.2.S.2.4	Control of critical steps and intermediates	3.2.S.7	Stability
3.2.S.2.5	Process validation and/or Evaluation	3.2.S.7.1	Stability summary and conclusion
3.2.S.2.6	Manufacturing Process Development	3.2.S.7.2	Post-approval Stability Protocol and Stability Commitment
3.2.S.3	Characterization	3.2.S.7.3	Stability data
3.2.S.3.1	Elucidation of Structure and other Characteristics		
3.2.S.3.2	Impurities		

C).US-DMF

In United states DMFs are submitted to the FDA. The main objective of the DMF is to support regulatory requirements and prove the quality, safety and efficacy of the medicinal product.

- DMF is required in CTD format (3.2.S)
- Module 3.2R (Regional Information) e.g. Executed Batch Production Records.

In US there are five types of DMF 's:

- Type I: Manufacturing Site, Facilities, Operating Procedures, and Personnel
- Type II: Drug Substance, Drug Substance Intermediate, and Material Used in Their Preparation, or Drug Product
- Type III: Packaging Material
- Type IV: Excipient, Colorant, Flavor, Essence, or Material Used in Their Preparation
- Type V: FDA Accepted Reference Information [NOTE: Now Four Types]

1). TYPE I DMF WITHDRAWN. [4]

TABLE2: Status of DMF: AS PER US FDA [5]

"A" = Active	This means that the DMF is acceptable for filing, and has not been closed.
"C" Complete	
"I" = Inactive	Holder or FDA has closed the DMF.
"P" = Pending	DMF is pending for Administrative Filing review
"N"	Not an assigned number.

Procedure for version numbering for the Regulatory Submissions: The version numbering to be followed for the Regulatory Submissions is as follows:

XX/AP/VN/YY-ZZ for Applicant's Part of ASMFs/EDMFs

XX/RP/VN/YY-ZZ for Restricted Part of ASMFs/EDMFs

XX/ADMF/VN/YY-ZZ for Applicant's Part of USDMFs

[Where: XX –Product code, AP - Applicant's Part, RP – Restricted Part, ADMF – Applicant's Part, VN – Version number, YY & ZZ – Month & Year of the compilation or technical modification,]

New DMF Requirements based on GUDFA

- DMF fee - when & how to pay
- Due for type II DMFs referenced for the API by an ANDA submission on or after October 1, 2012
- Required upon the first reference on or after October 1, 2012
- Paid only once during the DMF lifecycle
- Upon payment the DMF is entitled to a completeness assessment
- Upon "not failing" the completeness assessment the DMF is deemed "available for reference".
- All "available for reference" DMFs will be listed on a publicly available FDA website.
- ANDA submission can only be accepted for filing by OGD if all type II DMFs referenced for the API are "available for reference". [7]

Note: DMF fees increased from $21,340 to $31,460 [8]

D). EDMF- European Drug Master File

In Europe DMFs are submitted to EMEA. The main objective of the Active Substance Master File (ASMF) procedure, commonly known as the European Drug Master File (EDMF), is to allow valuable confidential intellectual property or 'know-how' of the manufacturer of the active substance (ASM) to be protected. In Europe the most common document for this purpose is the Active Substance Master File (ASMF) as long as the applicant has no Certificate of Suitability of the pharmacopoeial monograph (CEP). The European ASMF procedure differs significantly from the US-DMF procedure.

1). CEPs / COS

CEP stands for Certification of suitability of European Pharmacopoeia monographs. COS ("Certificate of Suitability") means the same and, even if often used, is not the official acronym. The role of the CEP is to demonstrate

that the purity of a given substance produced by a given manufacturer is suitably controlled by the relevant monograph(s) of the European Pharmacopoeia.

2). ASMFs / EDMFs

Active Substance Master File (ASMF) commonly known as the European Drug Master File (EDMF) is a submission made to European Competent Authorities and / or EMEA in support of Marketing Authorization Application [MAA] or Marketing Authorization Variation [MAV] of a medicinal product. ASMF / EDMF shall be prepared in CTD format. The scientific information in the EDMF should be physically divided into two separate parts, namely the Applicants Part (AP) and the Restricted Part (RP). The AP contains the information that the EDMF holder regards as non-confidential to the Applicant / MA holder, whereas the RP contains the information that the EDMF holder regards as confidential.

In addition to the AP and RP, the EDMF should contain a table of contents, and a separate summary (QOS) for the AP and the RP. [6]

3)). The EDMF procedure can be used for the following active substances (except biological active substances)

- New active substances

- Existing active substances not included in the European Pharmacopoeia (Ph. Eur.) or the pharmacopoeia of an EU Member State

- Pharmacopoeial active substances included in the Ph. Eur. or in the pharmacopoeia of an EU Member State

E). MARKETING AUTHORIZATION PROCEDURE IN EUROPEAN MARKET

- CENTRALIZED PROCEDURE
- MUTUAL RECOGNITION PROCEDURE
- DECENTRALIZED PROCEDURE
- NATIONAL PROCEDURE

1. CENTRALIZED PROCEDURE:

The Centralized Procedure came into being in the EU in 1995.

- Marketing authorization covers the entire EU region
- Mandatory for products developed by bio-technological processes / biotechnology-derived, genes, antibodies & high-technology medicines, New Active substances
- Dossier is submitted to EMA, evaluation is carried out by CHMP/ CVMP of EMEA
- Lays down a centralized Community procedure for the authorization of medicinal products, for which there is a single application, a single evaluation and a single authorization allowing direct access to the single market of the Community.
- A marketing authorization granted under the centralized procedure is valid for the entire Community market, which means the medicinal product may be put on the market in all Member States.

- At least seven months before submission, applicants should notify the EMEA of their intention to submit an application and give a realistic estimate of the month of submission.
- Evaluation by Rapporteur and Co-rapporteur and assessment report reviewed by two scientific experts from each member state.
- A scientific opinion is issued within 210 days of the date of filing the application. [9]

2. MUTUAL RECOGNITION PROCEDURE:

The MRP has been in place in the EU since 1995. The objective of this procedure is to obtain marketing authorizations in one or several Member States, when the medicinal product has already been granted authorization by at least one country in the European Community. [10]

3. DECENTRALIZED PROCEDURE:

The new DCP came into effect in the EU in 2005. This procedure is used to obtain marketing authorization in more than one member state but at the time of application medicinal product should not be approved in any member state.

- Similar Process as for Centralized Procedure but Selection of participating countries possible
- No possibility to withdraw application after process was started
- MRCG [Mutual Recognition Coordination Group] to coordinate process in case of different opinions

a). The decentralized procedure is divided into five steps:

- Validation step
- Assessment step I
- Assessment step II
- Discussion at the coordination group level, if needed
- National Marketing Authorization step

4. NATIONAL PROCEDURE

- Used to authorize medicinal products for local use in Individual member states
- Submit MAA to National authorities: MHRA (UK), MEB (The Netherlands), Spanish authorities (Spain) and so on
- Issued by the competent authority of the member state
- Also applicable during the initial stages of an MRP in that country which is acting as a reference member state
- Approval Time is 210 days [11]

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Design and Fabrication of Ornidazole Loaded Chitosan Microspheres for Colon Delivery

Amritpal Singh
Deptt. of Pharmaceutics
CT group of Institutions
Jalandhar, Punjab, INDIA

Anju
Deptt. of Pharmaceutics
CT group of Institutions
Jalandhar, Punjab, INDIA

Kapil Kanwar
Deptt. of Pharmaceutics
CT group of Institutions
Jalandhar, Punjab, INDIA

Sukhbir Kaur
Deptt. of Pharmaceutics
CT group of Institutions
Jalandhar, Punjab, INDIA

Abstract: The purpose of the present studies was to prepare and characterize and evaluate the colon targeted microsphere of ornidazole for the treatment and management of Amoebiasis. The microsphere was prepared by the Emulsion dehydration method. The microspheres were coated with Eudragit S-100 by the solvent evaporation technique to prevent drug release in the stomach. The prepared microspheres were evaluated for Surface morphology, entrapment efficiency, drug loading, micrometric properties and in-vitro drug release. Micrometric properties showed good flow properties and packability of prepared micorspheres.

Keywords: Emulsion dehydration method, Microspheres, Amoebiasis

I. INTRODUCTION

Microspheres are micro particles. They can be manufactured from various natural and synthetic materials like Agarose, carrageenan, chitosan, starch, albumin, collagen, poly alkyl cyano acrylates, poly anhydrides, poly methyl methacrylate etc. The idea behind Microspheres for Colon specific drug delivery system is intended because it may reduce the Systemic side effect because of low dose of the drug. The absorption of the poorly absorbed drug is increase because of increase retention time in the colon. [1, 2]. Ornidazole is used for the management of amoebiasis. Amoebiasis is an infection caused by Entamoeba histolytica with or without symptoms (WHO 1969). The aim of the study was to develop colon targeted Microsphere of Ornidazole using Chitosan, and Eudragit S-100. The significance of this research investigation is to increase absorption and bioavailability of the drug via delayed release formulation.Utilize the non-toxic and biodegradable nature of Chitosan that makes it safer for patients as compared to other synthetic polymers it is also economical.Reduce the dose and administration frequency.Reduce the incidences of adverse drug reaction

II. MATERIALS AND METHODS

Ornidazole, Chitosan and eudragit S-100 was purchased from the balaji pharmaceutical Pvt.Ltd. The Span-80, Liquid paraffin and Acetone was obtained from the central drug store.

A). Preparation of Microspheres

Microspheres were prepared by Emulsion dehydration method. Accurately weighed ornidazole and chitosan were dissolved in 1% glacial acetic acid and stirred to solublize. This drug polymer solution was dispersed in liquid paraffin containing 1.25% wt/vol span 80 stirred at 1000 rpm for 30 min to form uniform emulsion. Then acetone was added in order to dehydrate the chitosan droplets continuously stirred for 1hrs. Microspheres were formed which were dried overnight and kept in air tight container for further studies[3].

B). Coating of Microspheres

Chitosan microsphere was coated with eudragit S-100 by Solvent evaporation method. Chitosan microsphere was dispersed in Eudragit coating solution prepared by dissolution of 500mg of Eudragit S-100 in 10 ml of Ethanol: Acetone (2:1). Finally, the coated microspheres were filtered. Washed with n-Hexane, and dried in desiccators [4]

C). Evaluation of Microspheres

1). Micromeritic properties

a). Bulk density**:** Bulk density is determined by following formula

$$\textbf{Bulk density} = M/Vb$$

M = Mass of microspheres (g)
Vb = volume of microspheres (after three tapping)

b). Tapped density: Tapped density is determined by following formula.

$$\textbf{Tapped density} = m/vt$$

m = mass of microspheres (g)
Vt= volume of microspheres (final tapped volume)

c). *Carr's Index*: It is determined by following formula.

$$\textbf{Carr's Index} = \frac{\text{tapped density} - \text{bulk density}}{\text{tapped density}} \times 100$$

d). Hausner ratio: It is determined by following formula.

$$\textbf{Hausner ratio} = \frac{\text{tapped density}}{\text{buk density}}$$

e). Angle of repose: Determination of angle of repose of chitosan microspheres were carried out by employing fixed funnel method.

Angle of repose θ = Tan-1(h/r)

h=height of pile, **r=** radius of pile

f). Percentage yield: The measured amount was divided by total amount of all non volatile component which were used for the preparation of microspheres.

%yield= Actual weight of product **/** total weight of drug and polymer * 100

g). Drug entrapment: In 100ml of volumetric flask 100mg of microspheres were crushed taken and dissolved with 6.8 pH phosphate buffer and stirred for 24 hrs. after stirring the solution was filtered through whatman filterpaper and from the filtrate appropriate dilution were made and absorbance was measured at 317nm by using shimadzu 1700 UVspectrophotometer.

%Drug entrapment =$\frac{\text{amount of drug actually present}}{\text{theoratical weight of the drug}}$X100

h). FTIR Spectroscopy: FTIR spectra of Ornidazole, Chitosan, Eudragit S-100 and mixture of Ornidazole, Chitosan, Eudragit S-100 was taken by using Bruker Infrared spectrophotometer.

III.   RESULT AND DISCUSSION

A). Micromeritic properties

The values of micromeritic properties Carr's index (9.51 - 16.83), Hausner ratio (1.10 - 1.20), angle of repose (29.36 – 39.65) of chitosan micropsheres indicates the excellent to fair flow properties of microspheres

TABLE 1: Formulation of Microspheres

Sr. No	Formulation Code	Amount of Chitosan (gm)	Amount of drug (gm)	1% glacial acetic acid (ml)	Liquid paraffin (ml)	Span 80 (% w/v)	Acetone(ml)
1.	F1	1	1	40	50	1.25	50
2.	F2	2	1	40	50	1.25	50
3.	F3	3	1	40	50	1.25	50
4.	F4	4	1	40	50	1.25	50
5.	F5	5	1	40	50	1.25	50

TABLE 2: Micromeritic properties of microspheres

Sr. No.	PROPERTY	F1	F2	F3	F4	F5
1.	BULK DENSITY	0.67	0.64	0.60	0.61	0.57
2.	TAPPED DENSITY	0.75	0.73	0.69	0.69	0.68
3.	CARR'S INDEX	9.51	11.89	13.86	12.21	16.83
4.	HAUSNER RATIO	1.10	1.14	1.16	1.13	1.20

5.	ANGLE OF REPOSE	29.36	30.96	33.28	34.56	39.65

Table 3: Percentage yield and drug entrapment efficiency of microspheres

Sr. No.	PROPERTY	F1	F2	F3	F4	F5
1.	PERCENTAGE YIELD (%)	90	86.66	87.5	88	85
2.	DRUG ENTRAPMENT EFFICENCY (%)	65.7	75.4	86.45	79.45	72.34
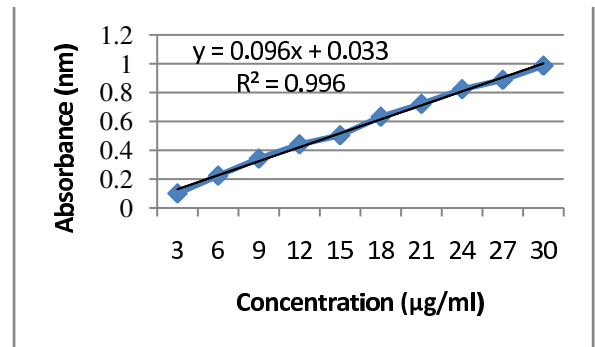
(A)
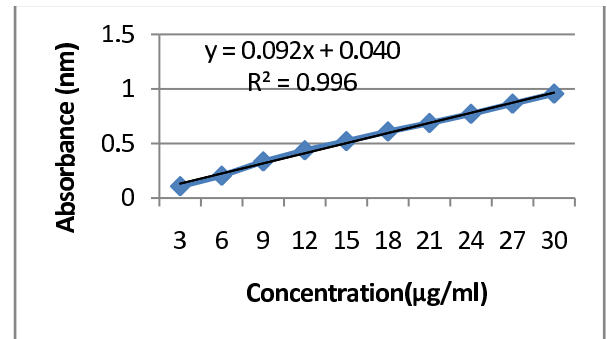
(B)
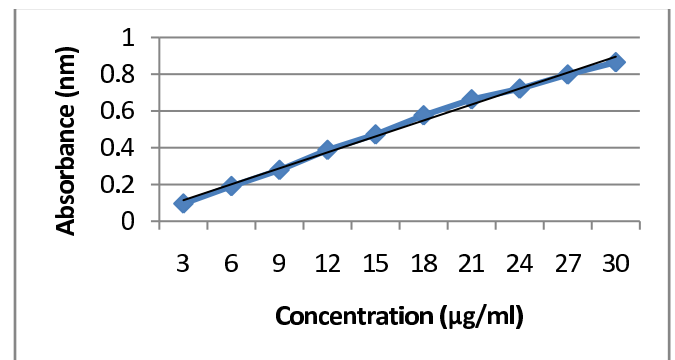
(C)

Fig 1: Calibration curve of Ornidazole in (A) 0.1N Hcl (B) 6.8 pH Phosphate buffer and (C) 7.4 pH Phosphate buffer

B). FTIR Spectroscopy

The FTIR spectra of Ornidazole, Chitosan, Eudragit S-100 were taken. The FTIR of mixture of Ornidazole, Chitosan , Eudragit S-100 (1:1:1) Showed all the peak of pure drug spectra which showed absence of drug and excipients interaction.

(A)

(B)

(C)

(D)
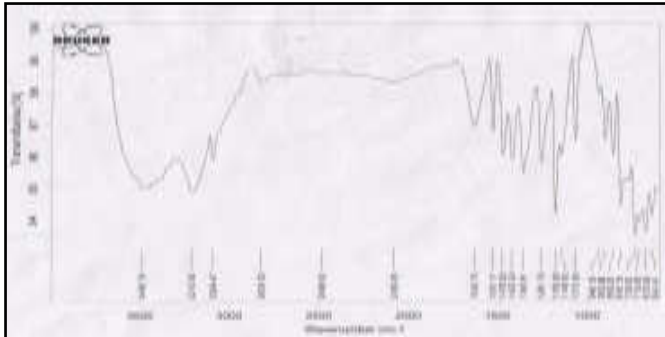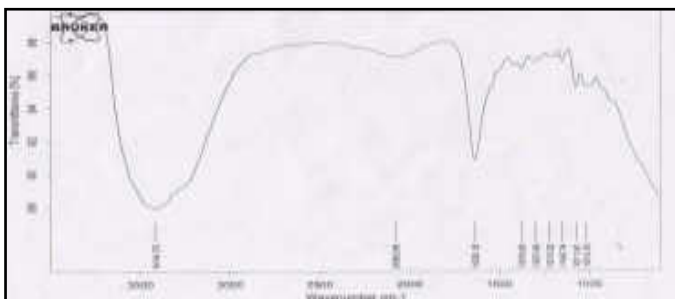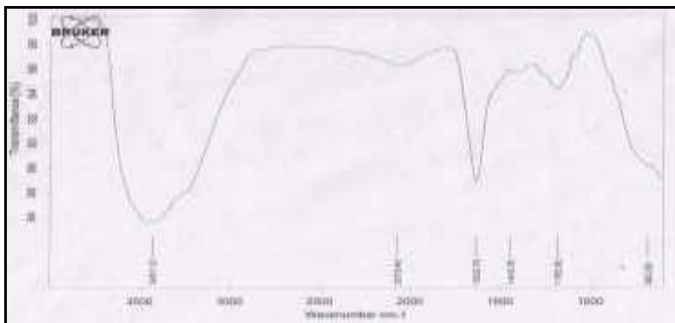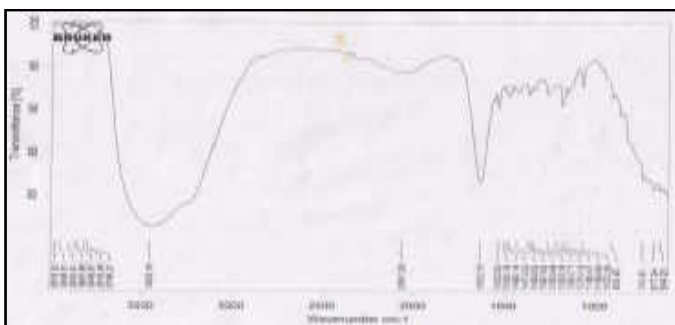
Fig 2: FTIR spectrum of (a) Ornidazole (b) Chitosan (c) Eudragit S-100 and (d) Mixture of Ornidazole, Chitosan and Eudragit S-100 (1:1:1)

C). Percentage yield

The percentage yield of chitosan microspheres was found to be 85 to 90%. The percentage yield of chitosan microspheres decerease with increase in concentration of the polymer.

D) Drug entrapment efficiency

The drug entrapment efficiency of chitosan microspheres was found to be 65.7 to 86.5%. That showed good entrapment efficiency of drug.

E). SEM analysis

The morphology of microspheres was examined by scanning electron microscopy which showed the Smooth surface of the microspheres.
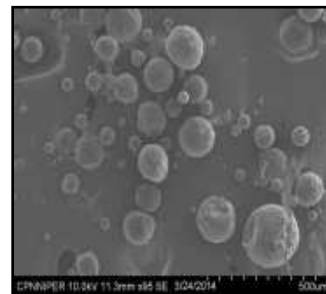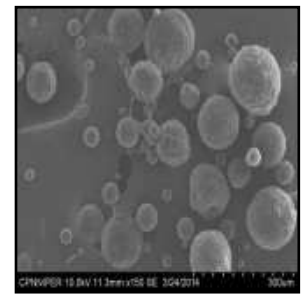
(A)   (B)

Fig 3: SEM images of ornidazole loaded chitosan microspheres of batch F3

IV.   CONCLUSION

The entrapment efficiency of the drug was found to be 65.4- 86.45% and the percentage yield was found to be 85-90%. All the formulations shows good flow properties.

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Novel Method Development and Validation for UV–Visible Spectrophotometric Analysis of Methscopolamine Bromide

Maninder Pal Singh
CT Institute of Pharmaceutical Sciences,
Shahpur, Jalandhar, Punjab, India:
manisingh2123@gmail.com

Narendra Kumar Pandey
Department of Pharmaceutical Sciences,
Lovely Professional University,
Phagwara, Punjab

Abstract: The aim of the research work presented here is to develop a novel approach towards precise and effective analytical method for qualitative estimation of methscopolamine bromide, a drug of choice to treat peptic ulcer. The absorbance of methscopolamine bromide was low even at higher concentration as obtained from U.V. visible spectroscopical method. Therefore it was required to enhance absorbance value to precisely perform qualitative analysis by different approaches. In this process, novel attempts were made to develop a new method for estimation such as addition of chromophores and use of colorimetric techniques but all of attempts did not produce satisfactory results. At last encouraging results including enhanced absorbance were obtained by using sodium picrate at λ_{max} of 440 nm and linearity was observed within the range of 1-5 µg/ml with a regression coefficient of 0.984. The method was then validated to ensure the reproducibility as per ICH (International Conference on Harmonization) guidelines.

Keywords: methscopolamine bromide, UV-spectrophotometry, Validation.

I. INTRODUCTION

Methscopolamine bromide (Mb) is an anticholinergic drug. It reduces the secretions of certain organs in the body such as stomach. It is used to control the peptic ulcers by blocking the muscuranic receptor. It is white crystalline powder. The melting point of methscopolamine bromide is 220-230^{0}C[3].

Mechanism of action of methscopolamine bromide is acts by interfering with the transmission of nerve impulses by acetylcholine in the parasympathetic nervous system (specifically the vomiting center). It does so by acting as a muscarinic antagonist. [5].
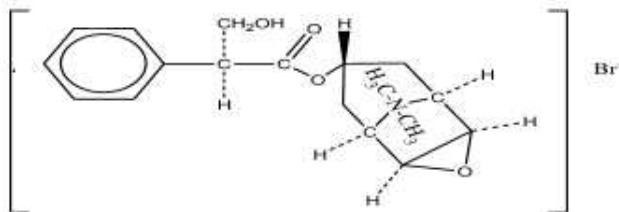
Fig. 1. Structure of methscopolamine Bromide [3]

The estimation of methscopolamine bromide by, high performance liquid chromatography [HPLC], high performance thin layer chromatography [HPTLC] and sensitivity of UV is very less reported in literature [6]. Thus the present study was undertaken to develop and validate a simple, sensitive, accurate, precise, and reproducible U.V method for methscopolamine bromide.

II. MATERIALS AND METHODS

A. Equipments

The following equipments were used: double beam UV visible spectrophotometer connected to a computer loaded with Shimadzu UVPC,

B. Reagents and Chemicals

Methscopolamine Bromide (assigned purity 99%) was provided as a gift sample by Alkaloids Private Limited, Kolkata (India). Sodium Periodate (99% pure) was purchased from Nice Chemicals Private Limited, Cochin (India) and Ninhydrin (99% pure) was obtained from Qualikems Private Limited (India)

C. Method development

The scanning and U.V spectra of solution containing methscopolamine were recorded for the concentration ranging from 300-500µg/ml. It was observed that the resulting λ_{max} was showing less absorbance even at high concentration. This problem highlighted the requirement and necessity for development of a new method which can offer detection with enhanced sensitivity. complex, however the method was develop -ed by complexation with epoxide group.
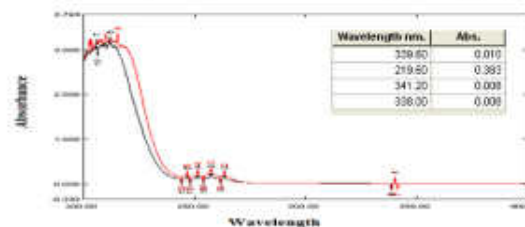
Fig.2. Scan of Methscopolamine bromide (300, 500µg/ml)

1. Addition of Chromophore

The hydroxyl group of methscopol -amine bromide was estimated to form complex with sodium periodate and Taurine with reference to (Woo et al., 2006). The chromophore solution (Sodium periodate and Taurine) was added to drug solution with concentration of 10 μg/ml. The solution was then heated at 80-100^{0}c for 15 minutes and was scanned by UV-spectrophotometer. The absorbance was less and it was observed that the method was not efficient in estimation of drug.
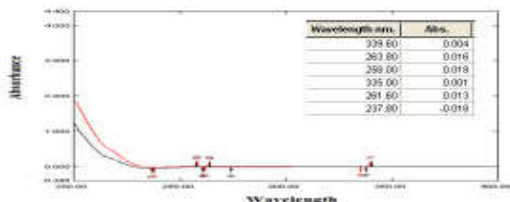
Fig. 3. Scan of Methscopolamine bromide (10 μg/ml, 100 μg/ml) with Sodium periodate and Taurine

2. Addition of Ninhydrin and Silver nitrate

The structure of methscopolamine bromide is having quarternary ammonium as one of the functional group. The group was targeted to provide complexation with ninhydrin or silver nitrate. 500 μg/ml solution of ninhydrin was added to the drug solution of concentration 100μg/ml. In both the cases again, the method was not found to be good enough to be used for estimation of drug as the absorbance was found to be very less as well as the complexes were not found to be stable .
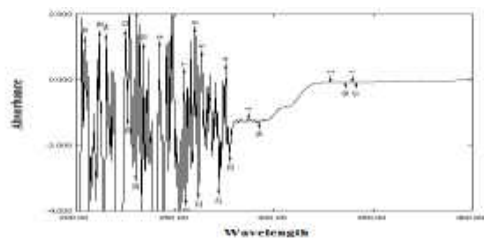
Fig. 4. Scan of drug 100μg/ml with Ninhydrin solution 500μg/ml
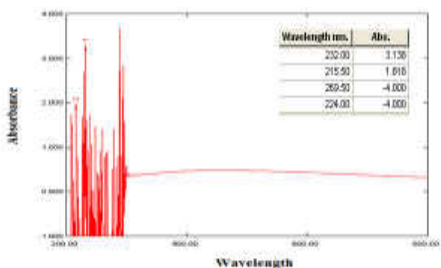
Fig. 5. Scan of drug solution 10μg/ml with silver nitrate.

3. Addition of Picric acid solution

The epoxide group of methscopolamine bromide was predicted to form complex with picric acid. One ml of 0.25M picric acid was added to drug solution with concentration of 10 μg/ml. The solution was heated at 50-60^{0}C for 15 minutes and was scanned by using spectrophotometer. This method was found to show little improvement but the desired results were not obtained.
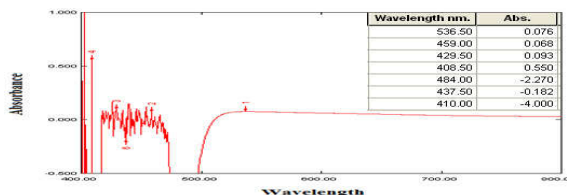
Fig. 6. Scan of 10μg/ml drug solution with 0.25 M picric acid solution.

4. Addition of Sodium Picrate

The Sodium picrate solution was the one which reacted with the epoxide group of methscopolamine bromide and formed stable complex. 0.1 ml of sodium picrate solution was added in drug solutions with concentration ranging from 1μg/ml to 5μg/ml and these solutions were kept undisturbed for some time at room temperature. The scanning was done and the λ_{max} was found to be 440 nm. The standard plot was then prepared for drug solution with concentration ranging from 1-5 μg/ml. Thus, a sensitive method for estimation of methscopolamine bromide was developed. The method was further validated according to ICH guidelines.
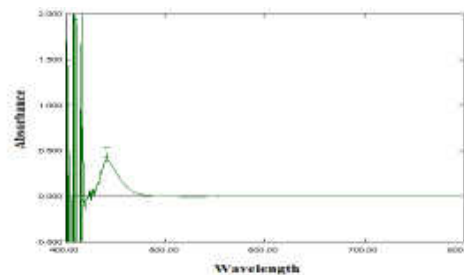
Fig. 7. Scan of methscopolamine bromide (2 μg/ml) solution with sodium picrate

D. Method Validation

Method validation was performed in accordance with International Conference on Harmonization (ICH) [1] specifications, which include linearity, specificity, accuracy, precision, robustness, detection limit and quantitation limits.

III. RESULTS AND DISCUSSION

A. Preparation of standard plot

1. Scanning of methscopolamine bromide

Scanning of drug was done by using UV spectrophotometer and λmax was found to be 257 nm
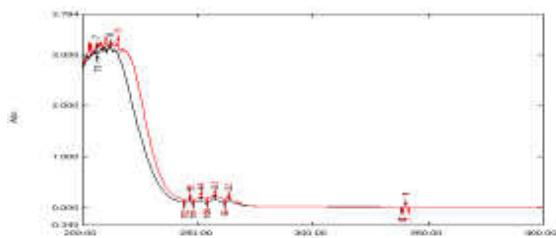
Fig.8.Scanning of methscopolaminee bromide (500µg/ml)

2. Standard plot

Standard plot of methscopolamine bromide was prepared in 0.1 N hydrochloric acid (pH 1.2) at 257 nm. The range of the concentration was 100-1000 µg/ml. The dose of methscopolamine bromide was very less (5 mg) so developed the UV visible analytical method as shown in table

Table 1. Reading of standard plot of drug in 0.1 N hydrochloric acid (pH 1.2)

Concentration(µg/ml)	Absorbance
0	0
100	0.057
200	0.114
300	0.154
400	0.203
500	0.254
600	0.302
700	0.362
800	0.408
900	0.461
1000	0.506
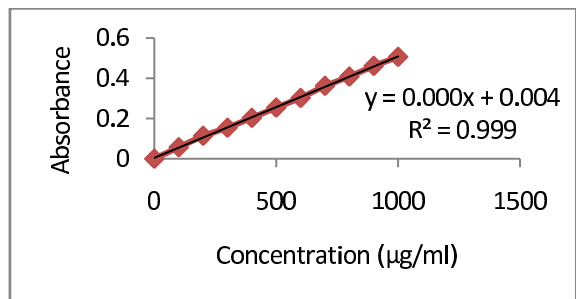
Fig. 9. Standard plot of methscopolamine bromide in 0.1N HCl (pH1.2).

B. Method development using UV visible range.

The absorbance maximum was found to be 440 nm. The calibration plot of methscopolamine bromide was found to be 0.506 at 1000 µg/ml. The absorbance was very less at higher concentration so the method was developed by complexation method. Sodium picrate solution was used to develop the method. The λmax was found out to be 440 nm.

1. Scanning of methscopolamine bromide with 0.1 ml sodium picrate

Scanning of drug was done by adding of sodium picrate using UV spectrophotometer (400-800 nm range) and λ max was found to be440 nm.
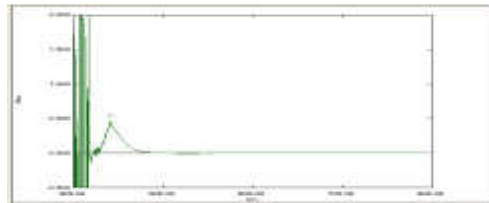
Fig. (10). Scan of methscopolamine bromide + sodium picrate.

2. Standard plot of methscopolamine bromide with 0.1 ml of sodium picrate

0.1 ml of sodium picrate solution were added in drug having 1µg/ml to 5µg/ml concentration and kept for 15-30 minutes at room temperature. The absorbance (0.2 to 0.8) was found to be 1µg/ml to 5µg/ml at 440 nm (Table 3).

Table 2. Reading of standard plot of drug + sodium picrate

of days	Concentration (µg/ml)	Mean absorbance	Standard deviation*
Day 1	LQC(2)	0.420	0.006
	IQC(3)	0.564	0.004
	HQC(4)	0.686	0.003
Day 2	LQC(2)	0.423	0.005
	IQC(3)	0.566	0.004
	HQC(4)	0.684	0.003
Day3	LQC(2)	0.422	0.005
	IQC(3)	0.567	0.004
	HQC(4)	0.687	0.003

Fig. (12). Standard plot of methscopolamine bromide + sodium picrate.

C. Method validation

Method validation was performed in accordance with International Conference on Harmonization (ICH) specifications, which include linearity, specificity, accuracy, precision, robustness, detection limit and quantification limits.

1. Linearity and Range

Table 4 shows concentration and absorbance at 440 nm. Linearity was observed in range of 1– 5 µg/ml at 440 nm with significant higher value of correlation coefficient, $R^2 = 0.984$ thus, follow Beer Lamberts law

Table 3. Linearity and range data of methscopolamine bromide by U.V. spectroscopy

Concentration(µg/ml)	Mean absorbance	Standard deviation (±S.D)
1	0.233	0.008
2	0.412	0.003
3	0.528	0.007
4	0.671	0.009
5	0.799	0.001

2. Accuracy

The method was found to be accurate within the acceptable deviation. These results proved that the method was accurate.

Table 4. Accuracy study of methscopolamine bromi -de + sodium picrate

Concentration (µg/ml)	Mean absorbance	Standard deviation*
LQC(2)	0.411	0.003
IQC(3)	0.565	0.004
HQC(4)	0.683	0.001

*Each value is an average of three determinations

3. Precision study

The results of intraday, interday repeatability and reproducibility have been summarized

Table 5. Intra-day precision study of methscopol-amine bromide + sodium picrate

Concentration (µg/ml)	Mean absorbance	Standard deviation*
LQC(2)	0.419	0.006
IQC(3)	0.562	0.005
HQC(4)	0.686	0.003

*Each value is an average of three determinations

Table 6. Inter-day precision study of methscopolam- ine bromide + sodium picrate

No. of days	Concentration (µg/ml)	Mean absorbance	Standard deviation*
Day 1	LQC(2)	0.420	0.006
	IQC(3)	0.564	0.004
	HQC(4)	0.686	0.003
Day 2	LQC(2)	0.423	0.005
	IQC(3)	0.566	0.004
	HQC(4)	0.684	0.003
Day3	LQC(2)	0.422	0.005
	IQC(3)	0.567	0.004
	HQC(4)	0.687	0.003

4. Robustness

Robustness results have been summarized in table and showed good results. All the samples in 0.1N HCl (pH 1.2) showed SD below 2.

Table 7. Result of robustness of methscopolamine bromide + sodium picrate at different λmax.

Conc. taken (µg/ml)	Λmax	Absorbance± S.D*
3	438 nm	0.563 ± 0.005
3	440 nm	0.565 ± 0.006
3	442 nm	0.569 ± 0.005

*Each value is an average of three determinations, S.D = Standard Deviation.

IV.   CONCLUSIONS

The validated analytical method for quantitative determination of methscopol -amine bromide has the advantages of speed, simplicity, low-cost conditions. All validation parameters were found to be satisfactory, including linearity, accuracy, precision, robustness and adequate detection and quantification limits. The validated method is a good alternative for routine quality control of methscopolamine bromide by them pharmaceutical industry and quality control laboratories.

V.   ACKNOWLEDGEMENT

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Phytochemical Screening of Psorelea Coryfolia for Phytosomal Preparation

Anju
CT Institute of
Pharmaceutical Sciences
Jalandhar, Punjab, India
anjulpu@gmail.com

Navneet Kaur
CT Institute of
Pharmaceutical Sciences
Jalandhar, Punjab, India

Sukhbir Kaur
CT Institute of
Pharmaceutical Sciences
Jalandhar, Punjab, India

Anil Kumar Sharma
CT Institute of
Pharmaceutical Sciences
Jalandhar, Punjab, India

Abstract: The Psoralea corylifolia is commonly known as babchi, bakuchi, bavanchi, Bkchi. is belongs to Fabaceae family. Bakuchi is used in treatment of many skin diseases like acne, leucoderma and psoriasis. Natural plant extracts and phytoconstituents have excellent bioactivity in vitro, but less or no in vivo actions due to their poor lipid solubility.Psoriasis is a inflammatory disease of the skin and joints, with an incidence of 1% to 2% worldwide. Topical therapy is employed as first-line treatment in psoriasis.. Psoralen containing plants have been used for centuries in popular medicine to treat psoriasis.. Drug delivery system for phytosomes was prepared by complexing polyphenolic phyto- constituents with phospholipid mainly phosphatidylcholine which bind components to each other on a molecular level. Phytosomes have the capacity to deliver the standardized plant extracts, which increases the bio-availability of the herbal formulation. In the present study the phytosomes of Psorelia corylifolia extract were prepared for the topical delivery for the treatment of psoriasis.

Keywords – Psoriasis ,psorelia corylifolia, phytosomes,

I. INTRODUCTION

The Psoralea corylifolia is commonly known as babchi, bakuchi, bavanchi, Bkchi. is belongs to Fabaceae family. Bakuchi is used in treatment of many skin diseases like acne, leucoderma and psoriasis [1]. Psoriasis is an inflammatory disease of the skin and joint. It is characterized by epidermal hyper proliferation, enhanced antigen presentation, T helper 1 cytokine production, T cell expansion, and angiogenesis [2].Phytosomes of standardized extracts or purified fractions complexed with phospholipids for a better bioavailability and enhanced activities The significance of this research work is to increase the absorption and bioavailability of the drug. Reduce the dose and administration frequency. Reduce the incidences of adverse drug reaction.

II. MATERIAL AND METHODS

Psoralea corylifolia (gift sample from Aimil Pharmaceuticles Pvt. Ltd., Lecithin soya from HiMedia Laboratories and Cholesterol, was purchased from the balaji pharmaceutical Pvt. Ltd

III. PREPARATION OF ETHANOLIC EXTRACT

Extraction of psoralen from Psoralea corylifolia seeds was done by simple soxhalation. 1.5 kg of powdered drug was soaked in petroleum ether for 2 hours for imbibing of the seeds into the solvent powder for de-fatting. After 2 hours the imbibed drug was put into the soxhlet apparatus and it was extracted with ethanol for 4-5 hours at 75°C+5°C.Than the petroleum ether extract was treated with Sudan red III reagent to check the presence of fats and oils. Ethanolic extract was concentrated to 3000 ml. After that the Ethanolic extract was also treated with Sudan red III reagent to check the absence of fats and oil. Dark brown sticky ethanolic extract of Psoralea corylifolia seeds was stored at a cool place in a well closed container [3].

IV. PHYSIOCHEMICAL SCREENING

The phytochemical screening of extract of psorelia corylifolia was performed in order to confirm the presence and absence of compounds like carbohydrates,gums, mucilage, proteins, amino acids, glycosides, tannins and phenols, volatile oils, fats and oils, steroids, flavonoids and alkaloids in the extract [4]. The extracts of psorelia corylifolia is analyzed by various tests.

HPTLC: A method was developed and validated for 3000 ml ethanolic extract solution from 1.5 kg seed powder of Psoralea corylifolia by HPTLC. HPTLC was performed for the quantitative determination of psoralen in the ethanolic extract solution[5].

V. PREPARATION OF PHYTOSOMES

Phytosomeses were prepared by Film hydration method. Accurately weighed lecithin and cholesterol were dissolved in 100 ml of chloroform and extract in RBF.The mixture was sonicated for 10 min using bath sonicator.Then evaporate the solvent at 45° C[6]

and prepared a thin film by using rotary evaporator .After that lipid film was hydrated with distilled water.After hydration mixture was sonicated by ultra sonic probe sonicatur for 20 min in presence of ice bath for heat dissipation.Phytosomal suspension kept undisturbed for 2 hour at room temperature and stored in a freezer. The composition of the formulation is given in the Table No. 4

V1   RESULTS AND CONCLUSION

A.   Standardization of extract:

Preliminary phytochemical screening of extract for the presence of coumarins,flavanoids,alkaloids,tannins and phenolic compounds was performed and results are given in Table 1, Phytosomes are probably a system which can improve absorption of phytoconstituents through skin, to regulate the physiology of skin compositions. The Morphological characters of extracts is given in Table No. 2

Table 1.Phytochemical screening for extracts of psorelia corylifolia

S/No.	Name of test	Observation
1	Carbohydrates	-ve
2	Gums	-ve
3	Mucilage	+ve
4	Proteins	-ve
5	Amino acids	-ve
6	Fats and Oils	-ve
7	Steroids	-ve
8	Volatile oils	+ve
9	glycosides	-ve
10	Coumarins	+ve
11	Flavanoids	+ve
11	Alkaloids	+ve
12	Tannins and phenolic compound	+ve

Table 2.Morphological characters of extracts

S. no.	Parameters	Observation
1	Color	Light yellow
2	Odour	Odourless
3	Taste	Tasteless
4	Nature	Concentrate form

Results of the HPTLC include various validation parameters which were shown in table 3. From the chromatogram of psoralen marker as shown in Fig. 1 and from the chromatogram of ethanolic extract as shown in Fig. 2, the concentration of psoralen in the ethanolic extract was observed to be 148.14ng/spot. The volume of spot was 5µl and it was diluted to 10 times, and therefore the concentration of psoralen in the ethanolic extract of Psoralea corylifolia seeds was calculated to be 0.3mg/ml. Percentage content of psoralen in ethanolic extract of Psoralea corylifolia seeds was found to be 0.03%. Thus total amount of

psoralen present in 3000 ml of ethanolic extract was calculated to be 1 g from the total raw material
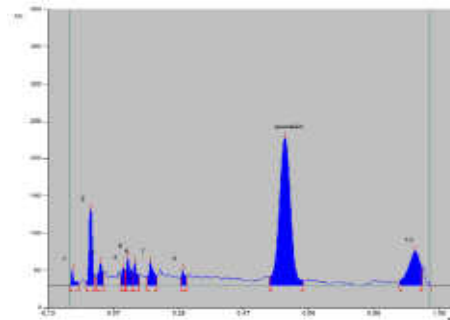
Figure 1: Chromatogram of Psoralen Marker
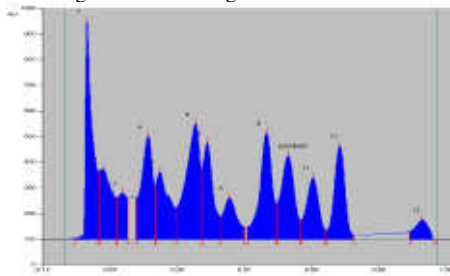
Figure 2: Chromatogram of Ethanolic Extract

Table 3: Validation Parameters of Ethanolic Extract for Psoralen by HPTLC

S.No	Validation parameters	Result
1	Absorption maxima, λ_{max} (nm)	299
2	Linearity range (ng/spot)	50-150
3	Coefficient of determination (r^2)	0.9976
4	Regression equation	Y=35.79x+129
5	Slope (b)	35.79
6	Intercept (a)	129
7	Limit of detection LOD, (ng/spot)	5
8	Limit of quantitation LOQ, (ng/spot)	20
9	Repeatability (%R.S.D)	Less than 1%
10	Precision (%R.S.D)	Less than 1%
11	Recovery (%R.S.D)	Less than 1%
12	Mobile phase	Toluene : Ethyl acetate (7.5:2.5v/v)
13	Rf value	0.61

Table 4: Formulation Composition of Phytosomes

Formulation Code	F1	F2	F3	F4	F5
Cholesterol(mg)	15	15	15	15	15
Lecithin(ml)	40	45	50	55	60
Chloroform(ml)	5	5	5	5	5
Psoralia corylifolia extract(ml)	10	10	10	10	10

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Mucoadhesive Microcapsules: Predicted Tools to Improve Bioavailability and Half Life of Glimepiride

Chatter Singh
S.D. College of Pharmacy & Vocational Studies, Bhopa road, Muzaffarnagar (U.P.)
topharma_pharm@hotmail.com

A.K Jain
Deptt. of Pharmaceutics, Bundelkhand University, Jhanshi

B Kumar
Deptt. of Pharmaceutics, Bundelkhand University, Jhanshi

Abstract-The present study was aimed to formulate the mucoadhesive microcapsule to improve the bioavailability and half life of pioglitazone hydrochloride. The orifice gelation method was used to formulate the microcapsules resulted increased bioavailability and half life. Finally increase the half life of the drug by employ the orifice ionic gelation method to formulate muco-adhesive microcapsule. Mucoadhesive microcapsules of Glimepiride were prepared using sodium alginate as a shell forming polymer and Carbapol 940, HPMC, Sodium CMC as mucoadhesive polymer for the potential use of treating acute and chronic diabetes mellitus (Type II diabetes). Large spherical microcapsules with a coat consisting of alginate and a mucoadhesive polymer could be prepared by orifice-ionic gelation process. The microcapsules exhibited good mucoadhesive properties in an in-vitro test. Glimepiride release from these mucoadhesive microcapsules was slow and extended over longer periods of time and depending on the composition of the coat. Drug release was diffusion controlled and followed zero-order kinetic. These mucoadhesive microcapsules are thus suitable for sustained release of Glimepiride.

Keywords: Glimepiride; Mucoadhesive microcapsules; Sustained release

I. INTRODUCTION

Microencapsulation has been accepted as a process to achieve controlled release[2] and drug targeting. Mucoadhesion[1] has been a topic of interest in the design of drug delivery system to prolong the residence time of the dosage form at the site of application or the absorption and to facilitate intimate contact dosage form with the underlying absorption surface to improve and enhance the bioavailability of drugs[3,4,5]. Therefore control release (CR) products are needed for Glimepiride, to improve duration of action and patient compliance.

II. MATERIAL AND METHODS

A. Materials

Glimepiride[6,7] sample from Ipca Pharmaceuticals Ltd. (Silvasa, India), Sodium Carboxy methylcellulose (sodium CMC) was. (Kolkata,India), HPMC was a gift sample from Colorcon Asia PVT, LTD.(Verna, India).

B. Methods

1) Preparation of mucoadhesive microcapsules:

Microcapsules are prepared by orifice- ionic gelation method[8,9]. Sodium alginate and mucoadhesive polymer[10] are dissolved in purified water to form a homogenous polymer solution. The active substance, Glimepride is added to polymer solution and mixed thoroughly with a stirrer to form a viscous dispersion. The resulting dispersion is then added manually drop wise into $CaCl_2$ (10% w/v) solution through a syringe with a needle of size no. 18. The added droplets are related in the $CaCl_2$ solution for 15 min to complete the curing reactions and to produce spherical rigid microcapsule. The microcapsules are collected by decantation, and the product thus separated, washed repeatedly with water and dried at 45°C for 12 hrs.

2) Estimation of Glimepiride:

Glimepride was estimated spectrophometrically at 229 nm using shimadu 1701 (Japan) spectrophometer Standard curves for the estimation was prepared in phosphate buffer of pH 1.2 and pH 7.8 in concentration rang 1μg/ml - 10μg/ml. In this concentration range good linearity was observed with correlation coefficient (R^2) –0.9999 in pH 7.8 phosphate-buffer and (R^2) –0.9997 in pH 1.2 HCL.

About 500mg of microcapsule was accurately weighed and transfer in to 1000 ml beaker, which contain 900ml of pH 7.8-phosphate buffer at 37°C. The phosphate solution was stirred continuously until all the microcapsules were dissolved. 1% SLS Solution was used to enhance the solubility of Glimepiride in pH 7.8-phosphate buffer. Drug loading was determined by U.V Photometric method at 229 nm.

Drug loading efficiency or microencapsulation efficiency was calculated.

3) Morphological characterization of microspheres:

The surface and inner part of the microspheres was observed through the Scanning Electron Microscopy (SEM), SEM was performed for morphological characterization of microcapsules using the electron microscope (SEM-LEICA. S430, London, U.K.)

4) In-vitro drug release

a) In pH 7.8-phosphate buffer medium:

In-vitro release rate of Glimepiride was tested using USP dissolution test apparatus with a rotating paddle at 50 rpm. 500 mg of Glimepiride microspheres, which contain 225 mg Glimepiride, were suspended in 900ml of ph 7.8-phosphate buffer medium with the temperature $37^{\circ}C$, 9gm of SLS mixed in the buffer to enhance the solubility of Glimepiride in the phosphate buffer. The rotating rate of paddle was adjusted to 50 rpm. 5 ml of sample were withdrawn at different intervals. Sample was then filtered through whatman filter. The same volume of dissolution medium was replace after each withdrawal. The samples were assayed at 229 nm for Glimepride content spectrophotometrically. The drug release experiments were conducted in triplicate (n=3).

b) In pH 1.2 HCl medium:

Glimepiride release in the pH 1.2 HCl medium was also carried out same conditions as in pH 7.8-Phosphate buffer, Only medium was replaced with pH 1.2 HCl.

5) Mucoadhesive testing:

The mucoadhesive property of the microcapsules was evaluated by wash-off method. Freshly excised pieces of intestinal mucosa (2 × 2 cm) from sheep were mounted onto glass slides with cyanoacrylate glue. Two glass slides were connected with a suitable support. About 50 microcapsules were spread onto each wet rinsed tissue specimen, and immediately thereafter the support was hung onto the arm of a USP tablet disintegrating test apparatus. The tissue specimen was given a slow, regular up-and-down movement in the test fluid at 37°C contained in a 1 L vessel after the definite time interval, the machine was stopped and the number of microcapsules still adhering to the tissue was counted. Gastric pH (0.1N HCl, pH 1.2) and intestinal pH (phosphate buffer, pH 7.8) were used as test fluid.

III. RESULTS AND DISCUSSION

A. Morphological characteristics of the microspheres:

The mucoadhesive microspheres of Glimepiride were prepared by the orifice-ionic gelatin method were found to be discrete, spherical and free flowing. The microcapsules were uniform in size, with size range of 300 µm. The SEM photographs indicated that microcapsules were spherical and completely covered the coat polymer (Figure -1).

B. In vitro release of Glimepiride

Glimepiride release from the microspheres was studied in phosphate buffer (pH 7.8) for 16 hours; Glimepiride release from the microspheres was slow (Figure-2). Microspheres of alginate-carbopol gave slow and prolong release compared to others. The order of increasing release rate observed with various microspheres was alginate-carbopol < alginate-sodium CMC < alginate-HPMC. Pioglitazone release from microspheres, GM9 was slow and extended over a period of 14 hours, so GM9 found to be suitable for oral sustained release (Fig-2).

C. In vitro evaluation of mucoadhesiveness

The Microspheres with a coat of sodium alginate and a mucoadhesive polymer (Sodium CMC, HPMC, Carbapol) is prepared by ion-gelation method. The wash-off test shows that Glimepiride microcapsules of carbapol and sodium alginate polymer (1:1) have good bioadhesion property in acidic medium (pH 1.2) compare to alkaline medium (pH 7.4). Table-2,3

IV. CONCLUSION

The Microspheres with a coat of sodium alginate and a mucoadhesive polymer (Sodium CMC, HPMC, Carbapol) is prepared by ion-gelation method. The in-vitro studies show that Glimepiride microcapsules with carbapol and sodium alginate polymer (1:1) have good bioadhesion property in pH 1.2 compare to pH 7.4.

Release studies show that (9:1) Glimepiride microcapsules with carbapol and sodium alginate polymer giving best release than compare to other preparations and release at pH 1.2 is low and high at pH 7.8

Table 1. Composition and Microencapsulation

efficiency of microcapsule.

S.No	Microspheres	Composition	Drug polymer ratio	Percentage Drug Loading
1.	AC 3	Alginate:carbapol 940 (9:1)	1:4	81.52
2.	AH 3	Alginate: HPMC (9:1)	1:4	89.98
3.	AS 3	Alginate: sodium CMC (9:1)	1:4	88.75

4.	AC 2	Alginate:Carbapol 940 (6:1)	1:4	89.50
5.	AH 2	Alginate:HPMC (6:1)	1:4	86.85
6.	AS 2	Alginate: sodium CMC (6:1)	1:4	86.78
7.	AC 1	Alginate:carbapol 940 (1:1)	1:4	88.68
8.	AH 1	Alginate: HPMC (1:1)	1:4	87.22
9.	AS 1	Alginate: sodium CMC (1:1)	1:4	84.69

Table.2 In vitro wash off test to show mucoadhesive properties of microspheres in pH 7.8.

Time (hours)	1	2	4	6	8
Microcapsules	Mean	Mean	Mean	Mean	Mean
A C1	62.66 ±2.08	54.33 ±2.51	23.00 ±2.00	12.00 ±2.00	4.00 ±3.00
A C2	66.66 ±1.52	63.00 ±2.00	19.33 ±2.08	11.33 ±2.08	6.33 ±1.52
A C3	68.66 ±2.64	63.33 ±4.72	24.66 ±2.51	19.66 ±1.52	9.66 ±1.52
AH1	70.66 ±2.34	58.33 ±3.51	21.33 ±2.51	14.00 ±3.00	9.00 ±2.34
AH2	68.00 ±5.09	56.66 ±3.05	23.00 ±2.00	12.33 ±0.57	5.00 ±3.00
AH3	68.00 ±3.00	64.33 ±3.05	19.33 ±2.51	14.66 ±4.50	7.66 ±2.25
AS1	70.33 ±2.51	53.33 ±3.51	22.00 ±2.00	2.33 ±1.90	0.33 ±0.97
AS2	68.66 ±3.51	61.33 ±3.51	33.33 ±1.52	15.33 ±3.69	6.33 ±2.51
AS3	70.00 ±3.00	59.33 ±7.57	31.66 ±2.51	8.66 ±3.05	3.33 ±2.30

Table.3 In vitro wash off test to show mucoadhesive properties of microspheres in pH 1.2.

Time (hours)	1	2	4	6	8
Microcapsules	Mean	Mean	Mean	Mean	Mean
A C1	82.33 ±2.51	68.66 ±3.21	74.33 ±2.08	68.00 ±2.00	62.66 ±3.05
A C2	71.66 ±1.52	68.00 ±2.00	63.66 ±1.52	54.33 ±2.08	48.00 ±3.60
A C3	83.00 ±2.00	75.33 ±1.52	73.33 ±2.08	71.33 ±1.52	58.00 ±3.00
AH1	76.33 ±1.52	69.66 ±3.05	59.00 ±3.00	45.66 ±3.51	33.33 ±2.51
AH2	71.6 ±2.51	66.66 ±2.08	57.00 ±2.00	43.33 ±3.08	32.33 ±3.34
AH3	82.66 ±3.41	73.66 ±2.51	57.66 ±2.08	46.33 ±3.50	38.00 ±3.60
AS1	76.00 ±2.64	70.00 ±4.18	56.66 ±2.08	35.33 ±2.55	16.66 ±2.51
AS2	76.33 ±3.65	73.66 ±2.51	47.66 ±5.11	33.66 ±1.52	15.66 ±2.51
AS3	82.66 ±3.02	79.33 ±1.52	58.66 ±2.08	36.00 ±3.60	23.33 ±2.51

Fig1. Scanning eletron microscopy of Glimepiride microcapsules

Figure 2. Release profile of Glimepiride microcapsules
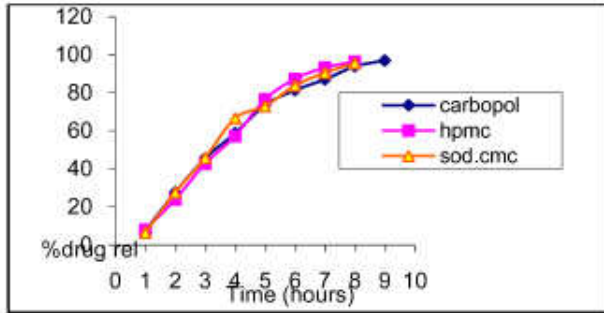
Fig. 2(a) Comparative Graph Between polymers (9:1) at pH 1.2

Fig. 2(b) Comparative Graph Between polymers (1:1) at pH 1.2

Fig. 2(c) Comparative Graph Between polymers (6:1) at pH 1.2

Fig. 2(d) Comparative Graph Between polymers (9:1) at pH 7.8

Fig. 2(e) Comparative Graph Between polymers (6:1) at pH 7.8
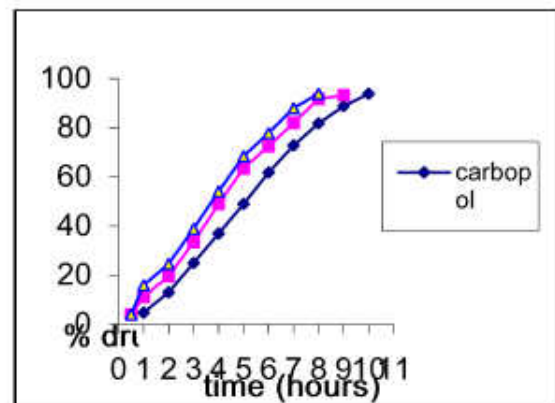
Fig. 2(f) Comparative Graph Between polymers (1:1) at pH 7.8

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Formulation and Evaluation of Dexamethasone Matrix Tablets for the Treatment of Inflammation in Colon Cancer

Ankush Sharma
CT Institute of Pharmaceutical Sciences
Jalandhar, Punjab, India
ankush.ankush89@yahoo.com

Kapil Kanwar
CT Institute of Pharmaceutical Sciences
Jalandhar, Punjab, India

Abstract: The purpose of the present studies is to prepare and evaluate the colon targeted matrix tablets of Dexamethasone for the treatment and management of inflammation in colon cancer. The different formulation of matrix tablet of dexamethasone were prepared by wet granulation method by using different ratio of natural polymers chitosan : xanthan gum (1:0, 4:1, 3:2, 1:1, 2:3, 1:4, 0:1). The matrix tablets were coated with shellac by dip coating to prevent drug release in the stomach. The prepared matrix tablets were evaluated for weight variation, hardness, friability and in-vitro drug release.

Keywords: Wet granulation method, Matrix tablets, Inflammation.

I. INTRODUCTION

Cancer is one of the major public health problems worldwide prevalence of cancer is known to vary from region to region. The idea behind Microspheres for Colon specific drug delivery system is intended because it may reduce the Systemic side effect because of low dose of the drug. The absorption of the poorly absorbed drug is increase because of increase retention time in the colon. Dexamethasone is used in reducing the inflammation in colon cancer. The aim of the study is to develop colon targeted Matrix tablets of dexamethsone using Chitosan, and xanthan gum as carriers. Significance of this Research Investigation Increase the absorption and bioavailability of the drug via delayed release formulation. Utilize the non-toxic and biodegradable nature of Chitosan and Xanthan gum that makes it safer for patients as compared to other synthetic polymers it is also economical. Reduce the dose and administration frequency. Reduce the incidences of adverse drug reaction [1, 2].

II. MATERIALS & METHODS

Dexamethasone, Chitosan and Xanthan Gum was purchased from the balaji pharmaceutical Pvt.Ltd. The Shellac was obtained from the central drug store.

PREPARATION OF MATRIX TABLETS

Dexamethasone, Chitosan and xanthan gum was weighed and passed through sieve no 60. The 10% of starch paste was added to form a wet mass. Then wet mass was passed through sieve no 12. Then wet granules were dried in oven for half hour. The dried granules were passed through sieve no. 12 to form uniform size granules. Then granules were compressed into the tablets by using tablet punching machine [3]. The composition of matrix tablet was given in Table 1.

Coating of Tablets

Tablets were coated with different concentration of shellac solution 1%, 2% & 3%. Tablets were coated with dip coating method. 1% shellac solution was prepared by dissolving 1 gm shellac in a mixture of 100 ml solvent (ethanol and isopropyl alcohol (1:1)) on a magnetic stirrer. 2% shellac solution was prepared by dissolving 2 gm shellac in a mixture of 100 ml solvent (ethanol and isopropyl alcohol (1:1)) on a magnetic stirrer. 3% shellac solution was prepared by dissolving 3 gm shellac in a mixture of 100 ml solvent (ethanol and isopropyl alcohol (1:1)) on a magnetic stirrer.

FTIR Spectroscopy: FTIR spectroscopy was performed for Dexamethasone, Chitosan and Xanthan Gum by using Bruker Infrared Spectrophotometer.

Calibration curves: Calibration curve of dexamethasone in different solutions 0.1n HCl, 6.8 pH phosphate buffer & 7.4 pH phosphate buffers by using U.V spectrophotometer (Shimandzu).

III. EVALUATION OF TABLETS

Weight variation: 20 individual tablets were selected and average weight was calculated. Not more than two of the individual weights deviate from the average weight by more than the percentage shown in the table and none deviates by more than twice that percentage. The weight variation tolerances were listed below.

Average weight of tablet (mg)	Maximum percentage deviation allowed
80 mg or less	10
More than 80 mg but less than 250 mg	7.5
250 mg or more	5

Hardness: The hardness of tablets was determined by Monsanto hardness tester. On testing, tablet was placed between two plungers. The lower plunger was placed in contact with the tablet, and a zero reading was taken. Then upper plunger was forced against a spring by turning a threaded bolt until the tablet fractured. As the spring was

compressed, the force of fracture was recorded, and the zero force reading was deducted from it.

Friability: Friability of tablets was determined by laboratory friability tester, known as Roche friabilator.

In-vitro dissolution: In-vitro dissolution test was conducted in USP 2 apparatus at 75 rpm and a temperature of 37 ± 0.5^0C. Sampling was done at predetermined time intervals and the same were estimated for drug content after suitable dilution by using double beam UV-VIS spectrophotometer. Initial drug release studies were conducted in 900 ml of 0.1N HCl for 2 hours. Then, 900 ml of 6.8 potassium phosphate buffer solution for next 22 hours.

IV. RESULT & DISCUSSION

FTIR Spectroscopy: FTIR spectroscopy was performed for Dexamethasone, Chitosan and Xanthan Gum. The FTIR spectra were given in Fig. 1.

Calibration curves: Calibration curve of dexamethasone in pH 1.2, PBS pH 6.8 and 7.4 were given in fig. 2 a, b and c respectively.

EVALUATION OF TABLETS

Weight variation: The weight variation of 20 tablets was performed and weight variation of different batches was found to be 250.10 - 251.65 mg which passes the limit given in the I.P. The wt. variation of tablets of different batches was given in Table no. 2.

Friability: The friability of different batches was found to be 0.57 to 0.93%. The friability of tablets of different batches was given in Table no. 2.

Hardness: The hardness of different batches was found to be 3.15 to 3.40 kg\ cm^3. The hardness of tablets of different batches was given in Table no. 2.

In-vitro drug release profile: The in-vitro study of uncoated tablets of different batches was given in Table no. 3 and the in-vitro release study of 2% shellac solution of batch F5 is 84.41% to 99.41% coated tablets was given in Table no. 4. Figure no. 3 & 4 contain in-vitro release profile of coated & uncoated matrix tablets.

V. CONCLUSION

On the basis of above study it may be concluded that the formulation (F5) containing Xanthan gum & Chitosan in the ratio 60:40 ensures the better release profile in colon (more than 95%).The xanthan gum & chitosan containing matrix tablet formulation holds tremendous potential to deliver a variety of drugs in colon diseases specifically at colon and ensures maximum drug concentration at colon and will also help to reduce the dose and frequency of the drug , thus consequently lowers the drug-associated side effects.

Table 1: Formulation Composition of tablet

S. No	Formulation Code	Drug(mg)	Chitosan (mg)	Xanthan gum (mg)
1.	F1	5	100	0
2.	F2	5	80	20
3.	F3	5	60	40
4.	F4	5	50	50
5.	F5	5	40	60
6.	F6	5	20	80
7.	F7	5	0	100

Table 2: Evaluation of tablets

Sr.No.	PROPERTY	F1	F2	F3	F4	F5	F6	F7
1.	Weight variation	250.15	250.60	251.20	250.10	250.50	250.85	251.35
2.	Friability	0.82	0.89	0.57	0.70	0.75	0.93	0.71
3.	Hardness	3.15	3.20	3.25	3.30	3.40	3.15	3.20

Table 3: In-vitro dissolution studies of uncoated matrix tablets of Dexamethasone

Sr.No.	Time (hours)	F1	F2	F3	F4	F5	F6	F7
1.	2	10.14	10.24	10.28	10.31	10.33	10.14	10.04
2.	5	32.11	32.31	38.24	35.21	36.10	36.17	35.20
3.	7	59.47	61.40	64.31	66.24	71.09	68.18	65.28
4.	9	77.99	80.87	82.82	84.76	92.51	85.14	82.83
5.	12	84.83	86.77	87.72	90.66	97.4	90.66	87.75
6.	15	86.80	87.77	89.71	91.66	99.42	91.66	90.67
7.	18	86.81	87.87	90.30	92.63	99.53	91.76	90.79
8.	21	86.90	87.97	90.69	93.11	99.62	91.86	90.88

| 9. | 24 | 86.90 | 87.97 | 90.69 | 93.12 | 99.62 | 91.86 | 90.88 |

Table 4:- In-vitro dissolution of 2% Shellac coated matrix tablets of Dexamethasone

Sr.No.	Time (hours)	F1	F2	F3	F4	F5	F6	F7
1.	2	7.15	7.34	7.63	7.72	7.82	7.80	7.74
2.	5	11.05	11.15	11.79	12.02	12.2	12.15	12.11
3.	7	24.59	25.55	30.39	33.28	41.9	38.11	35.22
4.	9	33.35	34.32	38.21	42.09	53.70	49.84	45.97
5.	12	50.78	52.72	57.57	62.42	69.23	64.39	60.61
6.	15	65.36	68.27	73.13	77.02	84.70	76.06	71.21
7.	18	73.17	76.08	79.01	82.89	92.59	82.88	76.10
8.	21	79.97	82.88	85.80	88.72	96.49	87.75	82.88
9.	24	84.84	86.78	90.66	92.61	99.41	91.64	89.68

(A)
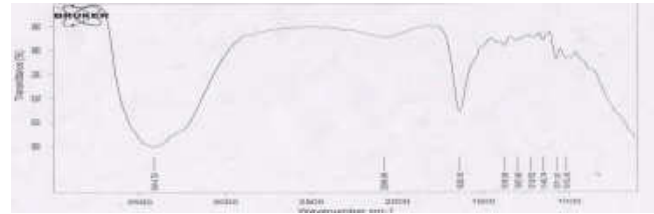
(B)

(C)

Fig 1: FTIR spectrum of (A) Dexamethasone (B) Chitosan (C) Xanthan gum

$y = 0.098x + 0.019$
$R^2 = 0.999$

(a)

$y = 0.067x + 0.018$
$R^2 = 0.995$

(b)

$y = 0.078x + 0.023$
$R^2 = 0.993$
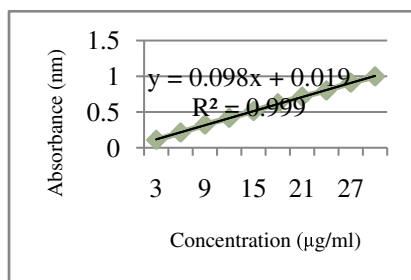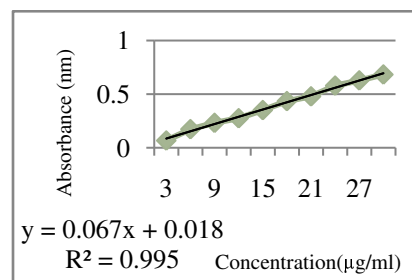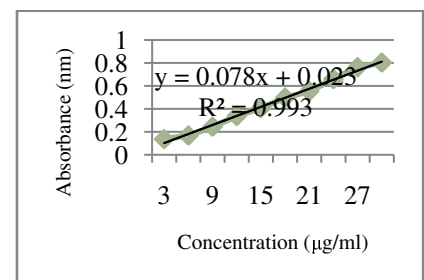
(c)

Fig 2: Calibration curve of Dexamethasone in (a) 0.1N HCl (b) 6.8 pH Phosphate buffer and (c) 7.4 pH Phosphate buffer
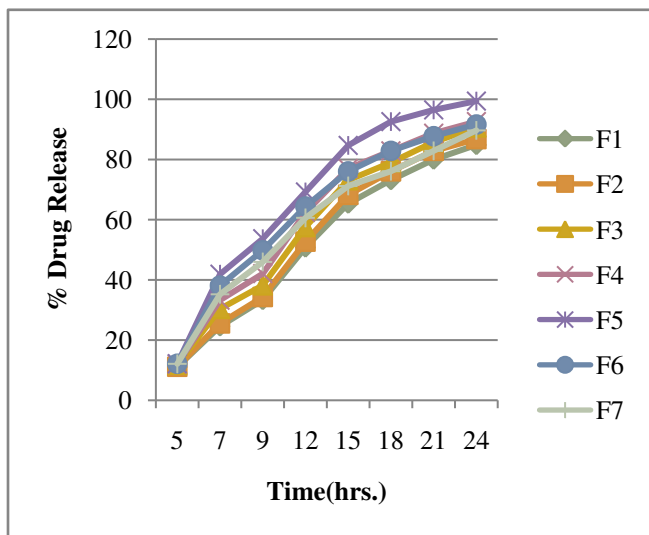
Fig. 3: In-vitro release of uncoated matrix tablets of Dexamethasone
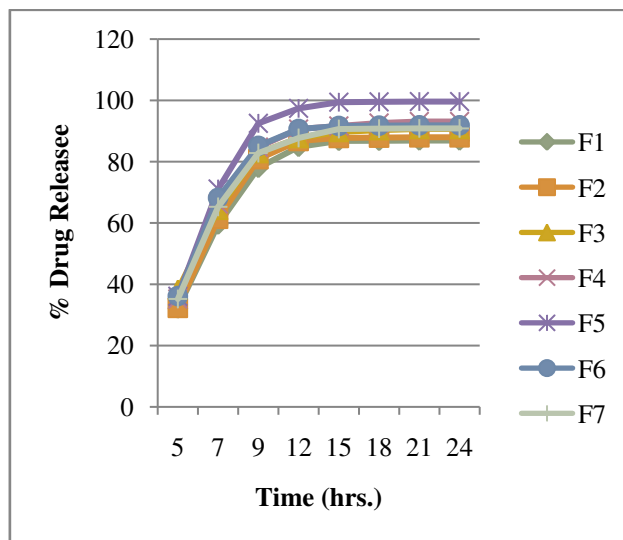
Fig. 4: In-vitro release of 2% shellac coated matrix tablets of Dexamethasone

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Track 3
Technical Session: 2
Biotechnology

Isolation and Arsenic Uptake Study by Immobilized Lab Cells

Mandeep Sidhu
Department of Biotechnology and Biosciences
Lovely professional University
mandeep.sidhu@lpu.co.in

Promila Sama
Department of Biotechnology and Biosciences
BIS Institute of Science and Technology
drpromilasama@yahoo.com

Hina Rehan
Department of Biotechnology and Biosciences
BIS Institute of Science and Technology
hinarehan27@gmail.com

Sheelendra M Bhatt
Department of Biotechnology and Biosciences
Lovely professional University
drsmbhatt@gmail.com

ABSTRACT:- The aim of the current study was to develop effective bioremediation of Arsenic from drinking water by using immobilized arsenic resistance Lactic Acid Bacteria (LAB). For this Arsenic resistant LAB have been isolated from curd samples using spread plate technique in MRS agar media at high arsenic concentration ranging from 50 µg/ml - 1000 µg/ml. In addition, uptake of arsenic by immobilized LAB cells have also been studied by Langmuir adsorption isotherm and we had observed that immobilized LAB cells were able to absorb up to 88.14% of arsenic in 5 hours and 30 minutes.

Key words: LAB, As, MRS, Bioremediation, Heavy metals

I. INTRODUCTION

Arsenic toxicity now posing dangerous health impacts word wide [5] not only to human health but also to broader ecosystem noted during the last few decades via ground water pollution and is said to be one of the notoriously poisonous to multicellular life [15]. Presence of excess Arsenic in the ecosystem is due to various anthropogenic sources such as production of pesticides, herbicides, and insecticides which remain persistent due to its compound formation with phosphate and nitrogen. Heavy metal pollution in not only affects the production and prominence of crops, rather extended pressure over the quality of the atmosphere and water bodies have been reported in various literature. The accumulation of heavy metals in water and soil is alarming due to the safety issues of drinking water and food. The most commonly reported heavy metal contaminants are arsenic, phosphate and fluoride[13]. Increasing Arsenic content in water has become as one of the major challenge in the world. Not only humans but animals are also coming in contact by eating grasses and crops contaminated with arsenic pesticides [14]. Toxicity of arsenic is dependent on its oxidation states . Arsenites (As III) is ten times more toxic then arsenate (As V) [19,6] . Arsenic is reported to be mutagenic and carcinogenic [9] and is now has been reported from ground water table of west Bengal, Bangladesh, West Bengal, Punjab, Jharkhand, Bihar, Uttar Pradesh the Ganga River; Assam and Manipur in flood plain of the Brahamaputra and Imphal rivers, and Rajnandgaon village in Chhattisgarh state and some part of Delhi where their concentrations have been exceeded beyond the recommended value WHO 50 µg/L. [19,6] . To prevent various adverse impacts of As, WHO and EPA the promulgated the new arsenic rule that lowered the maximum contaminant level (MCL) in drinking water to 10 µg/ l (10ppb or 0.010 mg/ L) [18,21,15] .

Bioremediation strategies are the essential component employed to clean the polluted water in order to save from the ill effects of heavy metals, especially Arsenic, over health. Thus, apart from the chemical exchanger to detoxify life threatening metals, various microorganisms have been employed known for bioremediation capacity of heavy metals such as Escherichia coli, Bacillus subtilis, and Saccharomyces species employed to remove heavy and toxic metals[15].

Use of lactic acid bacteria (LAB) for the removal of toxic and heavy metals from water is also one of the microbial technologies that are useful in removal of heavy metals. of all living beings including humans is because of the contaminated water and through food chain [17] .Various symptoms of arsenic is in form of skin lesions and cancer of brain, liver, kidney and stomach [21]. The rising severe health impact because of arsenic (As) contamination in water and soil is the impulsion of the present investigation. Various techniques including use of microbes for removal of heavy metals has been reported.

II. MATERIALS AND METHODS

A). Isolation of heavy metal resistant bacteria

Three curd samples were diluted up to 10^{-6} dilution and 1 ml of this 10^{-6} dilution were inoculated over MRS media agar plates containing 50µl, 100 µl, 200µl, 400 µl, 600 µl, 800 µl, 1000 µl of 173.3mg/100ml of sodium arsenite . For the selective screening of arsenic resistant bacteria, arsenic was incorporated in MRS media. Stock solution of arsenic (173.3mg/100ml) was prepared from Sodium arsenite (Loba Chemie).Spread plate technique was used to isolate LAB after incubation at 37°C for 24 h anaerobically. MRS agar media plates were supplemented with As at different concentrations were incubated at 37°C for 24 hours anaerobically. After the incubation period the plates were observed for any kind of growth on the media.

B). Determination of Minimum Inhibitory Concentration (MIC)

MIC of the heavy metal resistant bacteria isolates grown on heavy metals incorporated media, against respective heavy metal was determined by gradually increasing the concentration (50µl, 100 µl, 200µl, 400 µl, 600 µl, 800 µl,

1000 µl) of the heavy metal, on agar plate until the strains failed to give colonies on the plate. The culture growing on the last concentration (1000 µl of 173.3mg/100ml of sodium arsenite) , was unable to grow even after 10 days of incubation.

C). Identification of As resistant LAB

The isolated and distinct colonies were sub cultured repeatedly on the same media for purification. Colonies with distinct yellow zones were randomly picked from the plates of higher dilution (800 µl) and re-streaked in

800 µg/ml As containing MRS agar plates for purification. Identification of pure culture was carried out on basis of morphology and biochemical characters.

1). Endospore test : Bacterial smear was prepared on microscopic slide under aseptic conditions and heat fixed. The slide was placed over the steaming water bath and malachite green (primary stain) was applied for 5 minutes followed by rinsing with water. The slide was then flooded with the counter stain Safranin for 20 second and rinsed with water. Slides were blot dried, they were observed under the light microscope.

2). Hugh and Leifson test :The purpose of this test was to determine whether an organism is an oxidizer or a fermenter on the basis of production of acid in aerobic and anaerobic conditions. Hugh and Leifson's medium was prepared into culture tubes and were autoclaved at 121°C for 15 min. Filter sterilized solution of 10% carbohydrate (glucose) was aseptically added to the medium and cooled, inoculated by stabbing with the test organism. All the culture tubes were kept in incubator under aerobic and anaerobic conditions at 37°C for 24 to 48 h. After incubation, all the test tubes were observed for fermentation.

3). Catalase test : This test was used to check the production of enzyme catalase. Drop of 3% H_2O_2 was taken on the microscopic slide aseptically and loopful of bacterial culture was taken and mixed with 3% H_2O_2 solution on the slide. The presence of the bubble production was observed.

4). Sugar fermentation test : 100 ml of the nutrient broth solution was prepared in conical flask and 1 ml phenol red was added to it. This medium was autoclaved at 121°C for 15 min and cooled at room temperature. A syringe filter sterilized solution of 1% glucose was prepared under aseptic conditions. In all sterilized test tube, 5 ml of the broth and 100 µl of the glucose solution was taken and labelled. Then these test tubes were kept at room temperature for 24 h to check the contamination. After 24 h, all the test tubes were inoculated with freshly grown bacterial culture and incubated at 37°C for 48 h. In case of homofermentation, there will be production of acid along with the change in colour of the medium from red to yellow, and in heterofermentation there will be gas production in Durham tube alongside the change in the colour.

D). Preparation of Immobilized LAB cells

Ability to remove metal (As) by LAB was determined by measuring the uptake of immobilized LAB cells. Wet biomass was suspended in 3% concentration of Sodium alginate and was added drop wise to a solution of 0.1M $CaCl_2$. Then the resulting beads were washed with distilled water.

E). Langmuir adsorption isotherm

A general form of the Langmuir model equation is

$$q = \frac{q_{max}\ bC_{eq}}{1 + bC_{eq}} \qquad (1)$$

Where q= uptake of species (mg/g), qmax = maximum uptake (mg/g), Ceq = equilibrium (final) concentration in solution (mg/L), and b=constant related to energy of adsorption. b is the equilibrium or association constant (mg/L).

III. RESULTS AND DISCUSSION

A). Isolation and identification of As resistant LAB:

After 24 hours, 1 plate with 800 µl of arsenic was having good growth of microbes which was further subculture in 3 plates containing 800 µl Arsenic. Only one plate was having good growth of tolerance up to 800 µl while other strains were unable to grown in subculture. To isolate As-resistant LAB, clear creamish- yellowish colonies were selected from the As containing MRS agar plates as a initial screening. Three resistant colonies were picked from the plates and sub cultured. Microscopic observation revealed purple colour rod shaped bacteria. Endospore test shows, no green coloured bacterial endospores. Hugh and Leifson test, both anaerobic and aerobic test tubes showed colour change from green to yellow indicating acid production. No colour change from yellow to red was observed thus indicating the test organism to be fermentative only. No haze growth was observed in the slants indicating the organism to be non-motile. Catalase test shows no gas bubbles and hence catalase negative.

1). Sugar fermentation test : In case of acid production, the media turned red to yellow.

Colour change: Glucose Lactose Sucrose

         Yes   Yes   Yes

In case of gas production, gas bubbles were observed in Durham's tube

Gas production: Glucose Lactose Sucrose

         No   Yes   Yes

No acid and gas production was observed in 3 control test tubes.
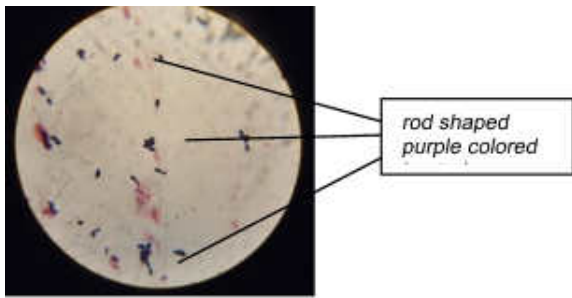
Fig.1 Plate showing rod shaped bacteria (Gram staining)
Grown in presence of Sodium arsenite (1mg/ml)

Fig.2 Endospore test

Fig 3: Hugh and Leifson test (anaerobic)

Fig 4: Hugh and Leifson test (aerobic)
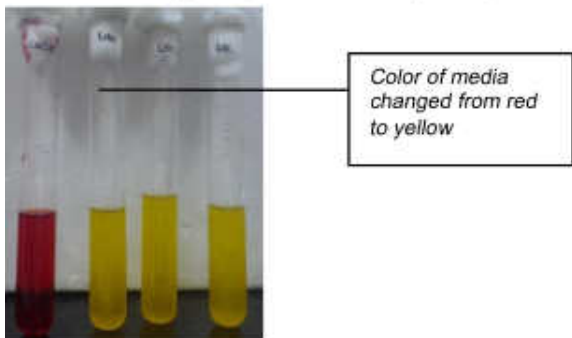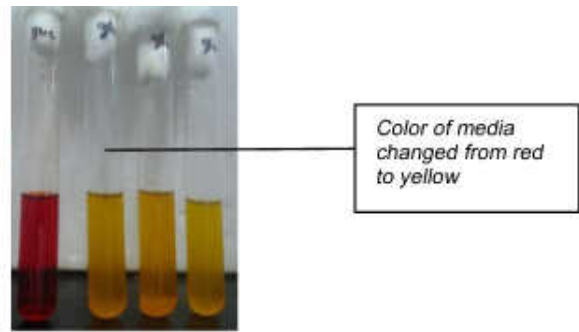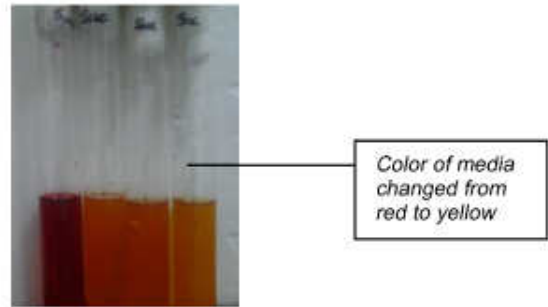
Fig 5: Sugar fermentation test (lactose, glucose and sucrose)

2). Determination of Minimum Inhibitory Concentration (MIC): Plates were prepared by gradually increasing the concentration (50μl, 100 μl, 200μl, 400 μl, 600 μl, 800 μl, 1000 μl) of arsenic. At concentration of 800μl/ml and 1000 μl/ml, 85% and 100% bacterial cells were killed, respectively.

Fig.6 : Showing growth in plates with 800 μl of arsenic
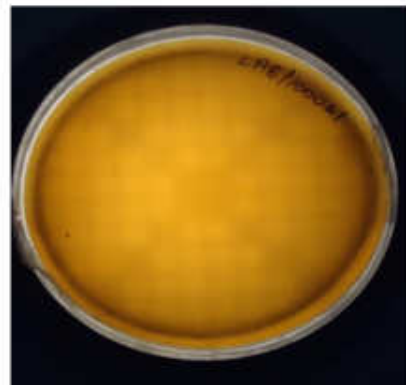
Fig.7 : Showing no growth in plates with 1000 μl of arsenic

B). Metal Removal by Resistant Isolate

Isolated arsenic resistant LAB cells were incubated for different time intervals (0, 30, 60, 90,120,150,180,210,240,270,300,330,360,390 min.) at 37^0C. Concentration of immobilized bacterial cell was taken as 1gm/50ml. Percentage of maximum arsenic removed in 5 hours and 30 minutes was 88.14% by use of immobilized LAB cells.
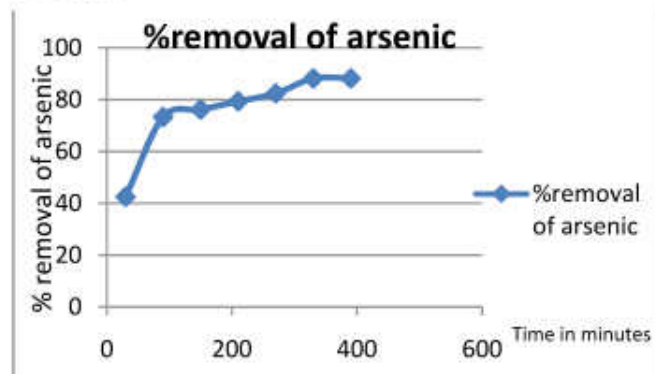
Fig. 8: Removal of arsenic by use of bacterial cells

Table 1: Bioremediation of arsenic using lactic acid bacteria (C=173.3mg /100ml)

Time (minutes)	adsorption of 'As' [C=173.3mg/100ml sodium arsenite(OD)	Amount of arsenic absorbed (C-C_0)	%removal of arsenic (C-C_0)/C*100
30	1.988	73.6	42.46970571
60	1.177	114.15	65.86843624
90	0.921	126.95	73.25447201
120	0.846	130.7	75.41834968
150	0.821	131.95	76.13964224
180	0.811	132.45	76.42815926
210	0.711	137.45	79.31332949
240	0.634	141.3	81.53491056
270	0.604	142.8	82.40046163
300	0.512	147.4	85.05481823
330	0.405	152.75	88.14195038
360	0.406	152.7	88.11309867
390	0.405	152.75	88.14195038

IV CONCLUSION

Experiment conducted for removal of arsenic from water by use of isolated and immobilized LAB is the preliminary stage of screening and identification, but further efforts are required to study the possible metal up taking LAB strains and its molecular analysis.

V. ACKNOWLEDGEMENT

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A Comparative Study on Quality Production of Micropropagated Co5011 and Conventionally Propagated Sugarcane Plantsin Punjab

Indu Bala
Dept. of Education
GNDU, Asr, India
indu_jld@yahoo.com

ABSTRACT-The present study was carried out to know the quality production of micropropagated Co5011 and conventionally propagated sugarcane plants. The sugarcane plants Co5011 showed better quality production as attained better height (206 cm), periphery of cane (8.12 cm), more number of nodes (14), more intermodal distance (12.5 cm) as compared to conventionally propagated sugarcane plants. MS medium was used as basal medium, separately supplemented with kinetin (1 mg/l) and BAP (3 mg/l) and sucrose (45 g/l), also place the filter discs in the media. Conventionally propagated sugarcanes through offsets is slow in growth and pathogens keep on accumulating generation after generation, which reduces the yield and quality of sugarcane. Micropropagation through tissue culture holds great potential for mass multiplication and quality production of sugarcane.

KEYWORDS:Sugarcane; MS medium; micropropagation; conventionally propagated; BAP

I. INTRODUCTION

Sugarcane (Saccharum officinarum L.) is an important sugar crop in the world. It is grown as cash crop in India. Sugarcane is thought to have originated in Asia. Higher quality of sugarcane depends on the selection of higher yielding cultivars, proper management of the crop and balanced nutrition (Akhtar and Silva, 1997, 1999). A number of micropropagation techniques suitable for commercial seed production in sugarcane have been reported. Apical meristem culture was used by Coleman (1970) and to obtain sugarcane mosaic virus free plants (Hendre et al.1975). Axillary bud culture was applied successfully to produce true to type clones in manysugarcane varieties (Sauvaire and Galzy, 1978). The standardized an apical meristem culture technique for rapid multiplication of mosaic virus-free plants of variety Co 740 (Hendre et al. (1983). Another standardized micropropagation technique based on the use of apical meristem with two or three leaf primodia (meristem tip) as the explants (Sreenivasan and Jalaja, 1981).

Conventional propagation of sugarcane through offsets is slow, usually one to ten in a period of one year. Moreover, pathogens keep on accumulating generation after generation, which reduces the yield and quality of sugarcane. Therefore, efficient propagation system is required for mass multiplication of sugarcane. Micropropagation through tissue culture holds great potential for mass multiplication and subsequent rejuvenation and quality production of sugarcane. The present investigation was carried out to micropropagate sugarcane plants Co5011and conventionally propagated sugarcane plants to evaluate their quality production.

II. OBJECTIVE

To Compare the Quality Production of Micropropagated Co5011 and Conventionally Propagated Sugarcane Plants.

III. HYPOTHESIS

Micropropagation method affects more the quality production of sugarcane plants than conventional propagation method.

IV. MATERIALS AND METHOD

A. Plant material: The spindles of sugarcane variety Co5011 were used as explants.

B. Media: MS medium (500 ml) + (BAP 3 mg/l) + Sucrose (45 g/l) + Kinetin (1 mg/l)

C. Surface Sterilization of spindle explants of Co5011: Excise the spindle explants (5-10 cm) long from field grown plants. Surface sterilize with $Hgcl_2$(0.1%) for 10 minutes. After three washings with sterilized water aseptically remove outer 2-3 whorls of leaves to obtain culturable spindle (0.5-1.0 cm) long.

D. Inoculation of spindle explants: Culture the sterilized individual explants by dipping it in liguid media supplemented with IAA, BAP and GA3. Incubate the culture for 4-5 weeks.

Table 1: Number of spindle explants inoculated in the Media of sugarcane variety Co5011

Media Composition	Number of Spindle explants inoculated of variety Co5011	
MS media	40 jars	40 spindle explants

The cultures were kept in dark condition for one week at 26 ± 1°C and then transferred under 16 hours photoperiod at 3000 lux and 25 ± 1_C. After one month of inoculation, the shoot clumps that developed from inoculated spindle explants.

During data collection the shoot clumps frequency was recorded considering that each shoot clump piece originated from a single spindle explant. The frequency of shoot clump was calculated according to the following formula:

$$\text{Plant regeneration frequency (\%)} = \frac{\text{Number of shoot clumps regenerated}}{\text{Number of spindle explants cultured}} \times 100$$

E. Hardening of micropropagated plants and their tranfer to soil:

Rooting and hardening can be done by adding growth hormones. It is essential to improve their survival in the soil. Then well grown plants were observed and transfer to the soil. The normal sugarcane seeds are also sown to the soil. These are the sugarcane seeds which are sowed by using conventional propagation method. When the sugarcanes were fully grown observed the growth of the sugarcane plants as grown by both micropropagation and conventional propagation methods for better quality production.

V. RESULTS AND DISCUSSION

The spindle cultures of sugarcane var. Co5011 was established on MS fortifiedwith IAA (0.5 mg/l), BAP (0.5 mg/l) and GA3 (0.5 mg/l). Shoot regeneratyionoccurred within 12 to 15 days of inoculation, thereby suggesting establishment ofshoots cultures. Buds that sprouted from the nodal region were excised and theactively growing shoots were transferred to liquid shoot multiplication medium.The drying tips and the base of the explants turned brownish black due to the release of phenolics. The explants in culture usually released phenolics causing browning of the medium but this browning did not hamper the shoot proliferation.

The transfer of proliferaing clumps to half strength basal medium devoid of hormones exerted a strong influence leading to elongation of shoots with 15 to 20days. Base of the clumps produced heavy roots within 10 to 12 days upon their transfer to the rooting medium. Plants were transferred to polybags with asurvival rate of 94%. In an earlier stuides Dhaliwal et al. (1997a, b) reported several factors affecting hardening of the micropropagated sugarcane.

The plants in culture were basically free from diseases and showed rejuvenation. These first generation canes were of exceptional quality as seedcane. The plantlets grew early and within a short time abundant numbers oftillers developed in a synchronous manner.

Table 2. Observations taken of micropropagated sugarcane variety Co5011 and conventionally propagated sugarcane plants

Method Used	Height (cm)	Cane Periphery (cm)	Internodal Distance (cm)	No. of Nodes
Micropropagation	206	8.12	12.5	14
Conventional Propagation	191	6.4	11.4	11

The results from the above table has shown that micropropagated sugar cane plants are having better quality production as attained better height (206 cm), periphery of cane (8.12 cm), more number of nodes (14), more intermodal distance (12.5 cm) as compared to conventionally propagated sugarcane plants.

Kilaru and Aruna (1998) reported higher rate of sugar recovery inmicropropagated plants as compared to the control. Adoptation of tissue culture methods brought about substantial improvement in that material was free from diseases and grew vigorously contributing to a greater productivity Micropropagation ensures tree to type and rapid multiplication of disease free material and as such can be used as super elite seed stock for quick spread of new varieties and rejuvination of old ones of sugarcane.

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Biosorption of Chromium and Mercury using Attenuated Cells of Bacillus Licheniformis and Escherichia Coli

Vidushi Abrol
Dept. of Biotechnology
CT Institute of Pharmaceutical Sciences,
Jalandhar, (Pb.)

Nitin Khajuria
Dept. of Biotechnology,
Lovely Professional University,
Phagwara,(Pb.)

Jasmeen Johal
Dept. of Biotechnology
Lovely Professional University,
Phagwara,(Pb.)

Abstract: A number of biological agents especially bacteria have received increasing attention for heavy metal detoxification due to their good adsorption capacity, low cost and high multiplication rate. Heavy metals due to their non-biodegradable nature accumulate in the environment and enter food chain posing serious threat. Biosorbent serve as an effective and cheaper alternative for the removal of heavy metals from aqueous solution. Biosorbent prepared from attenuated biomass have greater biosorption capability then viable cells. In the present study, biosorption of heavy metals chromium and mercury has been carried out using individual and mixed cultures of Bacillus licheniformis and Escherichia coli. The various parameters governing the biosorption process of heavy metals such as contact time, pH, biomass concentration and temperature have been studied. Optimization of the parameters for the biosorption process has been done using batch experiments. The present study shows 71% of biosorption of mercury for mixed cultures of Bacillus licheniformis and Escherichia coli and 60% and 80% biosorption for individual cultures of Escherichia coli and Bacillus licheniformis respectively. The optimum biomass concentration for maximum biosorption of mercury was found to be 2.5, 2 and 2 mg/ml for individual cultures of Escherichia coli, Bacillus licheniformis and mixed cultures respectively. The study on biosorption of chromium shows that 70% of biosorption was achieved for mixed cultures while 72 and 76% was achieved for Escherichia coli and Bacillus licheniformis respectively. The optimum biomass concentration was found to be 1.5, 2 and 2.5 mg/ml respectively for Escherichia coli, Bacillus licheniformis and mixed cultures.

I. INTRODUCTION

Heavy metals like copper, lead, cadmium, chromium, zinc, etc. are toxic even at low concentrations. These metals are non-biodegradable so they can readily accumulate in the environment and enter the food chain posing a very serious threat. The removal of these metals from waste water and industrial effluents is a pressing environmental concern. All metal processing activities lose and/or discharge sometimes even large quantities of heavy metals. The development and implementation of cost-effective process for removal/recovery of metals is essential in order to improve the competitiveness of industrial processing operations and to minimize the environmental hazard of toxic metal-containing effluents.

The search for new technologies for the removal of toxic metals from wastewaters led us to biosorption process which is based on metal uptake properties of various biological materials. Biosorption is the ability of biological materials to accumulate heavy metals from waste water through metabolically mediated or physico-chemical pathways of uptake. Algae, bacteria and fungi and yeasts have proved to be potential metal biosorbents. The biosorption scores over conventional treatment methods in following ways: Low cost; High efficiency; Chemical and biological sludge minimization; No additional nutrient requirement; Regeneration of biosorbent; and Possibility of metal recovery [1]. The main aim of the present work is to see the biosorption of Cr^{6+} and Hg^{2+} using the attenuated cells of Bacillus licheniformis and Escherichia coli. Optimization of various parameters i.e. pH, temperature, contact time and biomass concentration.

II. RESEARCH METHODOLOGY

A. Biosorption Studies

Biosorption studies were done using biomass as a function of various parameters; Effect of pH, Effect of biomass concentration, Effect of temperature, Effect of time [2].

B. Adsorption isotherms [3]

The Langmuir model

$$Q = Q_{max}bC_f/ \ 1+bC_f.$$

Linearized Langmuir model; $1/Q = 1/Q_{max} (1/b \ C_f + 1)$

The Freundlich Model;

$$Q = k \ C_f (1/ \ n)$$

Linearized Freundlich equation;

$$Log \ Q = Log \ k + 1/n \ log \ C_f.$$

C. Rate kinetics

A lumped analysis of adsorption rate is sufficient to practical operation from a system design point of view. The commonly employed lumped kinetic models are the pseudo-first-order equation and the pseudo-second-order equation is presented below for determination of rate kinetics [4]

$$ln(q_e - q_t) = ln(\ q_e) - k_1 t$$

$$t/q_t = 1/k_2 \ q_e^2 + t/ \ q_e$$

III. RESULT AND DISCUSSION

Biosorption studies of Mercury using attenuated cells of Escherichia coli, Bacillus licheniformis and Mixed culture
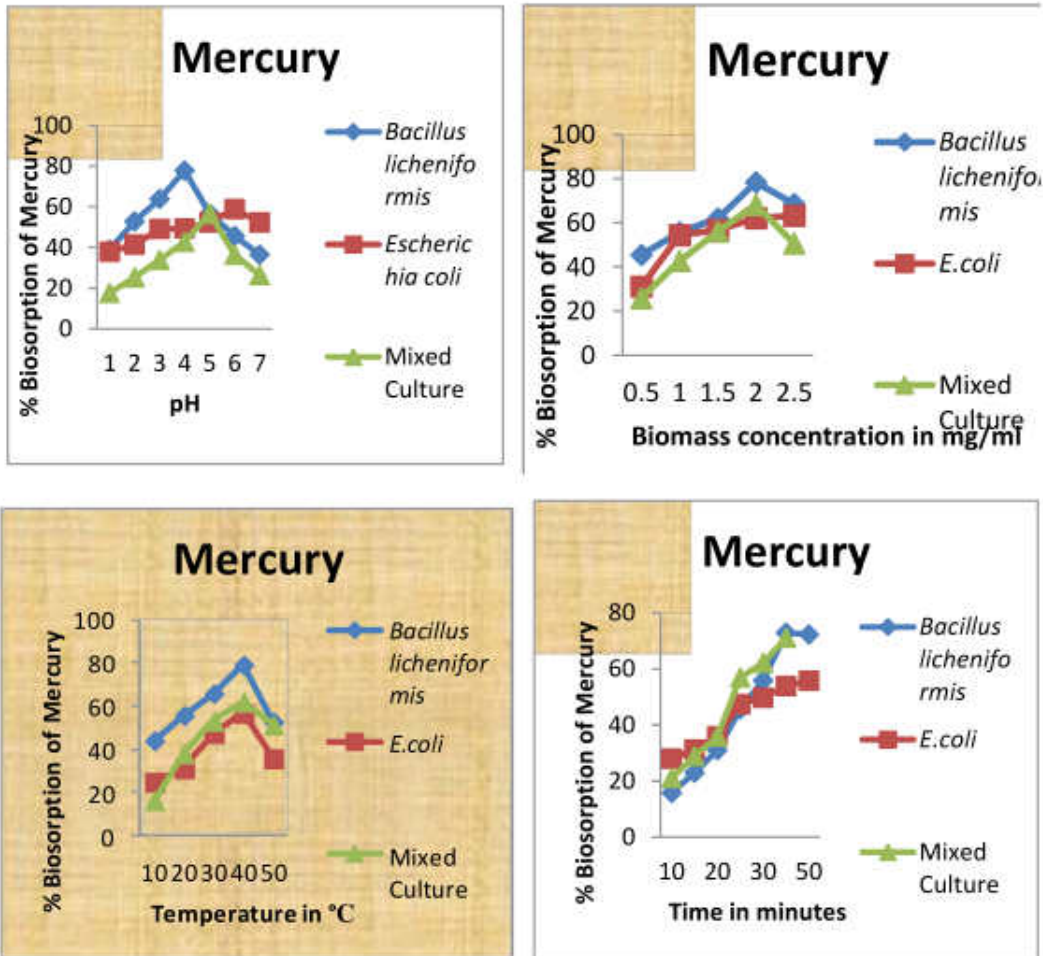
Biosorption studies of chromium using attenuated cells of Escherichia coli, Bacillus licheniformis and Mixed culture
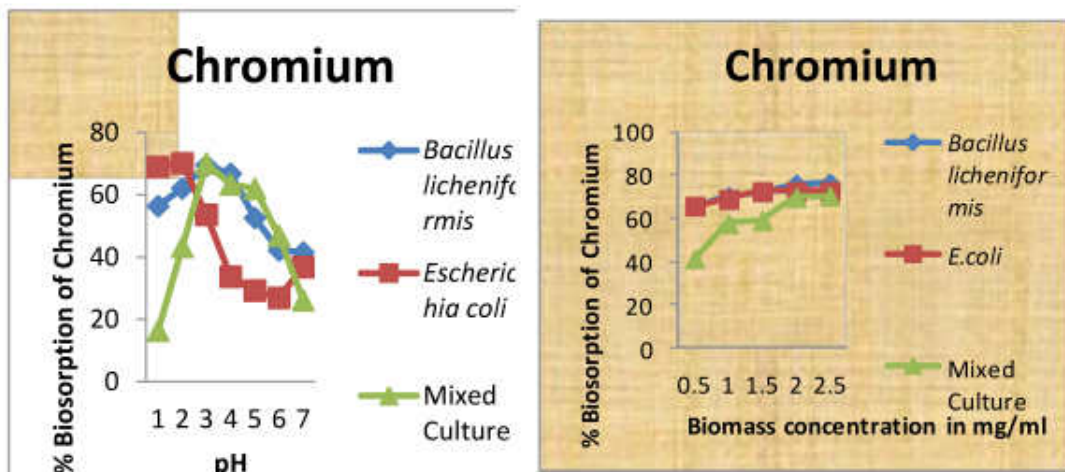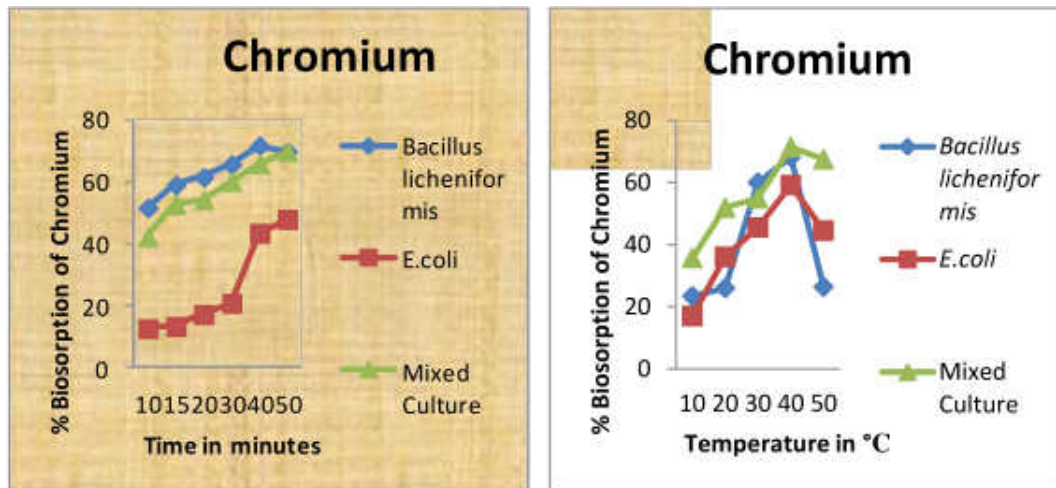
Adsorption Isotherms: The experimental data obtained from the biosorption experiments was analyzed for their applicability Langmuir and Freundlich model.

Table: Parameters of isotherm models for heavy metal Mercury

Metal	Langmuir parameters			Freundlich parameters		
	q_m	b	R^2	K	1/n	R^2
Mercury	6.944	1.170	0.910	3.074	-1.148	0.934

Rate kinetics for the determination of the suitable kinetic model the adsorption data was fitted into first order and second order kinetics.

Table: Kinetic data of Escherichia coli and Bacillus licheniformis (1:1) mixed culture for Mercury.

Metal	Pseudo 1st order			Pseudo 2nd order		
	K_1	q_e	R^2	K_2	q_e	R^2
Mercury	15.29	2.307	0.978	0.0124	9.708	0.882

Adsorption Isotherms The experimental data obtained from the biosorption experiments was analyzed for their applicability Langmuir and Freundlich model.

Table: Parameters of isotherm models for heavy metal Chromium

Metal	Langmuir parameters			Freundlich parameters		
	q_m	b	R^2	K	1/n	R^2
Chromium	10.39	1.165	0.9762	2.227	-0.755	0.9739

Rate kinetics For the determination of the suitable kinetic model the adsorption data was fitted into first order and second order kinetics.

Table: Kinetic data of Escherichia coli and Bacillus licheniformis (1:1) mixed culture for Chromium.

Metal	Pseudo 1st order			Pseudo 2nd order		
	K_1	q_e	R^2	K_2	q_e	R^2
Chromium	5.7327	4.0148	0.9241	0.0366	3.2216	0.9942

IV. CONCLUSION

Biosorption of two heavy metals mainly Mercury and Chromium were performed using individual and mixed culture of Escherichia coli and Bacillus licheniformis. Biosorption of heavy metals is the most promising technology involved in the removal of the toxic materials from industrial wastes and natural waters. Primary factors that influence the biosorption of heavy metals are pH, biomass concentration, temperature and contact time. The principle factor affecting the biosorption process by bacterial biomass is the cell walls of bacteria. Cell walls of gram negative bacteria and gram positive bacteria are different from each other on the basis of their thickness and cross-linking. Outer membrane is made up of layer of lipopolysaccharides and phospholipids and proteins which are mainly involved in biosorption through processes of cell surface complexation, ion exchange and microprecipitation [5]. In our study, gram positive Bacillus licheniformis showed higher absorption rate for chromium, this is

because of techoic acid acted as the prime binding site for metal cation [6]. For mercury, biosorption affinity was more for gram negative Escherichia coli as compare to gram positive Bacillus licheniformis. Here cell surface complexation was the mechanism occurring for the mercury biosorption. Complexation showed by the gram negative bacteria is due to the cross- linked peptidoglycan layer [7].

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Assessment of Physico-Chemical Parameters of Industrial Waste Water in Northern Region of Punjab

Navdeep Sidhu
Department of Biotechnology
CT Institute of Pharmaceutical Sciences,
Jalandhar
nsidhu540@yahoo.co.in

S K Munshi
Department of Biotechnology,
Punjab College of Technical Education,
Baddowal, Ludhiana
skmpau@rediffmail.com

Abstract: In the present study, emphasis is on the assessment of quality of industrial wastewater of the northern region of Punjab. Samples were collected from various drains carrying effluent of industries around Jalandhar city namely, Kalasanghia drain, Chaheru drain, Maqsudan drain, urban estate drain, Basti Bawa Khel and Hamira. The waste water quality is estimated by basic tests such as BOD, COD, Alkalinity, and DO and also heavy metals estimation like Lead and Copper is carried out. It was observed from the study that the impact of the waste water on environment is deletrious and needs to be studied for benefit of mankind.

Key words: waste water, BOD, COD, DO, Heavy metals.

I. INTRODUCTION

Due to increased population, many cities in northern region are generating huge quantities of solid and liquid waste which is simply disposed off on to the open land and in the drains surrounding various cities, sometimes covering the surrounding agriculture land [9] . The term wastewater is used to describe liquid wastes that are collected and transported to a treatment facility through a system of sewers. Wastewater is generally classified as domestic wastewater and industrial wastewater. Domestic wastewater comes from communities of homes, businesses, and institutions and comprises mainly 99.9% water and only 0.1% solids. The solids present may be dissolved or in suspended form. The suspended solids may settle down or may be filtered but dissolved solids are to be converted to suspended solids during the treatment process. Wastewaters generated by industries are much more polluted in comparison to domestic and commercial wastewaters. Several industries discharge their effluents into natural river streams which is unauthorized [3]. It has also been observed that the industries discharge their polluted wastewaters into municipal sewers which further make the treatment process more difficult and costly also. Laws have been made to stop such practice of industries. Moreover it becomes ethical for the industry to treat their wastewaters in their individual treatment plants,

before discharging their effluents either on land, lakes, rivers or in municipal sewers. The characteristics of the wastewater produced may vary according to the process carried out in industry [10]. Industrial wastewater is one of the major sources of pollution of water and soil. During the last few decades, huge amount of industrial wastewater has been discharged into water bodies and coastal areas. This has resulted in serious pollution problems in the environment and disturbed the eco-system and human life[7]. The increasing rate of industrial wastewater in developing countries is much higher than that observed in developed countries which further increase the environmental pollution. The major types of industries in Punjab are involved in Brewing, organic dye-stuffs, glue and adhesives, soaps, synthetic detergents, pesticides and herbicides, Tanneries and leather industries, Textile industries, pharmaceuticals, Cellulose and paper manufacturing plants, fermentation, and Metal processing industry. Different and special types of wastewater are produced by the industries mentioned above. The quality of the wastes produced varies according to the type of raw materials, working processes and waste generated [11]. The quality of waste water is assessed using parameters which include Hardness, Alkalinity, TSS, TDS, DO, BOD, COD, presence of various ions, heavy metals and microbes.

II. MATERIAL AND METHODS

A) Dissolved Oxygen

Dissolved oxygen (DO) analysis is used to measure the amount of gaseous oxygen (O_2) dissolved in an aqueous solution. Winkler method is used to check DO in sample and grab sampling technique is used for sample collection. This test is performed on the site preferably or within two or three hour of sample collection.

B) Biological Oxygen demand

Biological oxygen demand (BOD) is the parameter which is used to determine the pollution load of waste water. It detects the amount of organic matter present in the water and the amount of oxygen required by the micro organisms to stabilize the

biologically decomposable organic matter in wastes under aerobic conditions. The test is done by Winkler method using 5 day technique. The value is expressed in milligrams of oxygen consumed per liter of sample during 5 days of incubation at 20 °C.

C) Chemical Oxygen demand

Chemical oxygen demand (COD) is the test used to measure pollution of waste water. It is the amount of oxygen required for the oxidation of inorganic matter using a strong chemical oxidant. COD is tested to determine the degree of pollution in the effluent samples. In this test, a measured wastewater sample was heated with a known amount of Potassium Dichromate-Sulphuric Acid solution. Some of the dichromate was consumed in the oxidation of organic wastes.

D) Alkalinity

The total alkalinity of the water is mainly caused by the contents of calcium, magnesium, sodium, potassium, ammonia and iron, combined either with carbonates and/or bicarbonates or sometimes by hydroxide.

E) Lead and Copper

Neocuproine method is used to estimate amount of Copper in waste water samples [6,1] whereas Dithiazone method is used for lead estimation [5,1] .

F) Microbial estimation

Waste water obtained from various sources contain a variety of microorganism which may be pathogenic or non pathogenic so the sample is subjected to microbial analysis. The serial dilution method followed by agar plating technique is the commonly used procedure for isolation of microorganism. This method is based upon the fact that when a sample contains microorganisms in it, each variable microorganism will developed into colony and the number of colonies appearing on the plates represents the no of living organism present in sample. Serial dilution of sample is done followed by pour plating of different dilutions and incubation at 37^0C. Further the pure cultures are prepared by streaking at least three times on fresh media.

III. RESULT AND DISCUSSION

The waste water samples were collected from drains as mentioned above in two months i.e. mid of January and end of April so that temperature effect can also be included. For authentication of results, the samples were collected from three different points of each drain and the tests were repeated thrice. The results shown in the table are average of three readings. It was analyzed from the study that the sample collected from Hamira is more affected and polluted as it showed high value of BOD, COD and

also heavy metals are present in it in more amounts in comparison to the permissible level. The sample also showed presence of microbes which are further to be assessed and characterized on basis of their colony and biochemical characteristics. Maqsudan and Urban Estate drains are less polluted in comparison to all other drains from where samples were taken.

Table 1: Showing physico- chemical parameters of January samples (BIS VALUES: alkalinity-200, DO-6,BOD-30,COD-250,LEAD- 0.1,COPPER-1.5)

AREA	PARAMETERS					
	ALKALIN ITY	DO mg/l	BOD mg/l	COD mg/l	LEA D mg/l	COPPER mg/l
MAQUSDAN						
M1	19	23	153	122	0.29	0.31
M2	36	19.2	190	170	0.29	0.32
M3	41	23.2	145	230	0.26	0.31
CHAHREU						
C1	19	23.2	173	193	0.29	0.34
C2	24	27.1	193	232	0.22	0.34
C3	21	27.1	168	190	0.27	0.32
BASTIBAWA KHEL						
B1	20	27.1	192	232	0.13	0.29
B2	23	29.2	203	290	0.18	0.29
B3	19	27.2	200	310	0.18	0.26
KALA SANGHIA						
K1	30	31.5	213	195	0.29	0.26
K2	31	31.2	192	200	0.28	0.29
K3	31	35.0	213	252	0.26	0.27
URBAN ESTATE						
U1	20	25.0	182	162	0.17	0.17
U2	28	25.0	183	213	0.17	0.17
U3	28	25.0	192	252	0.16	0.17
HAMIRA						
H1	42	31.0	253	456	0.56	0.64
H2	43	24.5	251	393	0.52	0.62
H3	43	29.6	253	322	0.56	0.65

Table 2: Showing physico- chemical parameters of April samples (BIS VALUES: alkalinity-200,DO-6,BOD-30,COD-250,LEAD- 0.1,COPPER-1.5)

AREA	PARAMETERS					
	ALKALIN ITY	DO mg/l	BOD mg/l	CO D mg/l	LEAD mg/l	COPPER mg/l
MAQUSDAN						
M1	19	23	214	263	0.29	0.31
M2	36	19.2	232	270	0.29	0.32
M3	41	23.2	213	234	0.26	0.31
CHAHREU						
C1	19	23.2	240	234	0.29	0.34
C2	24	27.1	190	230	0.22	0.34
C3	21	27.1	272	210	0.27	0.32
BASTI BAWA KHEL						
B1	20	27.1	114	232	0.13	0.29
B2	23	29.2	163	284	0.18	0.29
B3	19	27.2	173	297	0.18	0.26
KALA SANGHIA						
K1	30	31.5	325	183	0.26	0.37
K2	31	31.2	303	230	0.28	0.29
K3	31	35	317	252	0.25	0.27

URBAN ESTATE						
U1	20	25	154	291	0.17	0.17
U2	28	25	144	211	0.17	0.17
U3	28	25	171	252	0.16	0.17
HAMIRA						
H1	42	32	315	412	0.62	0.78
H2	42.3	38	343	436	0.62	0.75
H3	42.5	34	324	383	0.63	0.77

From the isolates, it was observed that one bacterial species, one yeast and four mold species were present. These organisms were identified on basis of their colony characteristics, staining and biochemical characteristics. But their Binomial classification and their correlation with pathogencity are pending.
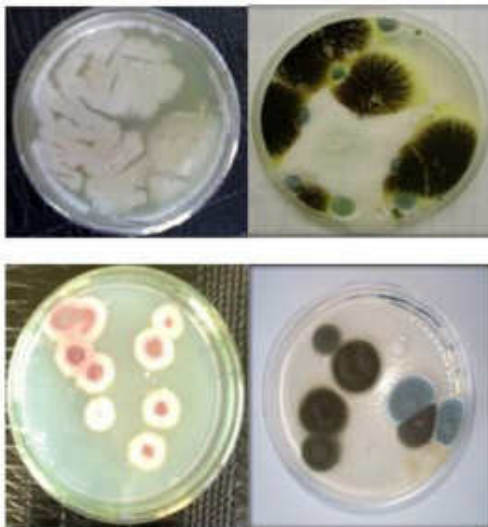
Fig 1: showing fungal colonies

Fig 2: showing bacterial colonies

IV. CONCLUSION

It is concluded from the present study that the waste water generated from the industries surrounding the study area has a deleterious impact on the environment as value of BOD, COD and lead are high where as alkalinity is low. The continuous discharge of wastewater has resulted in severe accumulation of pollutants. The polluted effluents must be treated properly before it is discharged into the drains so that there is minimum effect of the pollutants on the environment. The micro flora isolated from the waste water samples still requires its proper characterization and its pathogencity is still to be analysed.

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Antimicrobial Activity of Woodfordia Fructicosa Obtained from Chohal, Hoshiarpur (Punjab) Against an Isolated Species of Thermophilic Bacillus Stearothermophilus

Rupinder Chana
Medical Laboratory Technology
CT Polytechnic College,
Jalandhar
rupinder.ctips@gmail.com

Navdeep Sidhu
Department of Biotechnology
CT Institute of Pharmaceutical Sciences,
Jalandhar
nsidhu540@yahoo.co.in

Abstract: A thermophile is an organism a type of extremophile that survive at relatively high temperatures, between 45 and 80 °C. The most distinctive characteristic of this organism is its capacity to grow at 65°C. Bacillus stearothermophilus is a common contaminant of dairy products, particularly milk powder. The organism is characterized by the ability of its spores to survive pasteurization. The growth of thermophilic bacilli during the manufacture of milk powder is believed to occur as a biofilm. Methods to control the formation of biofilms in dairy manufacturing plants are required to reduce the contamination of dairy products with thermophilic bacilli. In order to overcome this problem the Antimicrobial Sensitivity of Bacillus stearothermophilus bacteria towards Woodfordia fruticosa which has got various medicinal properties was sort for. In the present paper, the antimicrobial activity of Woodfordia fructicosa against an isolated species of thermoplic Bacillus stearothermophilus was done. It was found that the organism isolated was B. stearothermophilus and was sensitive towards the plant extract.

Keywords— Thermophile, Bacillus stearothermophilus, Woodfordia fruticosa, Antimicrobial Sensitivity.

I. INTRODUCTION

The name Bacillus stearothermophilus (or Geobacillus stearothermophilus) is presumably intended to mean fat and heat loving. It is usually found in pairs (diplobacilli), or chains (streptobacilli). Bacilli may be single or adhere end to end to form chains. Some produce spores and some have flagella for locomotion. The most distinctive characters are the capacity to grow at 65°C. Bacillus strains capable of growing at temperature of 65°C and above do not belong to a single species, it is however a useful diagnostic character. Soils and manure are common habitats for Bacillus [3]. Bacillus produces its endospores to protect itself from desiccation. In addition Geobacillus species have also been recovered from artificial hot environments such as hot water pipelines, heat exchangers, waste treatment plants, burning coal refuse piles and bioremediation biopiles. A variety of potential environmental biotechnology applications involving Geobacillus species have

been described, perhaps unsurprising given the seemingly ubiquitous capability of Geobacillus species to metabolize hydrocarbons. These days work is done to study novel applications for Geobacillus species, firstly in metabolizing herbicides and therefore being potential sources of genes for use in agricultural biotechnology, and secondly as having the ability to disrupt quorum sensing in certain Gram-negative bacteria [2].

Bacillus stearothermophilus is a common contaminant of dairy products, particularly milk powder. The organism is characterized by the ability of its spores to survive pasteurization (73 °C, 15 s) and grow at 65 °C. The organism is recognized as a problem in the manufacture of milk powder, as high levels of these bacteria may, after reconstitution of the milk powder, cause spoilage [3]. The growth of thermophilic bacilli during the manufacture of milk powder is believed to occur as a biofilm [7]. Methods to control the formation of biofilms in dairy manufacturing plants are required to reduce the contamination of dairy products with thermophilic bacilli. As the environmental temperature is increased, the proportion of saturated fatty acids found in the membrane lipids is also markedly increased with a concomitant [1]. The temperature range over which the gel to liquid-crystalline membrane lipid phase transition occurs is thereby shifted such that the upper boundary of this transition always lies near (and usually below) the temperature of growth. In order to overcome this problem the Antimicrobial Sensitivity of Bacillus stearothermophilus bacteria towards Woodfordia fruticosa which has got various medicinal properties was sort for.

The plant is a well known non-wood forest produce that has long been in use regular demand amongst practitioners of traditional medicines in different South East Asian countries. In India, it is much used medicinal plant in Ayurvedic and Unani systems of medicines [12]. Although all parts of this plant posses valuable medicinal properties, there is heavy demand for the flowers, both in domestic and international markets

specialized in the preparation of herbal medicines. According to the Indian Systems of medicine, this flower is pungent, acrid, cooling, toxic, alexiteric, uterine sedative and anthelmintic, and is useful in thirst, dysentery, leprosy, erysipelas, blood diseases, leucorrhea, menorrhagia and toothache [11].

II. MATERIALS AND METHODS

A. The samples used to isolate the thermophilic bacteria were the soils taken from two local nurseries of Jalandhar. The two samples were mixed properly in a petriplate and incubated at 80°C and then at 65°C for ten minutes each. Then about 10 gm of the incubated samples were added into three flasks containing 90 ml Nutrient Broth in each as shown in fig. 1. The flasks were then incubated at 65°C for 48 hrs and observed. After the observation of growth, the broth from each of the three flasks was serially diluted till 10^{-9} dilution. After serial dilutions the samples were then incubated at 65°C for 48 hrs and observed. The organism was then isolated from the serially diluted broth on Nutrient agar plates by Pour Plating and Streaking methods .Here 1ml of sample from the three serially diluted test tube having best microbial growth was spread, onto Petri plate. After incubation, observations were noted and the process was repeated twice to obtain pure cultures. Then finally, cultures were T-streaked (onto freshly prepared and labeled NA plates) to isolate a pure culture. After the growth was obtained, this culture was further streaked on Nutrient agar plates in four quadrants by "tornado" pattern as shown in figure 2. One addition that was made in our procedures was to incubate the beaker with water. This was done to prevent over drying of the agar plates.

Fig. 1 Soil Samples after 48 hours incubation in natural Broth

B. The identification of the organism was done by subjecting the obtained culture to staining and biochemical tests. For this simple staining and Gram staining was done for morphological examination. Biochemical characterization was done in laboratories of CTIPS block of CT Institutes, Shahpur. The main tests performed were

1) Gelatin Liquifaction test

   Gelatinase enzyme is secreted by the organisms like Bacillus stearothermophilus which act on gelatin (liquefied) and it is confirmed by placing the test tube at 4°C for 30 minutes.

2) Catalase test

   This test is used to differentiate catalase producing Bacteria such as staphylococci from non-catalase producing bacteria.

3) Methyl Red test

   Some Enterobacteria when cultured in buffered glucose peptone water, ferment glucose to produce sufficient acidity, which gives red color with methyl red indicator (pH range 4.4-6.2).
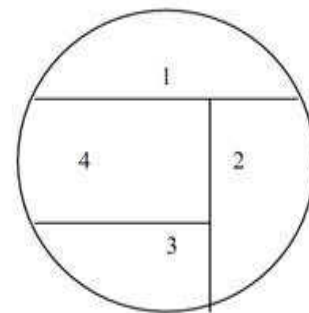
(a)
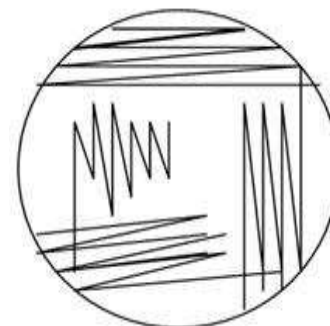
(b)

Fig. 2 Showing the pattern of Streaking a) the four quadrants b) Tornado pattern

C. Further, the Antimicrobial Sensitivity of the isolated organism towards the extract obtained from the plant Woodfordia fruticosa was done.The plant was obtained from the foothills of Shivaliks,from Chohal area in Hoshiarpur District,Punjab.The leaves of the plant were grinded and then were extracted in Soxhlet apparatus using different solvents i.e. Hexane, Acetone, Methanol. The

solvents were then distilled off leaving the crude extract The crude extract was now used to prepare Antibioticl Discs. The discs were first sterilized by autoclaving and then they were dipped in the freshly prepared plant extract. Antimicrobial test was done by first aseptically inoculating 20 µl of inoculum on Nutrient agar plates. Then after incubation the plates were divided into three parts and the prepared discs were transferred to each part with the help of a sterile forceps. The plates containing the bacteria and the discs were again incubated at 65°C for 24 hrs. After 24 hrs the observation for the presence and subsequent measurement of the zone of inhibition was done.

III. RESULT AND DISCUSSION

A. The colonies obtained (refer Fig 3.) at different time intervals of incubation are shown in table 1.

Fig. 3 Colony of Bacillus stearothermophilus

TABLE 1 - COLONIES OBTAINED AT DIFFERENT TIME INTERVALS OF INCUBATION

S. No.	Sample	After 24 Hrs	After 48 Hrs	After 72 Hrs
1.	I	65-85	87-93	99-106
2.	II	58-89	92-98	102-113
3.	II	62-77	89-93	100-107

Morphologically, the colonies of bacteria obtained were round, medium sized and whitish cream in colour. Growth was observed at 65° C under aerobic conditions. Due to motility, some colonies were spread-out on the plate with fingerlike projections. Gram staining performed on the bacteria showed blue colored rod shaped bacteria and non stained endospores were observed under light microscope. Endospores were located either towards the side of the cell or at the very end of the rod shaped cell. Not all cells formed endospores synchronously due to the fact endospore formation is instigated by a change in the environment (lack of nutrients, temperature change, desiccation, overgrowth) or age of the cell. Thus, endospore formation reflects conditions that are not optimal for the growth of the vegetative cell (cell without endospores). Therefore, some cells have endospores while others lack them.

B. Biochemical characterization of the organisms gave the results as per table 2.

TABLE 2 - BIOCHEMICAL CHARACTERIZATION OF THE ORGANISMS

S. No.	B.C. Test		Sample (I)	Sample (II)	Sample (III)
1.	Gelatin liquefaction Test	Dilution	$10^{-3}, 10^{-4}, 10^{-5}$	$10^{-3}, 10^{-4}, 10^{-5}$	$10^{-3}, 10^{-4}, 10^{-5}$
		Observation	Positive	Positive	Positive
2.	Catalase Test	Dilution	$10^{-3}, 10^{-4}, 10^{-5}$	$10^{-3}, 10^{-4}, 10^{-5}$	$10^{-3}, 10^{-4}, 10^{-5}$
		Observation	Positive	Positive	Positive
3.	Methyl Red Test	Dilution	$10^{-3}, 10^{-4}, 10^{-5}$	$10^{-3}, 10^{-4}, 10^{-5}$	$10^{-3}, 10^{-4}, 10^{-5}$
		Observation	Negative	Negative	Negative

1) Antimicrobial Effect

Further, the results for Antimicrobial sensitivity test (refer Fig. 4) are shown in table 3.

Fig. 4 Antibacterial Sensitivity Test

TABLE 3 - ANTIMICROBIAL SENSITIVITY TEST RESULTS

S. No.	Sample	ZONE OF INHIBITION		
		W.f. MeOH	W.f. Acetone	W.f. Hexane
1.	Bacillus I	16 mm	16 mm	28 mm
2.	Bacillus II	20 mm	16 mm	18 mm
3.	Bacillus III	12 mm	16 mm	14 mm

The number of colony of Bacillus stearothermophilus is count and medium-sized, round and cream colored. Due to motility some colonies were spread-out on the plate with fingerlike projections. Gram stains of the isolated colony indicated a gram-positive rod, some of which contained endospores found near the terminal end (subterminal) of the cell. One addition that was made in our procedures was to incubate the beaker with water. This was done to prevent over drying of the agar plates due to high incubation temperature.

The positive gelatin liquefaction test and catalase test (i.e. confirmation test) meant that the gelatinase and catalase enzyme is secreted by Bacillus and the methyl red confirmation test is negative mean that sufficient acidity is not produced by Bacillus. B. stearothermophilus isolation was supported by gelatin liquefaction and catalase test. This test was performed to

ensure that a similar Bacillus species was not insolated instead B. stearothermophilus. Bacillus coagulans is similar in that it is a gram-positive thermophile, rod shaped and with endospore formation. The major difference is that Bacillus stearothermophilus gives positive test for liquefaction of gelatin and catalase while Bacillus coagulans doesn't. Thus, even though Bacillus coagulans is rarely found in soils, the test was performed to ensure that there was no false isolation, or thermophilic contamination from laboratory sources such as from tools, incubator, air or other equipment. Also as Bacillus stearothermophilus is an obligate aerobe, a positive test for the presence of the enzyme catalase was indicated by the formation of oxygen bubbles.

The results of Antibacterial sensitivity test revealed that the isolated Bacillus stearothermophilus is markedly sensitive to the extract of Woodfordia fruticosa plant.

IV. CONCLUSION

Due to the observance of rod-shaped bacteria with endospores, along with positive Gram stain, positive Gelatin liquefaction catalase and negative from Methyl red tests, it was concluded that Bacillus stearothermophilus had been successfully isolated.

In this protocol, the appearance of endospores within the rod-shaped cells under the microscope was a major indicator that Bacillus stearothermophilus was present. Also the appearance of such size of clear zones around the discs indicated that the organism is sensitive to the extract of Woodfordia fruticosa and so can be used to control the unnecessary growth of and spoilage by Bacillus stearothermophilus.

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Phytoremediation - A Technology to Remediate the Polluted Cultivation Soils in Punjab

Rakesh Gupta
Department of Botany,
Punjabi University,
Patiala, Punjab, India

MIS Saggoo
Department of Botany,
Punjabi University,
Patiala, Punjab, India

Abstract: Growing industrialization and urbanization have lead to increasing water pollution since effleuents are often released in the drains irrigating cultivation belts of Punjab. Toxic metals are getting accumulated in soil then to Crops which ultimately effecting the qulity of in addition to side effect on environment. Use of fertilizers, pesticides, weedicides etc had also aggrevated the problem. The heavy metal containing effluents from Leather and Sports Complex, Jalandhar are discharged in the Kalasinghia drain which moves through the agricultural fields of Jalandhar –Kapurthala belts in Punjab,India Many native plants had faced this stress since decades and are well acclamatized due to genetic adaptaions and are resistant to metal stresses and also do accumulate them . Due to this, theses Local weeds like Pathenium, Amarnthus, Xanthium etc were selected to remediate the soils as they are adapted to stress and good toxic metal accumulators and was confirmed during investigation. Soil and weeds samples were taken from four polluted sites. The control area was about 20 kilometers away where only tube well irrigation is taking place. Soil and the plants samples were collected from the polluted as well as the control site. Investigation was done on metal accumulation in the aerial parts, and roots. Samples were acid digested and heavy metal accumulation was estimated using ICAP-AES method. Pot experimentation, Hydroponics were conducted and Bioaccumulation factor (BAF), Enrichment Factor (EF), Translocation factor (TLF) were calculated for different heavy metals and better phyoremediator weeds were screened. Tolerance index (TI) and Phytoextraction Capacity (PC) were also evaluated to screen better remediators .Many plants are reported to be good phytoremediator due to efficent metal accumulations. According to Baker et al (2000) the local growing plants can be good phyoremediator in polluted soils.The wild growing species can remediate the polluted soils where they are growing (Delio et al 2000).By above remediation potential evaluation, it was observed that Amarnathus Viridis emerged as a good metal accumulator weed as it was having good Biomass and a considerable metal accumulator in the leaves as was cofirmed from the BAF,EF,TLF,TI and PC Values in compare to other weed plants during investigation . Due to its better tolerance index values and Phytoextraction vales it can be suggested to be used to cure the toxic metal acculation in fields especially the Pb,Cr,Cu metals . Only treated water should be released to the drain as it is without the high concentarion of these heavy metals.

I. INTRODUCTION

Industrialization without proper environmental planning often leads to discharge of industrial effluents and sewage into rivers and water bodies. Industrial waste water is rich in heavy metals and other toxic elements. Waste disposal activities are one of most significant source of heavy metal pollution in the environment [1]. Waste waters often used for agriculture purposes, like irrigation thus leading to toxic metal contamination in cultivation soils. Cr pollution in soil is due to industry waste waters. Food safety issues of such agricultural practices and potential adverse health risks make one of the most environment concern.health risks to human and live stocks due theses agricultural practicies. Heavy metals are known to accumulate in living organisms and there is inherent tendency of plants to take up the toxic elements.Use of contaminated soil for raising crops results into contaminated food grains and vegetables which ultimately affect the human health [2].

Growing industrialization and urbanization have lead to increasing water pollution since effluents' are often released in the drains irrigating the cultivation belts of Punjab. Toxic metals are getting accumulated in soil then Crops which ultimately effecting the quality in addition to side effect on environment. Use of fertilizers, pesticides, weedicides etc had also aggrevated the problem. Many native plants had faced this stress since decades and are well acclamatized due to genetic adaptaions and are resistant to metal stresses and also do accumulate them. Due to this, theses Local weeds like Pathenium, Amarnthus, Xanthium etc were selected to remediate the soils as they are adapted to stress and good toxic metal accumulators and was confirmed during investigation. Soil and weeds samples were taken from four polluted sites. The control area was about 20 kilometers away where only tube well irrigation is taking place. Soil and the plants samples were collected from the polluted as well as the control site.

II. MATERIALS AND METHODS

A. Soil Analysis

Hundred grams of the soil sample was acid digested and total metal estimation was done using inductively coupled argon plasma atomic emission spectrophotometer (ICAP-AES) method (AOAC, 1984)**.**

B. Metal Uptake

The samples were analyzed using ICAP-AES (Inductively coupled argon plasma atomic emission spectrophotometer) method (AOAC, 1984).

C. Biochemical Analysis

The fresh leaves were washed thoroughly to remove all traces of soil particles and were used for estimation of various nutritive constituents like total soluble proteins (Lowry et al., 1951), carbohydrates (Ashwell, 1957) and chlorophyll (UV-Visible Spectrophotometer (U.S. EPA 1994).

III. OBSERVATIONS AND RESULTS

A. Soil Profile

Soil analysis was done for all selected locations i e. Control and Polluted one P1, P2, P3, P4. The soils of various polluted fields as well as the control fields were subjected to phytochemical analysis covering pH of soil and metal profile. The soil samples taken from each location were subjected to elemental analysis following Plasma atomic Emission spectrophotometer (ICAP-AES) Method (AOAC 1984). The observations on various parameters of soil characters are done.

1) Metal Bioaccumulations

The specimens of presently selected species were collected. The dried shoots and roots of each species were separately acid digested and heavy metal content was estimated with the help of ICAP.

Estimations were made for heavy metals like Cr, Cu, Ni, Pb and Cd species are provided.

2) Phytoremediation Potential

3) Seed germination testing

Seed germination and seedling growth, the critical stages of plant development, are key factors in metal tolerance test. The seed germination ability and viability of species of plants under investigation under different concentartion of heavy metals like Cr, Cu, Ni, Pb, and Cd was tested.

The results showed that metal concentrations in medium had an obvious effect on seed germination and different species showed different responses towards these heavy metals.

In Metal tolerance test, the dried seeds (30) were placed in Petriplates in triplets with standardized concentrations. The seeds were given treatments on moistered filter paper with the water solution of the various concentrations (in µg/g) for heavy metals. The Germination percentage and radical growth analysis were done. Make various solutions of 25, 50, 100 mg/L of various metals. The salt used was Chromium chloride ($CrCl_3$) for Cr, Copper Sulphate ($CuSo_4$), $NiCl_2$ for Ni, Lead Chloride ($PdCl_3$) and Cadmium Chloride ($CdCl_3$) for Cd (Table 3).

Table 3: Effect of various metals on seed germination and root growth on Amaranthus spinosus

Concentration of Metal (µg/g)	Metal Exposure				
	Cr	Cu	Ni	Pb	Cd
Seed germination (%)					
25	67	60	65	67	68
50	65	55	55	67	60
100	55	55	59	65	57
Radical Size(mm)					
0	1.6	1.9	1.9	2.0	2.2
25	2.2	2.2	2.3	2.5	1.8
50	2.8	2.2	2.2	2.2	1.8
100	1.2	2.1	1.9	2.2	2.1

B. Pot Experiments

The concept of using metal accumulator and hyper accumulator plants to remove excess of metals from contaminated soil was first suggested by Dr. IIya Raskin in 1991, since then much attention has been focused on

identification of plant species ideal for phytoremediation. The plants which efficiently extract metals or pollutants from the soil, have tolerance to adverse disturbed environment, fast growth, good biomass and have exceptionally high foliar metal concentration are considered ideal candidates to be used in remediation practice [3]. Presently, seven species of weeds from the study area (genotypes) from polluted areas were selected for evaluating their phytoremediation potential in vivo, by conducting pot experiment as well as hydroponic experiment.

Pot experiments have been performed to check their metal tolerance, metal uptake and growth potentials. Five heavy metals common in the polluted soils under investigation i.e. Cr, Cu, Ni, Pb and Cd were selected for further study. Salts like Chromium chloride (for Cr), Copper oxide (for Cu) were used as source of heavy metals. Plants were raised in nursery beds using seeds of the selected plant species collected from fields of polluted village Chaemera. Fifteen days old seedlings were transplanted in the pots (9 inch diameter) filled with the normal garden soil amended with known quantity of Heavy metal salts to make the final concentration of metals 25 µg/g, 50 µg/g and 100 µg/g in the soil for each pot. Garden soil without mixture of any salt served as the control.

C. Effect on Growth

The growth of Amaranthus spinosus was evaluated for the effect of Cr, Cu, Ni, Pb, Cd which was studied by making periodic observations Length, fresh and dry weights of roots and shoots after every 15 days of growth till 60 days from the date of transplantation. (Table 4)

Table 4: Effect of Chromium on growth of Amaranthus spinosus

Concentration of Cr (In µg/g) added in soil

Character	Plant parts	Control	25	50	100
At 15 days Treatment					
Length(cm)	Root	4.62±.77	4.52±.77	4.47±.32	4.32±.48
	Shoot	21.62±.92	21.57±.77	21.47±.32	21.32±.17
FW(mg)	Root	74.92±.62	74.67±.52	74.33±.67	74.17±.74
	Shoot	493±6.9	462±7.2	757±6.2	417±5.2
DW(mg)	Root	3.11±.64	3.11±.69	3.7±.67	3.5±.87
	Shoot	48.62±.56	48.55±1.2	48.36±1.4	48.22±.92
At 30 days Treatment					
Length(cm)	Root	5.71±.88	5.61±.62	5.42±.72	5.31±.52
	Shoot	29.42±.62	29.32±.54	29.1±.37	29.11±.22
FW(mg)	Root	133.42±.52	123.46±1.7	117.62±7.2	111.72±6.7
	Shoot	1594.33±7.68	1590.34±11.6	1566.92±22.4	1537.47±
DW(mg)	Root	21.44±.37	21.32±.46	21.27±.77	21.12±.56
	Shoot	282.74±7.62	282.62±7.4	282.43±6.2	282.41±6
At 45 days Treatment					
Length(cm)	Root	10.77±.49	10.67±.52	10.52±.37	10.41±.22
	Shoot	50.79±.66	50.67±.42	50.42±.32	50.32±.28
FW(mg)	Root	396.78±13.1	396.71±11.6	396.44±14.2	382.47±17
	Shoot	2894±7.6	2844±11.2	2832±22.6	2817±32.6
DW(mg)	Root	104±2.2	1020±4.2	101±2.3	96±3.3
	Shoot	1882.42±14.52	1842.62±17.2	1822.42±19.2	1811.62±22.6
Percentage Increase (15-30days)					
Length(cm)		33.88	33.88	33.08	34.24
Dry matter(mg)		488.01	488.35	483.37	486.87
Percentage Increase (30-45days)					
Length(cm)		75.23	75.61	76.54	76.44
Dry matter (mg)		552.9	841.47	533.19	528.27

Generally plants growing over Chromium amended soils showed dose dependent decrease in the plant dimensions in compare to control. There was a general trend of decreasing Fresh and dry weights of the roots and shoots of polluted plants in compare control plants and on average same trend observed after 30, 45 and 60 days of treatment for all metals i.e., Cr, Cu, Ni, Pb, Cd. The Plants growth rate was measured by the percent increase in the plant dimensions and the fresh and dry matter which showed a varied trend. Observations were taken for the average increase in the length of Roots and shoots including their fresh and dry weight for the Metal exposures and the non treated plants. The percentage increase in length and Dry weight was calculated for all metal exposures.

For Cr in Amaranthus spinosus, maximum percentage (%) increase was 34.24 in length with 488.35 in Dry matter in 15th day to 76.54 in length with 841.47 in Dry matter in 45th day. For Cu, maximum percentage (%) increase was 45.97 in length with 499.07 in Dry matter in 15th day to 78.84 in length with 550.93 in Dry matter in 45th day. For Ni, maximum percentage (%) increase was 45.4 in length with 3352.01 in Dry matter in 15th day to 84.01 in length with 12.81 in Dry matter in 45th day. For Pb, maximum percentage (%) increase was 49.69 in length with 478.28 in Dry matter

in 15th day to 90.38 in length with 560.6 in Dry matter in 45th day. For Cd, maximum percentage (%) increase was 46.97 in length with 481.85 in Dry matter in 15th day to 91.22 in length with 711.9 in Dry matter in 45th day.

A. Metal uptake

The Chromium uptake by Amaranthus spinosus was studied in pots. There was increase in all metals (Cr, Cu, Ni, Pb, and Cd) uptake by the plants with the increase in the concentration of these metals in the soil. Maximum metal uptake was observed in different parts in particular leaves in 100 µg/g exposure. Leaves showed a trend of higher uptake of metal followed by the roots and then the shoots. There was negligible or nondetectable metal trace in Control plants. Metal uptake range from 20.69 µg/g to 69.82 µg/g (Cr), 17.82 µg/g to 41.32 µg/g (Cu), 32.62 µg/g to 82.69 µg/g (Ni), 11.69 µg/g to 26.59 µg/g (Pb) and 17.89 µg/g to 45.69 µg/g (Cd) for metal treated soils with range from 25 µg/g, 50 µg/g to 100 µg/g in pots.

Bioaccumulation is the ratio of metal contentin root to ratio of metal content in soil and Translocation factor is ratio of metal content in shoots to metal content in root .Following results were observed for different metals (Tables 6 and 7)

Table 6: Bioaccumulation factor (BF) in the Amaranthus spinosus plants raised on soil amended with different conc of metals.

Bioaccumulation Factor (BF)

Metal exposure	Cr	Cu	Ni	Pb	Cd
25ppm	0.97	0.79	0.71	0.71	0.35
50ppm	0.85	0.73	0.59	0.52	0.34
100ppm	0.62	0.57	0.68	0.53	0.35

Table 7: Translocation factor (TF) in the Amaranthus spinosus plants raised on soil amended with different conc of metals.

Translocation Factor (TF)

Metal exposure	Cr	Cu	Ni	Pb	Cd
25ppm	0.87	0.9	1.84	0.66	2.04
50ppm	0.77	0.76	2.4	0.57	1.26
100ppm	1.13	0.73	1.22	0.5	1.32

IV. DISCUSSION AND CONCLUSION

More than 400 metal hyperaccumulator flowering plants have been identified that can grow on metal rich soils and can accumulate huge amount of metals in their tissue without showing any toxicity [4]. These are considered good for phytoremediation work. A number of hyperaccumulator

species may have little potential for phytoremediation because of their small size and slow growth [5]. The plants exhibiting high TF and BF value (< 1) are suitable for phytoextraction.

The efficiency of phytoextraction by a given species depends on two key factors biomass and metal accumulation factor

[6]. Hyperaccumulator or high accumulator of a metal if has low biomass does not fulfill the requirement of a good phytoextractor. Plant biomass, bioconcentration factor and soil mass are the three key variables that define phytoremediation potential of a given species [7]. Since the phytoextraction of heavy metals depends on shoot biomass production, soil metal content, metal uptake and other factors, the phytoextraction capacity (PC) of the presently investigated seven species was evaluated in vivo.

Amaranthus spinosus have the highest BF value for Cr if it compared with other weeds under investigation (Fig .1) .A remarkable deposition was observed in different parts of the plant specially the leaves for all metals also .By evaluationg the BF ,TF values it was found that Amaranthus spinosus show sigificant values for all metal exposuers specially Cr.Further their deposition was confirmrd by evaluating the correlation coefficient and have significant tolernance index .Since the plant have sufficeint Biomass (DW) so have good phytoextration values .From above discussion it is concluded that Amaranthus spinosus can be a potential remediator for heavy metals like Cr,Cu,Ni,Pb and Cd in particular Cr toxic soils .

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In-Silico Analogue Preparation and Toxicity Risk Assessment of the Yohimbine as α2 Adrengenic Receptor Inhibitors.

Neema Tufchi, Kumud Pant
Department of Biotechnology,
Graphic Era University
Dehradun, India
neematufchi@gmail.com, pant.kumud@gmail.com

Bhasker Pant
Department of IT,
Graphic Era University
Dehradun, India
pantbhaskar2@gmail.com

Abstract— Some natural alkaloids from medicinal plants, such as yohimbine, have been investigated with adrenoceptor (AR) α2 inhibiting activity. In this paper we are trying to model analogues using yohimbine as a standard compound. The 2 known analogues taken from Zinc database and, 50 analogues were prepared using chemsketch. The Physiochemical properties, Bioactivity, Toxicity and Absorption, Distribution, Metabolism and Excretion of Molecules (ADME) of these compounds were predicted. Analogue 33 showed good drug likeness score and bioactivity score, on comparison with other compounds. The ADME suggested very significant results in regard to yohimbine. These results can helps in designing of new selective AR α2 inhibitors.

Keywords—yohimbine, alkaloids, adrenoceptor, analogues, chemsketch.

I. INTRODUCTION

The alpha-2 (α2) adrenergic receptor is a G protein-coupled receptor (GPCR) which is associated with the G_i heterotrimeric G-protein. It is also known as adrenoceptor (AR). They are found in both the central and peripheral nervous system [1]. They are also present in both presynaptic neurons as well as postsynaptic cells. They work generally as autoreceptors to mediate feedback inhibition of sympathetic transmission. Other sites of adrenoceptor are pancreatic beta cells, platelets and smooth muscle of blood vessels. When they are associated with presynaptic neurons they inhibit the release of norepinephrine [2]. Inhibition of heteroreceptors (they inhibit acetylcholine release from cholinergic neurons) is also one of the function of adrenoceptor. Also, when alpha 2 receptors get activated on pancreatic beta cells membranes it inhibits the release of insulin. The a_2-adrenoceptor G-protein, Gi/Go, has been shown to be negatively coupled to adenylate cyclase and so reduces the formation of cyclic AMP which leads to a decreased influx of calcium during the action potential - the ion responsible for transmitter release [1]. Therefore lowered levels of calcium will correspondingly lead to a decrease in transmitter release. So far, 9 AR subtypes have been reported. According to the pharmacological functions and sequences they are classified into subtypes α1, α2 and β.α1 receptors have subtype A, B, and D. α2 receptors have subtypes A, B, and C. β receptors have β1, β2, β3.It has been shown that AR family has always been used as the

targets for drug discovery. Both the compounds which are agonist and the antagonist on different AR subtypes can be good target molecules with pharmacological effects. The alpha-2 adrenergic receptor affects the central nervous system and the encephalitis virus also affects the same so we can say that yohimbine can also inhibits some of the virulent proteins of encephalitis virus and thus any of the analogues can be effective drug against the virus. The α2 ARs are widely distributed throughout the peripheral and CNS. The compounds which are agonists to α2 ARs have analgesic properties like spinal, supraspinal, peripheral, and systemic administration [1].

Yohimbine is a plant metabolite which was first isolated from bark of a West African tree Pausinystalia yohimbe (Rubiaceae) in 1945 [3]. It was formerly known as Corynanthe yohimbe and sometimes spelled johimbe. It is a psychoactive plant (crosses the blood–brain barrier and acts primarily upon the central nervous system where it affects brain function) [4]. This plant conatins other alkaloids also but yohimbine accounts 1-20% of its total alkaloid content. The alkaloid yohimbine has other activities also like antidiuretic, antiadrenaline, mydriatic, serotonin antagonist, etc. But the most remarkable activity of yohimbine is antagonists to α2 ARs [5]. Due to this reason this chemical alkaloid has attracted more attention.

In this paper we have tried to make analogues of yohimbine by computational tools with their toxicity checked. These analogues have structure related to that of yohimbine, but their chemical and biological properties may differ so that we have numerous repository of yohimbine like alkaloid which can be further used in inhibition of diseases.
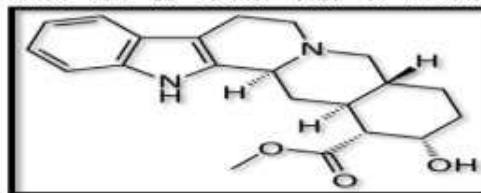
Fig 1: Chemical structure of yohimbine.

II. MATERIALS AND METHODS

A. Pubchem

PubChem is an online publically available repository for biological properties of small molecules. It is provided by the US National Institutes of Health (NIH). This database currently contains results for more than 700 000 compounds. The PubChem plays an important role in making the information easily accessible to researchers. PubChem's integration with NCBI's Entrez search engine provides similarity structure, sub/superstructure, bioactivity data, and other searching. PubChem database include more than: 1000 bioassays, 28 million bioassay test outcomes, 40 million substance contributed descriptions, and 19 million unique compound structures contributed from different organizations. PubChem is comprised of three linked databases, PubChem Compound, PubChem Substance and PubChem Bioassay. PubChem can easily link its chemical structure records to biological property information in PubMed [6].

B. Zinc database

This database is freely available for users and is available in (http://zinc.docking.org). This database contains information of many chemical compounds in several common file formats including mol2, SMILES, SDF, and DOCK flexibase format. This enables users to upload compounds by their zinc id, drug name, smiles, etc. Users can process their own molecules by uploading them to a server. This database provides virtual screening libraries to a wide community of structural biologists and medicinal chemists [7].

C. ACD labs Chemsketch

ACD labs Chemsketch v 12.0 is chemical drawing interface free software. It allows users to draw any chemical structure of organic molecules, organometallics and polymers. It also enables users to get IUPAC names, Lewis structures, 3D structures, molecular properties, physicochemical properties, space filling models or ball and stick models and other things of provided chemical structure [8].

D. Osiris Property Explorer

Osiris property explorer is an online tool which is free for academic users. This allows users to draw structure of chemical compound and calculates the toxicity of drawn compound. The results are color coded i.e.; Properties with high risks of undesired effects like mutagenicity, toxicity, irritant and reproductive effects are shown in red whereas a green color indicates drug conform behavior. It also calculates drug score and druglikeliness of the compound [9].

E. *Lipinski's Rule*

Lipinski's rule of five also known as the Pfizer's rule of five or simply the Rule of five (RO5). It is a rule of evaluating drug likeness or it determines whether a chemical compound with a biological or pharmacological activity has properties that would make it a likely orally active drug in humans. The rule was given by Christopher A. Lipinski (1997). This rule describes molecular properties of the drug and drug's behavior in the human body, and their absorption, distribution, metabolism and excretion (ADME) [10].

Lipinski's rule states:

1) Hydrogen bond donors should not be more than 5
2) Hydrogen bond acceptors should not be more than10
3) Molecular mass should be less than 500 Daltons
4) log P(An octanal-water partition coefficient) should not be greater than 5
5) Number of violations should always be less than one [11].

Mol inspiration is free online web based software that was used to calculate molecular parameters such as MiLogP, TPSA, and drug likeness. MiLogP (octanol/water partition coefficient) property is used to check whether the molecules have good permeability across the membrane. The method is very vigorous and is able to process nearly all organic and most organometallic molecules. Molecular Polar Surface Area TPSA is related to hydrogen bonding potential of compound. TPSA has been shown to be a very good descriptor characterizing drug absorption, including blood brain barrier penetration, CaCO2 permeability, intestinal absorption and bioavailability. Number of Rotatable Bonds (n rotb) is used for measuring molecular flexibility. It indicates a very good descriptor of oral bioavailability of drugs [12].

F. Admet Sar Database

ADMET (Absorption, Distribution, Metabolism, Excretion and Toxicity profiles) provides the latest and most comprehensive manually curated data for diverse chemicals. AdmetSAR is a freely available online database which searches for ADMET properties profiling by common name, CAS registry number, or structure similarity. AdmetSAR is used for in silico screening ADMET profiles of drug candidates and environmental chemicals [13].

III. RESULTS

The structure of yohimbine was downloaded from Pubchem database and the 2 known analogues of yohimbine were downloaded from Zinc database rest of 50 analogues were artificially prepared through chemsketch. The physicochemical properties of the yohimbine and its analogues were predicted by online server molinspiration. The drug likeness score was calculated by considering Milog P (partition coefficient), number of heavy atoms, number of hydrogen donor, number of hydrogen acceptor and number of violation, number of rotatable bonds, molecular weight and volume. The Table 1 depicts the values related to the

Lipinski's rule of five. From the table it is evident that all the analogues obey the Lipinski's rule.

TABLE I. DRUG LIKELINESS PROPERTIES OF COMPOUNDS.

S.No.	Annalogues of yohimbine	Molecular Weight	TPSA	XlogP	Hydrogen bond donor	Hydrogen bond acceptor
1.	Yohimbine	369.485	55.903	0.126	2	5
2.	Zinc id-40875677	371.457	86.988	-0.858	4	6
3.	Zinc id-02573069	355.458	66.76	0.058	3	5
4.	Analogue 1	308.469	19.029	5.122	1	2
5.	Analogue 2	294.442	19.029	4.647	1	2
6.	Analogue 3	340.467	48.491	3.339	2	4
7.	Analogue 4	354.494	48.491	3.715	2	4
8.	Analogue 5	354.45	65.562	2.238	2	5
9.	Analogue 6	383.536	74.514	2.299	4	5
10.	Analogue 7	68.719	68.719	2.653	3	5
11.	Analogue 8	382.504	65.562	3.19	2	5
12.	Analogue 9	381.52	72.343	3.329	3	5
13.	Analogue 10	384.52	68.719	2.839	3	5
14.	Analogue 11	339.483	54.286	2.848	3	4
15.	Analogue 12	338.499	57.079	2.648	4	4
16.	Analogue 13	339.483	51.284	3.14	3	4
17.	Analogue 14	340.467	48.633	3.243	2	4
18.	Analogue 15	341.451	45.84	3.442	1	4
19.	Analogue 16	342.439	58.732	2.347	1	5
20.	Analogue 17	341.455	61.383	2.244	2	5
21.	Analogue 18	343.427	70.617	2.109	2	6
22.	Analogue 19	342.439	57.725	3.204	2	5
23.	Analogue 20	343.423	55.074	2.503	1	5
24.	Analogue 21	342.439	57.725	2.4	2	5
25.	Analogue 22	357.406	72.145	2.38	1	6
26.	Analogue 23	356.422	78.926	2.181	2	6
27.	Analogue 24	342.439	57.867	2.303	2	5
28.	Analogue 25	356.422	74.938	2.181	2	6
29.	Analogue 26	342.439	60.869	2.011	2	5
30.	Analogue 27	371.481	87.821	1.975	4	6
31.	Analogue 28	355.482	68.579	2.378	3	5
32.	Analogue 29	354.498	71.372	2.179	4	5
33.	Analogue 30	326.44	59.485	2.72	3	4
34.	Analogue 31	340.423	76.556	2.601	3	5
35.	Analogue 32	341.411	88.583	1.462	4	6
36.	Analogue 33	341.4	87.583	1.362	3	7
37.	Analogue 34	341.411	88.583	2.266	4	6
38.	Analogue 35	341.411	89.448	1.506	3	6
39.	Analogue 36	341.411	88.587	1.977	4	6
40.	Analogue 37	353.466	71.357	2.725	3	5
41.	Analogue 38	354.45	68.706	2.828	2	5
42.	Analogue 39	355.438	76.827	1.168	3	6
43.	Analogue 40	356.422	71.032	1.66	2	6
44.	Analogue 41	355.434	59.00	2.17	1	5
45.	Analogue 42	323.436	40.537	2.52	1	3
46.	Analogue 43	322.452	47.318	3.045	2	3
47.	Analogue 44	323.44	59.345	2.276	3	4
48.	Analogue 45	325.412	73.35	2.221	2	5
49.	Analogue 46	353.462	53.677	3.50	1	4
50.	Analogue 47	350.506	46.332	2.805	2	3
51.	Analogue 48	359.382	97.064	1.146	2	8
52.	Analogue 49	354.45	68.706	2.828	2	5
53.	Analogue 50	356.422	75.803	2.421	1	6

Toxicity profiles of analogues were studied by using an online tool, Osiris property explorer. By employing the various toxicity problems like mutagenicity, carcinogenicity, irritancy and tumerogenicity of the designed set of 53 analogues, and the results are listed in the Table 2.

The below table shows that no analogue are mutagenic, tumerogenic and irritant this means they didn't exhibit any harmful effects when they go inside the body. Also the druglikeness and drug score of all the analogues are in positive which is a good sign of any chemical compound to be a drug. Prediction results are valued and color coded. Properties with high risks of undesired effects like mutagenicity or a poor intestinal absorption are shown in red. Whereas a green color indicates drug-conform behavior. Those analogues which show high risk for drug behavior were eliminated from the study and rests of analogues were analyzed further for their drug like characteristics.

GREEN-NO; Yellow-PARTIAL; RED-YES.

S.No.	Annalogues of yohimbine	Drug likeness	Drug score	Mutagenic	Tumerogenic	Irritant
1.	Yohimbine	2.09	0.79	No	No	No
2.	Zinc id-40875677	2.56	1.03	No	No	No
3.	Zinc id-02573069	2.43	1.45	No	No	No
4.	Analogue 1	4.13	0.83	No	No	No
5.	Analogue 2	1.51	0.66	No	No	No
6.	Analogue 3	3.85	0.83	No	No	No
7.	Analogue 4	2.46	0.76	No	No	No
8.	Analogue 5	5.64	0.86	No	No	No
9.	Analogue 6	3.93	0.81	No	No	No
10.	Analogue 7	3.86	0.83	No	No	No
11.	Analogue 8	3.29	0.75	No	No	No
12.	Analogue 9	3.42	0.82	No	No	No
13.	Analogue 10	1.4	0.73	No	No	No
14.	Analogue 11	3.08	0.83	No	No	No
15.	Analogue 12	3.93	0.85	No	No	No
16.	Analogue 13	4.66	0.85	No	No	No
17.	Analogue 14	4.62	0.8	No	No	No
18.	Analogue 15	3.92	0.77	No	No	No
19.	Analogue 16	2.9	0.84	No	No	No
20.	Analogue 17	3.25	0.87	No	No	No
21.	Analogue 18	2.7	0.85	No	No	No
22.	Analogue 19	3.33	0.81	No	No	No
23.	Analogue 20	4.84	0.85	No	No	No
24.	Analogue 21	4.87	0.88	No	No	No
25.	Analogue 22	2.14	0.75	No	No	6
26.	Analogue 23	3.02	0.83	No	No	6
27.	Analogue 24	5.66	0.86	No	No	No
28.	Analogue 25	3.85	0.85	No	No	No
29.	Analogue 26	4.39	0.85	No	No	No
30.	Analogue 27	4.27	0.82	No	No	No
31.	Analogue 28	1.1	0.72	No	No	No
32.	Analogue 29	5.0	0.89	No	No	No
33.	Analogue 30	3.82	0.85	No	No	No
34.	Analogue 31	4.14	0.87	No	No	No
35.	Analogue 32	5.75	0.91	No	No	No
36.	Analogue 33	5.83	0.92	No	No	No
37.	Analogue 34	3.95	0.85	No	No	No
38.	Analogue 35	3.55	0.89	No	No	No
39.	Analogue 36	3.81	0.87	No	No	No
40.	Analogue 37	1.36	0.76	No	No	No
41.	Analogue 38	1.43	0.72	No	No	No
42.	Analogue 39	1.89	0.82	No	No	No
43.	Analogue 40	2.36	0.83	No	No	No
44.	Analogue 41	2.21	0.84	No	No	No
45.	Analogue 42	4.14	0.84	No	No	No
46.	Analogue 43	3.77	0.88	No	No	No
47.	Analogue 44	4.86	0.92	No	No	No
48.	Analogue 45	3.69	0.88	No	No	No
49.	Analogue 46	5.12	0.7	No	No	No
50.	Analogue 47	3.53	0.78	No	No	No
51.	Analogue 48	3.36	0.83	No	No	No
52.	Analogue 49	1.43	0.72	No	No	No
53.	Analogue 50	1.24	0.71	No	No	No

The above table shows the drug likeliness and drug score of all prepared analogues with respect to yohimbine. Out of those 53 analogues, analogue 33 is showing the highest score followed by analogues 32, 44, 35 and 29.

A. ADMET Predicted Profile --- Classification

Model	Result	Probability
Absorption		
Blood-Brain Barrier	BBB-	0.8481
Human Intestinal Absorption	HIA+	0.9650
Caco-2 Permeability	Caco2-	0.5068
Distribution		

Metabolism		
CYP450 2C9 Substrate	Non-substrate	0.8512
CYP450 2D6 Substrate	Substrate	0.5583
CYP450 2C9 Inhibitor	Non-inhibitor	0.9331
CYP450 3A4 Inhibitor	Non-inhibitor	0.9833
CYP Inhibitory Promiscuity	Low CYP Inhibitory Promiscuity	0.9571
Excretion		
Toxicity		
AMES Toxicity	Non AMES toxic	0.8198
Carcinogens	Non-carcinogens	0.9547
Honey Bee Toxicity	Low HBT	0.7542
Biodegradation	Not ready biodegradable	0.9942
Acute Oral Toxicity	III	0.5036
Carcinogenicity (Three-class)	Non-required	0.6846

B.   ADMET Predicted Profile --- Regression

Model	Value	Unit
Absorption		
Caco-2 Permeability	0.3877	LogPapp, cm/s
Toxicity		
Rat Acute Toxicity	2.6657	LD50, mol/kg
Fish Toxicity	1.7969	pLC50, mg/L

Fig 2: Screen short of analog 33 from admet SAR database.

Figure 2 shows the ADME (Absorption, Distribution, Metabolism and Excretion) properties of analog 33. From the figure it is illustrated that this compound shows non AMES toxic as well as non carcinogens also they have low honey bee toxicity which conforms its drug like behaviour.

IV.   CONCLUSION

These properties of analogues were calculated and discussed on the basis of Lipinski's rule and its component. All the analogs fulfill Lipinski's rule and show good drug likeness score (Table 2). Milog P of the analogs was found below 5 that means these shows good permeability across cell membrane. TPSA below 160 ⬜2, n violations =1 or <0 it means compound easily bind to receptor, molecular mass <500, n rotb < 5 [10], No. hydrogen bond donors ≤ 5 (The sum of OHs and NHs), No.

hydrogen bond acceptor ≤ 10 (The sum of Os and Ns). The drug score of all the analogs are also greater than the yohimbine. Thus by comparing yohimbine with its analogues it is clear that there are many compounds which can inhibit adrenoceptor. These discoveries can be important for new AR $\alpha2$ selective antagonist design.

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Conservation of Wetlands – A Case Study of Kanjli Wetland

Meena Kumari
Department of Botany
NJSA Govt. College,
Kapurthala, Punjab (India)
meenasethi@gmail.com

Abstract— Kanjli Wetland, a manmade Wetland, which subsumes the Kanjli Lke is located in the kapurthala district of Punjab. This was created in 1870 by constructing the headworks across the perennial Bein River, a tributary of the Beas River to provide irrigation facilities to the hinterland. The rich biodiversity of the Wetland comprising aquatic, mesophytic and terrestrial flora and fauna including some important species of plants and animals were recognized internationally by the Ramsar Convention in 2002 by designating the Kanjali Lake in the list of wetlands of international importance. Kanjli Wetland is an extremely important ecosystem in the region. It support a diverse kinds of food chains and food webs, help in water recharging and discharging, improve water quality, reduce flooding, etc. It is important component of socio-religious aspects of the society. This Wetland is very important source of water in the Kapurthala district as such. The Kali Bein which passes almost mid-way through district has much more rewarding potential than ever estimated. Throughout its length, the Kali Bein is recharging the ground water and also it acts as a discharging drain by taking away excessive rainwater from sensitive crops like wheat, potato, etc. Kanjli Wetland has been threatened due to extensive growth of water hyacinth, eutrophication, anthropogenic pressure and land encroachment, conversion of Wetland for agriculture, human habitation, industrial expansion and recreational activities. Illegal and indiscriminate fishing causing disturbance is to migratory birds. Several programmes have been initiated by Ministry of Environment and Forest for the conservation wildlife under in-situ conditions and supplemented through ex-situ conservation measures

Keywords—Kali Bein, Kanjli Wetland, Water hyacinth, Conservation measures

I. INTRODUCTION

Kanjli Wetland named after the village Kanjli is at a distance of 4km from Kapurthala town. Geographically it is situated at 31° 25'-31° 28' North Latitude and 75° 23'-75° 25' East Longitude at an elevation of 210 meters above Mean Sea Level. It falls under the administrative boundary of Kapurthala district of Punjab. Kali Bein rivulet on which Kanjli Wetland is located used to be one of the important tributaries (live branch) of river Beas. It has, of late, become independent of river Beas due to silting up of the Bein and westward shifting of Beas. The Bein travels a long distance after originating from near village Dhanoa a few kilometers upstream of Budho Barkat Regulator in Hoshiarpur District and feeds the Kanjli Lake and the wetland areas. It further moves towards Bakerke village, 10kms short of Harike Pattan Regulator and joins river Beas. The wetland is located about 75 kms North-East of Harike. It is a permanent fresh water stream converted into a small reservoir at Kanjli for the purpose of irrigation supplies. Depth of water varies from 10 feet to 25 feet depending upon the season and water inflow. Catchment area is mainly under agriculture.

Kanjli Wetland came into formation in 1870 with the construction of Head Regulator near village Kanjli on the Kali Bein rivulet in Kapurthala district. It supports diversity of aquatic, mesophytic and terrestrial flora and fauna including some important species of plants and animals.

Climate of the area falls in semi-arid zone. The average annual rainfall in the region is around 620 mm extending from July to mid-October. The temperature ranges from an average of 6° C, occasionally dropping below the freezing point of water in winter to a maximum of 45°C in summer.

Kanjli Wetland is an extremely important ecosystem in the region. It support a diverse kind of food chains and food webs, help in water recharging and discharging, improve water quality, reduce flooding, etc. It is an important component of socio-religions aspects of the society because it is associated with the first Guru of Sikhs, Shri Guru Nanak Dev Ji.

II. METHODOLOGY

Literature has been reviewed from various web sites, publications and papers, recommendations of various committees, NGO's reports and recommendations etc. Fields visit were done to survey the area around Kanjli wetland.

III. WATER QUALITY

The water and sludge quality of the Wetland has been studied by the Punjab Pollution Control Board. Their report indicated that quality generally conforms to Class 'B' with some degree of quality degradation to Class 'D' sometimes during December.

From a satellite imagery study of the wetland it has been inferred that Kanjli Lake could be categorized under low turbidity class (dark blue hue) during pre-monsoon period and moderate turbidity class (medium blue) during post monsoon season which is indicative of regimentation occurring in the lake during post monsoon season.

IV. BIODIVERSITY

The flora and fauna recorded in the Wetland and the Kanjli Lake:

- Twelve varieties of trees recorded in the wetland are 1) Acacia arabica, 2) Albizzia lebbeck,3) Azadirachta indica, 4) Dalbergia sissoo, 5) Eucalyptus hybrid, 6) Ficus bengalensis, 7) Mangifera indica, 8) Melia azedarach, 9) Morus alba, 10) Prosopis juliflora, 11) Syzygium cumini and 12) Ziziphus mauritiana

- Shrubs recorded are: Calotropis procera, Ipomoea crassicaulis and Tamarix dioca

- Herbs noted are Saccharum munja, S.spontaneum, Scirpus sp.and other common herbs.

A. Aqua Flora

11 species of aquaflora, 34 species of Zoo Plankton and 15 species Macro invertebrate species have been reported.

B. Aqua fauna

According to the District Gazetteer and the study done by the National Environmental Engineering Research Institute (NEERI), 17 fish species (in Bein river and the Lake) have been reported which includes the common fish species of Catla catla, Channa marulius (Great snakehead), Cythus Striatus, Cirrhinus mrigala, Labeo calbasu, and L. rohita.

The tortoise is the common reptile reported in the area.

Birds found in the wetland are of two varieties, viz., common resident birds (28 species) and the migratory birds of 9 species. The migratory birds are: 1) Various species of goose, 2) White eyed pochard, 3) Wigeon, 4) Tufted pochard, 5) Common Teal, 6) Large whistling teal, 7) Pintail, 8) Mallard and 9) Shoveller

C. Fauna

The mammalian fauna seen in the wetland are 1) the Indian Civet, 2) Mongoose, 3) Indian porcupine, 4) squirrel and 5) common Indian hare.

V. THREATS

In the Wetland, the ecological status of the Kanjli lake, in particular, has been threatened on account of the following issues.

- A. Extensive growth of water hyacinth due to nutrients and pesticides from adjoining agriculture fields

- B. Anthropogenic pressure and consequent land encroachment

- C. Eutrophication, particularly due to in-situ decay of hyacinth

- D. Conversion of wetland for agriculture, human habitation, industrial expansion and recreational activities

- E. Illegal and indiscriminate fishing causing disturbance to bird life

Water hyacinth has been the main threat of Kanjli wetland. Main problem is its consistently fast growth and its in situ death and decay. An integrated approach has been adopted bring it under control by applying manual and biological methods but not chemical methods. Manually removed weeds are being utilized for production of biogas at Kanjli. In order to prevent movement of this weed into wider stretches of Kanjli Lake and of its easy removal at one place, a "log boom" was installed by Punjab Irrigation Department. But the log boom gave way due to high pressure exerted by rain water during 1993 monsoons. Thus, the same has been dismantled by Irrigation Departments. In addition to water hyacinth, certain submerged and rooted weeds also pose problem in Kanjli lake. Many of the fish and bird species survive on these aquatic weeds. If these are eradicated it can create a disruption in food chain structure. Apart from providing fuel, fodder and fruit, trees also help in maintaining the ecological balance in the wetland. About 10 ha area of Kanjli wetland has been brought under native tree plantation by the Forest Department, Punjab. Emphasis still needs to be laid in future on extensive plantation in areas especially less prone to floods. Plantation of some exotic tree species may requires studies keeping in view the preference on migratory birds visiting these wetlands.

To tackle the problem of grazing and encroachment, fencing is necessary. To protect out already endangered ecosystems, fencing of certain strategic areas has been undertaken by the Forest and Wildlife Department, Punjab. Also there is need of soil conservation in and outside the wetlands area. The research studies to analyze the biotic components, food chain sequence and potential threats should be taken up to make long term conservation strategies. Integrated wetland management which can benefit both man and animal and at the same time maintain the ecological balance is the need of the hour.

VI. CONSERVATION MEASURES

The conservation and management measures undertaken with assistance provided by the Ministry of Environment & Forests, Govt. of India (MoEF, GOI) by the Environment Division of the Punjab State Council for Science & Technology under the directive of the State Level Steering Committee are the following.

- A. Detailed mapping of the wetland for declaring and notifying the Kanjli Wetland as protected area under the Environment Protection Act, 1986.

- B. Judicious Hyacinth (weed) control by the Irrigation department, District Police, and even the Army Units, by manual methods. Conveyor belt system as a Mechanical method to clear the weeds is also being tried.

- C. Hyacinth control through biological control by releasing two weevil species (which have proved been found effective worldwide and introduced in the

downstream in the Harike Wetland Ecosystem) of Neochetina bruchi and N.eichorniae. Release of moth Sameodes albiguittal is also being considered as an option.

D. Introduction of more fish species in the lake judiciously to avoid any adverse effects of exotic species

E. Afforestation measures around the lake area and in the small islands, with mixed indigenous species of trees to prevent soil erosion resulting in siltation reduction in the lake, to attract large species of birds to nest and roost and to enhance the ecosystem.

F. Selective Fencing of the Wetland to prevent excessive grazing to preservation of important pockets provide habitat for wading birds and to check encroachments

G. monitoring of water quality continuously to check the degree of external nutrient loading of the lake waters and to evolve appropriate preventive and curative steps

H. Public awareness campaigns through mass-media, educational material, camps, etc. of the wetland eco system with the help of Voluntary Organizations

I. Continued scientific research on Biological and hydrological components, and Productivity potential with respect of economic value, social aspects of heritage and to rate the significance of the wetland.

For the proper conservation and management of Kanjli Wetland, several steps have been initiated by the Council under the aegis of Department of Environment, Govt. of Punjab with financial assistance form Ministry of Environment & Forests, Govt. of India. Conservation & management measures were started at Kanjli Wetland during 1988-89. Comprehensive Conservation and Management Plan was prepared in 1990. Again a Ninth Five Year Plan document for conservation for this wetland was prepared in 1998-99 (PSCST 1998). Various programmes taken up are:

1) Survey, Mapping & Notification, 2) Weed Control

3) Afforestation, 4) Fencing, 5) Monitoring of Pollution:

PPCB has recommended the following measures:

- Intensive afforestation activity is required to prevent the seepage and runoffs from the nearby field. A rich tree cover besides, acting as lungs of the ecosystem will provide adequate space for nesting of some birds species too.

- Weed clearing, manually or by dredging, is frequently required.

- Steps should be taken to prevent the people from making the lake a dumping site.

- Proper level of water must be maintained in the reservoir to save the biotic life of the lake in acute summers.

  - Deforestation should be strictly prohibited (in catchment along the Kali Bein).

  - The villages along Kali Bein feeding Kanjli Lake must not discharge their sullage into the Kali Bein. The village Panchayats may use Karnal Technology for use of sullage for irrigation purposes.

  - The farmers to be educated to use least amounts of fertilizers and pesticides and as far as possible switch over to bio- fertilizers and bio- pesticides.

The values of wetlands in landscape and their benefits for human kind are increasingly recognized yet economic development continues to destroy or degrade wetland systems. It is accepted that wetlands are functioning in a larger ecological entity. Their management and conservation programmes must, there, address to entire system processes functioning in the landscape as a whole to ensure is maintaining the sustainability. Various factors has to be taken into account for both short and long term measures to prevent any further loss and improve their ecological character. A truly holistic approach needs to be implemented after optimizing all the system qualities. Efforts to conserve Kanjli Wetland, which is one of national wetlands, have been continuing for the last few years. It is, however, observed that intensive efforts need to be made to restore the ecological character of this wetland.

VII. SUGGESTED MEASURES FOR IMPROVEMENT OF KANJLI WETLAND

- Building of green parks around Kanjli Wetland.

- Roads should be well developed.

- Proper security should be maintained as the area is becoming safe heaven for drug addicts.

- Schools and colleges should be encouraged to arrange short trips

- People with superstitious activities should be strictly prohibited not to throw anything into water so that lake should not become a dumping site.

- The development of Kanjli Wetland as heritage and historical tourist destination should be revised by developing this place by opening up different additional attractions required such as restoration of eating ventures, and water sports etc.

VIII. CONCLUSIONS

The most important component for ensuring proper conservation and protection of wetland is the awareness of common man about the uses, values and functions of these ecosystems. Any programme can be successful only if the public directly dependent on the resources is totally aware and gets involved in the day-to-day programmes. While planning, financing and implementation of programmes

are important factors but contribution and involvement of locals is of paramount significance. Unless people realize the need to safeguard wetland ecosystems and are aware of how they can contribute of this effort, there is little hope for the survival of these ecologically valuable and vulnerable habitats.

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Incidence of Surgical Site Infection

Shilpa Sharma
Lovely Institute of Distance education
Jalndhar City, Punjab, 144001

Abstract: Surgical site infection is an infection that occurs in the part of the body where the surgery took place, within 30 days after the operation. However infection develops in about 1 to 3 out of every 100 patients. Surgical site infections are the third most frequently reported nosocomial infection, accounting for 14 to 16% of all nosocomial infection among hospitalized patients. They cause significant post- operative morbidity, mortality and prolong hospital stay. SSI results in extended length of hospital stay, pain, discomfort and sometimes prolonged or permanent disability. They are estimated to double the length of post-operative stay in hospital and significantly increase the cost. Measure can be taken in the pre, intra and post-operative phases of care to reduce the risk of infection. SSI is morbid and expensive. However, not all SSIs are the same. Reports of economic costs that do not stratify for the depth of the infection or the context in which the infection occurs are potentially misstating the magnitude of these complications. Deep SSIs involving organs or spaces, as compared to SSIs confined to the incision, are associated with even greater increases in hospital stays and costs. Surgical site infection remains one of the most common causes of serious surgical complications. Evidence shows that proven measures such as antibiotic prophylaxis within the hour before incision and effective sterilization of instruments are inconsistently followed. This is often not because of the cost or lack of resources but because of poor systematization. Antibiotics for e.g., are given preoperatively in both developed and developing countries but they are often administered too early, too late or simply erratically , making them ineffective in reducing patient harm .A surgical site infection may range from a spontaneously limited wound discharge within 7-10 days of an operation to a life- threatening postoperative complication, such as a sternal infection after open heart surgery .Most surgical site infection are caused by contamination of an incision with microorganism from the patient's own body surgery is less common. The majority of surgical site infections are preventable of infection.

Keywords: Pre-operative, post-operative, sterilization.

I. INTRODUCTION

A surgical site infection or SSI is an infection of a wound from a surgery. It usually occurs between 5 to 10 days but may also develop within the first 30 days after the surgery. It may affect closed wounds or wounds left open to heal superficial or deep tissues, and in severe cases, the internal organs. Surgical site infection may be caused by various bacteria that reach and infect the wound. The bacteria may come from the skin; from the air, soil or water; or from the object used during the surgery. Likewise, it may be caused by complications from surgical hypothermia, contamination of the incision area by skin flora, surgical instrument contamination, and bacterial cross–contamination (1)

A. Criteria for Defining SSI

Infections are SSIs if they occur 30 days from the operative procedure if no implant and within one-year if an implant is left in place. Infection occurs within 30 days after the operation and infection involves only skin or subcutaneous tissue of the incision.

B. Superficial Incisional SSI

Infection occurs within 30 days after the operation and infection involves only skin or subcutaneous tissue of the incision and at least one of the following:

1) Purulent drainage, with or without laboratory confirmation, from the superficial incision.
2) Organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision.
3) At least one of the following signs or symptoms of infection: pain or tenderness, localized swelling, redness, or heat and superficial incision is deliberately opened by surgeon, unless incision is culture-negative.
4) Diagnosis of superficial incisional SSI by the surgeon or attending physician.

C. Deep incisional SSI

Infection occurs within 30 days after the operation if no implant† is left in place or within 1 year if implant is in place and the infection appears to be related to the operation and infection involves deep soft tissues (e.g., facial and muscle layers) of the incision and at least one of the following:

1) Purulent drainage from the deep incision but not from the organ/space component of the surgical site.
2) A deep incision spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of the following signs or symptoms: fever (>38ºC), localized pain, or tenderness, unless site is culture-negative.
3) An abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopathology or radiologic examination.
4) Diagnosis of a deep incisional SSI by a surgeon or attending physician.

D. Organ/space SSI

Infection occurs within 30 days after the operation if no implant† is left in place or within 1 year if implant is in place and the infection appears to be related to the operation and infection involves any part of the anatomy (e.g., organs or spaces), other than the incision, which was opened or manipulated during an operation and at least one of the following:

1) Purulent drainage from a drain that is placed through a stab wound‡ into the organ/space.

2) Organisms isolated from an aseptically obtained culture of fluid or tissue in the organ/space.
3) An abscess or other evidence of infection involving the organ/space that is found on direct examination, during reoperation, or by histopathology or radiologic examination.
4) Diagnosis of an organ/space SSI by a surgeon or attending physician.(2)

II. AIM

The aim of this project is to study the incidence of surgical site infection and effectiveness of guidelines being followed in Patel Hospital Cancer and Superspeciality Center. This study was conducted from 1st February 2012 to 5th May 2012.Post –Operative wound infection also called Surgical Site Infection (SSI) is a troublesome complication and it can be associated with serious morbidities, mortalities and increase resource utilization. Majority of surgical site infection are preventable. Measures can be taken in the pre, intra and post operative phases of care to reduce the risk of infection.

III. SIGNIFICANCE

The Centers for Disease Control and Prevention (CDC) estimates that 22% of all health –care associated infection are surgical site infection. It remains one of the most common causes of serious surgical complications and is a leading cause of morbidity and death in the surgical population. In October 2004 the World Health Organization (WHO) launched the World Alliance for patient safety and has focused as the first challenge on health care associated infection, while safe surgery has been chosen as the topic for the second Global Patient Safety Challenge.

IV. MATERIAL AND METHODS

I include all the surgeries of my project work like ORTHOLOGY, UROLOGY, GENERAL, HEAD AND NECK SURGERY .Total surgical cases observed 130 from 1 Feb 2012 to 5 may 2012.
Audit Chart OF Guideline
It is divided into three phases
1. Pre-operative
2. Intra-operative
3. Post-operative

Table No. 1 PRE-OPERATIVE

1. Co morbidities{DM/other/ None of these} if yes, specify	
2.Pre-existing infections if yes, please specify	Yes/No
3.Time between hair removal and transfer inside OT	
4. Injuries due to hair removal	Yes/No
5.Methods used for hair removal(recommended clipper)	
6. Which pre-op antibiotic used?	
7. Time between antibiotic given and incision time.	
8. Duration of surgical scrub by surgeon and each operative assistant.	
9. Was beta dining scrub paint used for patient preparation?	Yes/No
10.How many coats of beta dine paints were used?(recommended 3)	
11. Was beta dine scrub paints used from outside to inside?	Yes/No
12. During draping, was the OT assistant inadvertently touching the unsterile area?	Yes/No
13. Were the front ties of the gown tied behind back of the surgeon/assistant?	Yes/No
14. Did the OT masks of the OT personnel's cover the nostrils completely?	Yes/No
15. Were the patient and the trolley draped so that there was no potential contaminated till the level of torso of the surgeon and the assistants?	Yes/ No
16. Was any method (sutures/staples/surgical adhesives) used to approximate the drapes with the surgical field?	Yes/No
17. Were the radiology films put up(esp. in OT - A)with due care given to sterile precautions?	Yes/No
18. Category of wound?	Clean/Clean contaminated / contaminated dirty

Table No. 2 INTRA-OPERATIVE

1. What was the total duration of the procedure from the incision time to undraping?	
2. How many personnel entered the OT during the procedure besides the floor assistants/anesthetist/replacement assistants?	
3.What was the number of such OT entry events?(recommended none)	
4. Was patient body temperature normal throughout the operation?	Yes/No
5. How many scrubbed OT personnel descrubbed/rescrubbed during the case?	Yes/No
6. Did one assistant stand behind another assistant at any point of time during the case?	Yes/No
7. If any contamination episode happened, how was it handled?	
8. If any needle stick injury happened, how was it handled?	
9. Did the unscubbed OT personnel follow all sterile precaution?	Yes/No
10. If the patient was HIV/HBsAg/HCV positive, were universal precaution followed?	Yes/No
11. Was patient undraping begun prior to complete incision closure?	Yes/No
12.Were sterile precaution maintained while doing the immediate post-op dressing?(if dressing was done)	Yes/No

Table. No. 3 POST-OPERATIVE

1. During the first and subsequent dressing changes before patient discharge, was hand washing done before and after the dressing each time by all personnel doing the dressing?	Yes/No
2. Did all personnel involved in the dressing maintain sterile precaution?	Yes/No
3. Was drain site management before and following drain removal (if applicable) in accordance with sterile precaution?	Yes/No
4. What method of instrument disinfection was utilized?	
5.What was the timing of the first post-op dressing?(day 1/2/3)	
6.On what post- op day was infection detected?(only applicable if the infection was detected prior to patient discharge)	
7. Presenting symptoms of infection? (redness, swelling, discharge, fever etc.)	
8. Site of infection? (Surgical site/other) if other, please specify?	
9. Were appropriate culture taken as soon as infection was diagnosed?	Yes/No

A. PATIENT
1) Nutritional status, poor
2) Diabetes, uncontrolled
3) Smoking or use of other tobacco products
4) Obesity
5) Coexistent infections at a remote body site
6) Colonization with microorganisms
7) Altered immune response (HIV/AIDS and chronic corticosteroid use)
8) Length of preoperative stay
B. OPERATION
1) Preoperative shaving
2) Preoperative skin prep
3) Duration of operation
4) Antimicrobial prophylaxis
5) Operating room ventilation
6) Instrument processing (cleaning, HLD or sterilization)
7) Foreign material in the surgical site
8) Surgical drains
9) Surgical technique

- Poor hemostasis
- Failure to obliterate dead space
- Tissue trauma (3)

V. OBSERVATIONS

A. Hot Incision: - An infected incision may feel hot to the touch. This happens as the body sends infection fighting blood cells to the site of infection. Proper care of your surgical incision plays a significant role in preventing infection.

B. Swelling/Hardening of the Incision: - An infected incision may begin to harden as the tissue underneath are inflamed. The incision itself may begin to appear swollen or puffy as well.

C. Redness: - An incision that gets red, or has red streaks radiating from it to the surrounding skin may be infected. Some redness is normal at the incision site, but it should decrease over time, rather than becoming redder as the incision heals.

D. Drainage from the Incision: Foul-smelling drainage or Pus may begin to appear on an infected incision. It can range in color from blood-tinged to green, white or yellow. The drainage from an infected wound may also be thick, and in rare cases, chunky.

E. Pain: - Your pain should slowly and steadily diminish as you heal. If your pain level at the surgery site increases for no apparent reason, you may be developing an infection in the wound. It is normal for increased pain if you "overdo it" with activity or you decrease your pain medication, but a significant and unexplained increase in pain should be discussed with your surgeon. (13)

VI. RESULT

In four months study one hundred thirty patients, twelve samples received for culture and sensitivity and various organisms are isolated Infection rate found was 9.23% in one hundred thirty patients who have undergone surgeries

A. Data Collection

For Surgical Site Infection Surveillance places visited are:-
1) Operation theatre
2) Patient wards
3) Dressing room
4) Doctors
5) Received culture specimens

B. Analysis

Sample recivied for culture and senstivity
1. Pus
2. Tracheal secretion
3. Other body fluid i.e. aspirates from kidney, pleural fluid, synovial fluid, bile
4. Urine

C. Sample Processing
1. Gram stain
2. Culture
3. Biochemical test
4. Antibiotic sensitivity

5. Result

VII. DISCUSSION

Surgical site infection is an infection that occurs in the part of the body where the surgery took place, within 30 days after the operation, if no implants are left or within 1 year if any implant is in place and the infection appears to be related to the operation. To study the incidence of surgical site infection and effectiveness of guidelines being followed in Patel Hospital four months study done on one hundred thirty patients who have undergone surgeries .Daily CDC guidelines chart was followed on surgical patient. After surgery patients dressing change observed by visiting in their wards, dressing room for the surveillance of SSI. Any cases of surgical site infection suspected for e:g :- purulent drainage, pus discharge, fever, redness, pain or tenderness, localized swelling etc. from the wound, then diagnosed by the surgeon or attending physician and appropriate sample sent for culture in lab as soon as infection was diagnosed. In four months study one hundred thirty patients who have undergone surgeries were observed. Twelve sample received for culture and sensitivity and various organisms are isolated. Infection rate found was 9.23% in one hundred thirty patients who have undergone various surgeries.

VIII. CONCLUSION

Surgical site infection is an infection that occurs in the part of the body of the body where the surgery took place, within 30 days after the operation. However infection develops in about 1 to 3 out of every 100 patients. Surgical site infection are the third most frequently reported nosocomial infection, accounting for 14 to 16% of all nosocomial infection among hospitalized patients. They cause significant post- operative morbidity, mortality and prolong hospital stay. SSI results in extended length of hospital stay, pain, discomfort and sometimes prolonged or permanent disability. Infection of surgical site account for approximately 14% of all hospital acquired infection. They are estimated to double the length of post-operative stay in hospital and significantly increase the cost. Measure can be taken in the pre, intra and post-operative phases of care to reduce the risk of infection.SSI is morbid and expensive. However, not all SSIs are the same. Reports of economic costs that do not stratify for the depth of the infection or the context in which the infection occurs are potentially misstating the magnitude of these complications.

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Study of Development of Callus Induction in Dehusked 1121 Basmati and Palmar Varieties of Rice Seeds of Punjab

Ravneet Kaur
Innocent Hearts College of Education
Jalandhar, Punjab. India.
mrsravneetkaur@yahoo.com

Abstract : The effect of varieties and media compositions on callus induction from dehusked Oryza sativa (rice) seeds and subsequent plant regeneration was studied in the present investigation. Two rice varieties viz. 1121 Basmati and Palmar were studied. Among them, callus induction frequency was higher in 1121 (54%). MS medium was used as basal medium, separately supplemented with 2, 4-D (2.0 mg/l) + kinetin (0.5 mg/l) and PAA (2.0 mg/l) + kinetin (0.5 mg/l). The medium supplemented with 2, 4-D (2.0 mg/l) + kinetin (0.5 mg/l) showed better performance in callus induction having mean value in each treatment of rice seeds 37.5%.

KEYWORDS- Oryza sativa; Callus induction; MS medium; 2, 4-D; PAA; kinetin.

I. INTRODUCTION

Rice belongs to the genus Oryza, sub tribe Oryzinae of the family Gramineae (Roy 1985). It is the world's most important food crop after wheat and maize. A considerable improvement has already been made through traditional rice breeding. Traditional breeding has resulted in higher yield, improved quality, greater disease resistance and other important agronomic traits in the past and it will still play an important role in the future (Sun and Zheng 1990). Nowadays various tissue culture techniques are being applied for varietal development of cereal crops including rice in different countries (Dorosieve 1996). Among the techniques, anther culture, protoplast fusion, leaf culture, root culture and dehusked grain culture are important in rice tissue culture to exploit somaclonal variation for the creation of novel rice varieties (Ram and Singh 1998). Several high yielding rice varieties were developed through the application of anther culture in the People's Republic of China (Ying 1983). However, plant regeneration from callus obtained from somatic tissue is more successful than from that obtained by anther culture (Kucherenko et al. 1979 and Guo and Cao 1982).

The dehusked rice culture technique is used for callus production and plant regeneration. Its application is still limited by many factors influencing its culture efficiency such as plant genotypes (Shen et al. 1982 and Li 1991), the culture methods (Chen 1977 and Yangn and Zhou 1979), the media (Chen 1977 and Sun and Zheng 1990) and the culture conditions (Qu and Chen 1983 and Wang et al. 1977). In the backdrop of the above situation, the present study was undertaken to compare the performance of two dehusked rice varieties in respect of their callusing ability in MS medium with various supplements.

- **OBJECTIVE:** To study the callus ability in Oryza sativa L. cv. 1121 Basmati and Oryza sativa L. cv. Palmar in two different media.

- **HYPOTHEISIS:** The genotype of the varieties, media compositions and their interaction significantly affect callus induction

II. MATERIALS AND METHOD

A). Plant material

The seeds of Oryza sativa L. cv. 1121 Basmati and Oryza sativa L. cv. Palmar Basmati of Punjab were used as explants.

1). Media:

- CMI 1: The MS + 2, 4-D (2.0 mg/l) + kinetin (0.5 mg/l)

- CMI 2: The MS + PAA (2.0 mg/l) + kinetin (0.5 mg/l)

2). Surface Sterilization of Rice seeds:

Seeds of Oryza sativa L. cv. 1121 Basmati and Oryza sativa L. cv. Palmar were carefully dehusked manually. Inside the laminar air flow cabinet, 120 seeds of each variety were washed in distilled water and dipped in 70% ethanol for 30 secs. Then the seeds were dipped in a 0.2% $HgCl_2$ for 25 min, washed for three - four min with double distilled water and finally dried with autoclaved tissue paper.

3). Inoculation of Rice seeds:

The sterilized seeds of both the varieties are inoculated in the Jar containing CMI 1 and CMI 2 aseptically on the laminar airflow with the help of heat sterilized forceps and scalpel. Only 25 ml of the medium containing different combinations of chemical components were used in each Jar. Jar with medium were sterilized. Twelve seeds were inoculated in one Jar. Therefore, seeds inoculated are shown in Table 1:

Table 1: Number of seeds inoculated in the CMI 1 and CMI 2 of each variety

Media composition	Number of seeds inoculated			
	O. sativa cv 1121 Basmati		O. sativa cv. Palmar	
CMI 1	10 Jars	120 Seeds	10 Jars	120 Seeds
CMI 2	10 Jars	120 Seeds	10 Jars	120 Seeds

The cultures were kept in dark condition for one week at $26 \pm 1°C$ and then transferred under 16 hours photoperiod at 3000 lux and $25 \pm 1\_C$. After one month of inoculation, the calli that developed from inoculated seeds.

During data collection callus induction frequency was recorded considering that each callus piece originated from a single seed. The frequency of callus induction was calculated according to the following formula:

$$Plant\ regeneration\ frequency (\%) = \frac{No.\ of\ grains\ producing\ calli}{No.\ of\ grains\ placed} \times 100$$

RESULTS AND DISCUSSION

Dehusked rice seeds of two rice cultivars were tested to study their callus ability in two different media compositions. It was found that the varieties, media compositions and their interaction significantly affected callus induction at 5% level.

Table 2: Interaction between the genotype and growth regulators on callus induction in the dehusked seeds of two varieties of rice.

Media composition	Mean value of callus induction		Mean value of each treatment
	O. sativa cv 1121 Basmati	O. sativa cv. Palmar	
CMI 1	6.5 (54%)	2.5 (21%)	4.5 (37.5%)
CMI 2	1.4 (12%)	0.3 (3%)	0.85 (7.5%)
Mean Value of Variety	7.9 (33%)	1.4 (12%)	

The result of callus induction in the medium CMI 1 and CMI 2 vary significantly. The variety 1121 Basmati produced maximum callus (54%) in CMI 1 which is significantly higher than produced in CMI 2 i.e. (12%). Low callus induction was found in Palmar variety in both the media. However there is significant difference between the callus inductions of palmar variety in both the media. In CMI 1, callus induction of Palmar variety was 21% where as in CMI 2, it was only 3%. Mean frequency of callus

induction in the media compositions (Table 2) showed that the variety 1121 Basmati produced more callus i.e. 33% and it was significantly higher than the variety Palmar (12%). Among the media compositions, CMI 1 (37.5) was more effective in callus induction (37.5is significantly higher than of CMI 2 (7.5).

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Track 3

Technical Session : 3

Pharmaceutical Chemistry/ Pharmacognosy

Synthesis and Antimicrobial Potential of Some Novel Triazole Analogues Incorporated With Imidazole Nucleus

Rajeev Kharb
Department of Pharmaceutical Chemistry
CT Institute of Pharmaceutical Sciences
Jalandhar, Punjab, India
rajeevkharb_2007@rediffmail.com

Prabodh Chander Sharma
Department of Pharmaceutical Chemistry
Institute of Pharmaceutical Sciences,
Kurukshetra University
Kurukshetra, Haryana, India

Anil Bhandari
Department of Pharmaceutical Chemistry
Faculty of Pharmaceutical Sciences,
Jodhpur National University
Jodhpur, Rajasthan, India

Mohammad Shaharyar
Department of Pharmaceutical Chemistry
Faculty of Pharmacy,
Jamia Hamdard,New Delhi,
India

Abstract- A novel series of imidazole substituted triazole derivatives (7a-7o) was synthesized by various reactions including formation of ester, hydrazide and thiosemicarbazide derivatives of 2,4,5-trisubstituted-1H-imidazoles (2a-2e). The structures of newly synthesized compounds were determined by elemental analysis, IR, NMR and mass spectral data. All the synthesized compounds were screened for their antibacterial and antifungal activities by using ofloxacin and ketoconazole as standard drugs respectively.

Keywords- 2,4,5-trisubstituted-1H-imidazole; 1,2,4-triazole; antibacterial activity; antifungal activity.

I. INTRODUCTION

Microbial infections caused by various bacteria and fungi are claiming millions of deaths worldwide every year and emergence of resistance towards existing antimicrobial agents has made it difficult to treat such deadly infections[1-3]. Imidazole substituted triazole derivatives in the literature have been found to exhibit superior antimicrobial activities as compared to compounds having individual imidazole or triazole nucleus [4-6]. These findings have encouraged us for synthesis and antimicrobial evaluation of substituted imidazole bearing triazole compounds having synergistic effect on antimicrobial activity for better treatment of microbial infections.

II. EXPERIMENTAL SECTION

All the titled compounds were synthesized by following the scheme of reactions as shown in **Figure 1** and general procedures about all steps involved in synthesis of imidazole substituted triazole derivatives are presented as below:

a : R₁ = H
b : R₁ = 4-F
c : R₁ = 4-Cl
d : R₁ = 4-OH
e : R₁ = 4-N(CH₃)₂

a : R₂ = C₂H₅
b : R₂ = C₆H₅
c : R₂ = 2-OCH₃-C₆H₄

7a : R₁ = H	R₂ = C₂H₅	
7b : R₁ = 4-F	R₂ = C₂H₅	
7c : R₁ = 4-Cl	R₂ = C₂H₅	
7d : R₁ = 4-OH	R₂ = C₂H₅	
7e : R₁ = 4-N(CH₃)₂	R₂ = C₂H₅	

7f : R₁ = H   R₂ = C₆H₅
7g : R₁ = 4-F   R₂ = C₆H₅
7h : R₁ = 4-Cl   R₂ = C₆H₅
7i : R₁ = 4-OH   R₂ = C₆H₅
7j : R₁ = 4-N(CH₃)₂ R₂ = C₆H₅

7k : R₁ = H   R₂ = 2-OCH₃-C₆H₄
7l : R₁ = 4-F   R₂ = 2-OCH₃-C₆H₄
7m: R₁ = 4-Cl   R₂ = 2-OCH₃-C₆H₄
7n : R₁ = 4-OH   R₂ = 2-OCH₃-C₆H₄
7o : R₁ = 4-N(CH₃)₂ R₂ = 2-OCH₃-C₆H₄
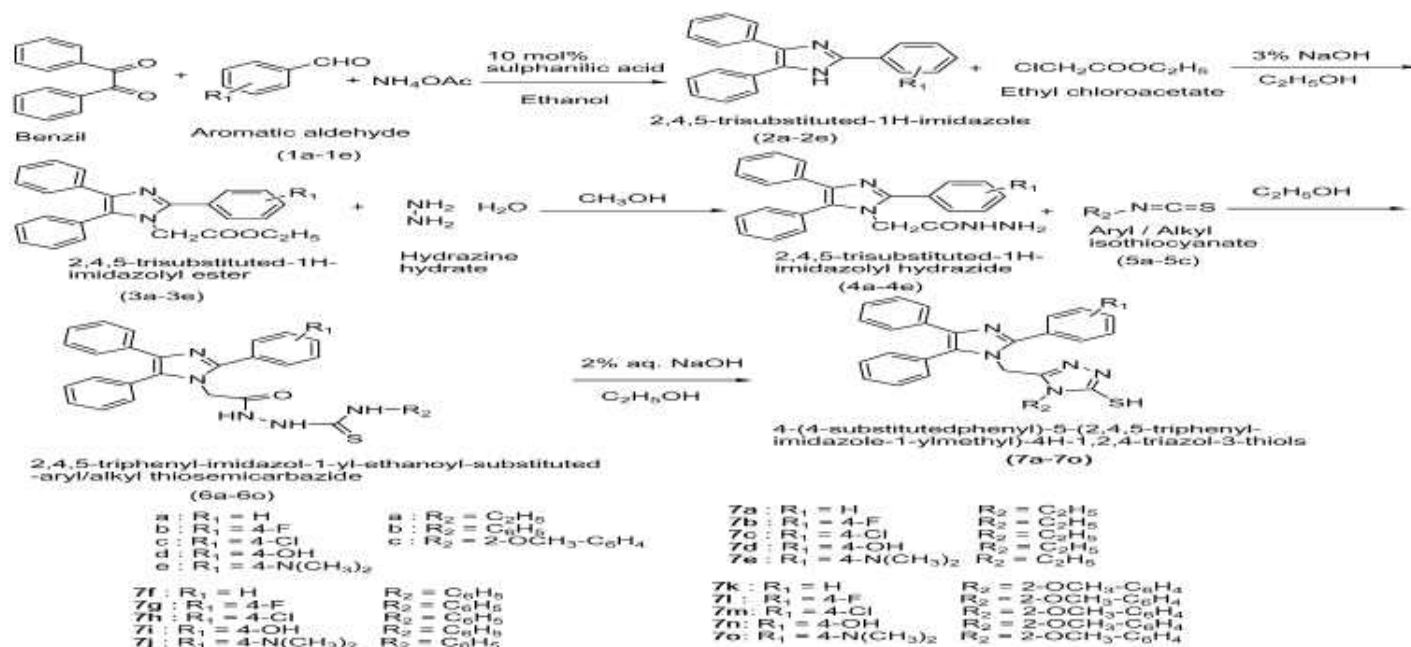
Figure 1: Synthesis of novel imidazole susbtituted triazole derivatives 7a-7o

Antimicrobial activities of the synthesized compounds against two Gram-positive bacteria (Staphylococcus aureus and Bacillus subtilis), two Gram-negative bacteria (Escherichia coli and Pseudomonas aeroginosa) and two fungal stains (Candida albicans and Aspergillus niger) were determined as zone of inhibition in mm determined by cup-plate agar diffusion method [7].

III. RESULTS AND DISCUSSION

Physicochemical and analytical data of the synthesized compounds **7a-7o** including molecular formula, molecular weight, percentage yield, melting point, R_f value and elemental analysis are shown in **Table I**. Analytical data including IR, NMR and Mass spectral data is presented in **Table II** whereas results of antimicrobial studies are listed in **Table III**.

TABLE I. PHYSICOCHEMICAL AND ELEMENTAL ANALYSIS DATA OF SYNTHESIZED COMPOUNDS

Comp. Code	Molecular Formula	Molecular Weight	% Yield	Melting Point (°C)	R_f Value	Elemental Analysis (%)
7a	$C_{26}H_{23}N_5S$	438	47	271-273	0.67	C, 71.35; H, 5.29; N, 15.98; S, 7.31
7b	$C_{26}H_{22}FN_5S$	456	56	298-300	0.70	C, 68.51; H, 4.82; F, 4.14; N, 15.31; S, 7.01
7c	$C_{26}H_{22}ClN_5S$	472	52	265-267	0.46	C, 66.11; H, 4.69; Cl, 7.50; N, 14.82; S, 6.77
7d	$C_{26}H_{23}N_5OS$	454	41	265-267	0.54	C, 68.81; H, 5.10; N, 15.41; O, 3.50; S, 7.01
7e	$C_{28}H_{28}N_6S$	481	57	289-291	0.74	C, 69.94; H, 5.83; N, 17.41; S, 6.62
7f	$C_{30}H_{23}N_5S$	486	43	293-295	0.56	C, 74.19; H, 4.73; N, 14.40; S, 6.58
7g	$C_{30}H_{22}FN_5S$	504	56	278-280	0.75	C, 71.50; H, 4.38; F, 3.71; N, 13.90; S, 6.31
7h	$C_{30}H_{22}ClN_5S$	520	55	286-288	0.61	C, 69.21; H, 4.22; Cl, 6.80; N, 13.41; S, 6.13
7i	$C_{30}H_{23}N_5OS$	502	49	295-297	0.69	C, 71.81; H, 4.60; N, 13.94; O, 3.17; S, 6.34
7j	$C_{32}H_{28}N_6S$	529	50	287-289	0.45	C, 72.68; H, 5.31; N, 15.88; S, 6.01

TABLE II. ANALYTICAL DATA OF TITLED COMPOUNDS

Comp. Code	IR (KBr, cm⁻¹)	¹H-NMR (DMSO, δ, ppm)	Mass (m/z, M⁺)
7a	3010.71 (Ar-CH), 2522 (SH), 1597 (C=N)	1.34 (s, 3H, CH₃), 4.95 (s, 2H, CH₂) 4.16 (s, 2H, N-CH₂), 7.01-7.35 (m, 15H, Ar-H), 10.96 (bs, 1H, SH)	437
7b	3020.75 (Ar-CH), 2567 (SH), 1589 (C=N), 1065.17 (C-F)	1.32 (s, 3H, CH₃), 4.91 (s, 2H, CH₂) 4.19 (s, 2H, N-CH₂), 7.01-7.33 (m, 14H, Ar-H), 10.91 (bs, 1H, SH)	455
7c	3020.71 (Ar-CH), 2512 (SH), 1593 (C=N), 721.42 (C-Cl)	1.33 (s, 3H, CH₃), 4.96 (s, 2H, CH₂) 4.16 (s, 2H, N-CH₂), 7.11-7.43 (m, 14H, Ar-H), 10.81 (bs, 1H, SH)	472
7d	3010.73 (Ar-CH), 2537 (SH), 1599 (C=N), 3209 (OH)	5.03 (1H, Ar-OH), 1.34 (s, 3H, CH₃), 4.96 (s, 2H, CH₂), 4.18 (s, 2H, N-CH₂), 7.12-7.49 (m, 14H, Ar-H), 10.86 (bs, 1H, SH)	453
7e	3012.73 (Ar-CH), 2536 (SH), 1597 (C=N)	2.92 (s, 6H, 2N-CH₃), 1.31 (s, 3H, CH₃), 4.93 (s, 2H, CH₂) 4.11 (s, 2H, N-CH₂), 7.19-7.47 (m, 14H, Ar-H), 10.89 (bs, 1H, SH)	480
7f	3013.73 (Ar-CH), 2532 (SH), 1591 (C=N)	4.96 (s, 2H, N-CH₂), 7.29-7.57 (m, 20H, Ar-H), 10.81 (bs, 1H, SH)	485
7g	3013.45 (Ar-CH), 2538 (SH), 1599 (C=N), 1068.17 (C-F)	4.95 (s, 2H, N-CH₂), 7.24-7.58 (m, 19H, Ar-H), 10.87 (bs, 1H, SH)	503
7h	3013.44 (Ar-CH), 2536 (SH), 1592 (C=N), 721.42 (C-Cl)	4.97 (s, 2H, N-CH₂), 7.28-7.52 (m, 19H, Ar-H), 10.88 (bs, 1H, SH)	520
7i	3012.42 (Ar-CH), 2528 (SH), 1589 (C=N), 3207 (OH)	5.03 (1H, Ar-OH), 4.95 (s, 2H, N-CH₂), 7.38-7.72 (m, 19H, Ar-H), 10.81 (bs, 1H, SH)	501
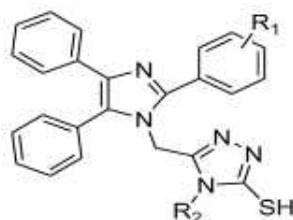
Fig.2. General structure of test compound

TABLE III. ANTIMICROBIAL ACTIVITY OF TEST COMPOUNDS 7a-7o

Compound code	R_1	R_2	Antimicrobial study* (zone of inhibition in mm)					
			Antibacterial activity				Antifungal activity	
			SA	BS	EC	PA	AN	CA
7a	H	C_2H_5	12	14	11	13	13	17
7b	4-F	C_2H_5	30	31	27	28	29	31
7c	4-Cl	C_2H_5	27	26	25	24	26	28
7d	4-OH	C_2H_5	21	20	19	18	23	25
7e	4-N(CH$_3$)$_2$	C_2H_5	24	23	22	21	32	34
7f	H	C_6H_5	13	16	15	14	16	20
7g	4-F	C_6H_5	31	33	29	31	30	32
7h	4-Cl	C_6H_5	28	27	26	25	27	29
7i	4-OH	C_6H_5	22	21	20	19	24	26
7j	4-N(CH$_3$)$_2$	C_6H_5	25	24	23	22	33	35
7k	H	$2\text{-}OCH_3\text{-}C_6H_4$	18	17	18	17	20	23
7l	4-F	$2\text{-}OCH_3\text{-}C_6H_4$	32	34	30	33	31	33
7m	4-Cl	$2\text{-}OCH_3\text{-}C_6H_4$	29	30	28	27	28	30
7n	4-OH	$2\text{-}OCH_3\text{-}C_6H_4$	23	22	21	20	25	27
7o	4-N(CH$_3$)$_2$	$2\text{-}OCH_3\text{-}C_6H_4$	26	25	24	23	34	36
Ofloxacin	NA	NA	34	36	37	38	NA	NA
Ketoconazole	NA	NA	NA	NA	NA	NA	37	40

Keys: * Mean values (n=3); SA – Staphylococcus aureus; BS – Bacillus subtilis;
EC – Escherichia coli; PA – Pseudomonas aeroginosa, AN – Aspergillus niger;
CA – Candida albicans; NA – Not Applicable.

IV. CONCLUSION

The present investigation designates that antimicrobial activities of the synthesized compounds can be enhanced significantly by incorporating p-fluoro and p-dimethyl amino phenyl groups on imidazole substituted triazole nucleus. The significant findings of this research work should be supportive to medicinal chemists and researchers working in this field. Hence, it is concluded that, this class of compounds certainly holds greater promise for drug design and discovery of potent antimicrobial agents for future.

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Study of the Protective Effect of Quercetin in Rat Hepatocytes on Azathioprine Induced TCA Cycle Enzymes Dysfunction by Enhancement of Oxidative Stress

Praveen Kumar
Moradabad Educational Trust, Group of Institutions, Faculty of Pharmacy, Moradabad, Uttar Pradesh, India
praveensha77@gmail.com

Sunil Kumar
Department of Pharmaceutical Sciences. National Institute of Medical Sciences University, Jaipur, India
sunilak2813@gmail.com

Abstract-Mitochondrion plays the most prominent role in the production of energy and cell cycle regulation. Administration of immunosuppressant drug AZA (azathioprine) adversely affects the hepatic mitochondria, which may culminate in hepatotoxicity. The present study is aimed at evaluating the role of QE (quercetin) in AZA provoked hepatic injury. Male Wister rats were used for the experimentation. AZA was administered as a single intraperitoneal injection (50 mg/kg body weight) on the 7th day of the experiment. A prominent depletion in the levels of TCA (tricarboxylic acid) enzymes such as ICDH (isocitrate dehydrogenase) α-KGDH (α-ketoglutarate dehydrogenase) SDH (succinate dehydrogenase) and MDH (malate dehydrogenase) were observed. Decrease in the levels of these enzymes suggests a loss in mitochondrial function and integrity. The supplementation of QE (50mg/kg body weight) restored the depleted levels of enzymes and above hepatic mitochondrial abnormalities to near normalcy. Thus, our study emphasizes on antioxidant property of QE in improving the mitochondrial functions in AZA induced hepatic degradation.

Key Words: Oxidative stress, Liver, Antioxidant, Azathioprine, TCA enzymes, Quercetin.

I. INTRODUCTION

Liver is that organ of body, which performs the function of detoxifying all substances, which are ingested by humans; therefore, hepatic cells are most susceptible to damage by metabolites of various allopathic drugs. These drugs cause significant hepatic damage due to formation of highly toxic metabolites. AZA, one of the prime agents employed in organ transplantations (1) and autoimmune diseases as delineated by previous records has earned quite a name as hepatotoxic agent, which impedes immunosuppressant therapies. Mitochondria are responsible for various functions such as generating the energy currency of the cell (2) that is ATP, cell cycle regulation, growth and death. Ironically, mitochondria become the ultimate targets of free radicals, which are generated during the transfer of electrons within enzyme complexes via its own electron transport chain (3). There is enough substantial evidence to suggest that free radical load hampers electron transport chain, gets intercalated between oxidative phosphorylation thereby destroying enzymes doeing in it,

subsequently forwarding to mitochondrial swelling and eventually hepatic necrosis(4,5). Due to excessive production of free radicals, antioxidants in liver mitochondria become inadequate to quench them thus leading to more free radicals, more oxidative stress and more mitochondrial damage.

One of these is flavonoid QE; copiously acquired in tea and onions, its cardio protective has been already established (6). Adequate experimental proof has been gathered regarding antioxidant effects of QE in which it scavenges free radicals thereby defending cell against mitochondrial damage (7). Therefore, in concordance with the previous established theory, QE was chosen as a novel remedy for ameliorating hepatic mitochondrial damage caused by generation of free radicals due to AZA intoxication.

II. MATERIALS AND METHODS

A. Drugs and Chemicals

AZA was purchased from Sigma Aldrich Chemical Company, Bangalore, India and QE was obtained from Hi-Media Lab, Nasik, India. All the remaining chemicals used were of analytical grade.

B. Experimental Protocol

1) Animals:

The study was performed on male albino rats of Wistar strain (average weight of 150-180 g), which were obtained from Experimental Animal Care Centre, Vel's College of Pharmacy, Chennai, India. The experimental protocol was approved by Institutional Animal Ethical Committee (IAEC) of Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), Government of India, Ministry of welfare, Chennai. Experiment was conducted under the strict guidelines laid by the committee.

The experimental animals were randomized into four groups of six rats each as follows:

Group I: Control rats received normal saline (2ml/kg body weight) for 7 days.

Group II: A single intraperitoneal injection of AZA (50 mg/kg body weight, suspended in saline) was administered to rats on the 7th day.

Group III: Intraperitoneal injection of QE (50 mg/kg body weight, suspended in saline) was given to rats for 7 days.

Group IV: QE (50 mg/kg body weight, suspended in saline) was administered to rats as in Group III, on the 7th day of experimental period 1hr after administration of QE, single dose of AZA (50 mg/kg body weight, suspended in saline) was given intraperitoneal as in Group II.

C. Determination of TCA cycle enzymes

The activity of ICDH was assayed by the method of (8). The activity of α-KGDH was assayed by the method of (9). The activity of SDH was assayed according to the method of (10), in which the rate of reduction of potassium ferricyanide was measured by decreased in optical density at 400nm, in the presence of adequate amount of potassium cyanide to inhibit cytochrome C oxidase. The activity of MDH was assayed by the method of (11). The substrate used was oxaloacetate and determination of enzyme activity was carried out by measuring the rate of oxidation of NADH.

D. Statistical analysis

All the grouped data were statistically evaluated with Statistical Package for Social Sciences (SPSS), Version 10.

III. RESULTS

The level of hepatic mitochondrial TCA cycle enzymes ICDH, KGDH, SDH and MDH were significantly depleted in mitochondria of liver tissue in AZA induced rats (group II), when compared to control rats (group I). These enzyme levels were reversed in QE pretreatment (group IV), which demonstrate amelioration in levels when compared to the AZA induced rats (group II). The rats receiving QE alone (group III), did not show any significant change when compared to control rats (group I) (Table 1).

Table 1: Effect of Azathioprine and Quercetin on the activities of liver mitochondria TCA cycle enzyme

GROUPS	ICDH	KGDH	SDH	MDH
Group I (Control)	821.35 ±29.16	229.38 ±20.46	52.23 ±1.51	320.38 ±11.81
Group II (AZA)	426.36 ±16.99*[a]	141.20 ±17.78*[a]	12.48 ±0.55*[a]	180.01 ±10.65*[a]
Group III (QE)	801.75 ±16.40[NS]	224.91 ±21.10[NS]	49.78 ±2.19[NS]	312.73 ±9.09[NS]
Group IV (AZA+QE)	809.55 ±09.01*[b]	222.16 ±19.82*[b]	43.41 ±2.02*[b]	274.51 ±13.42*[b]

Results are expressed as mean ±S.D. for 6 rats. Units: ICDH, nmole of α-ketoglutarate formed/h/mg protein; KDH, nmole of ferricyanide formed/h/mg protein; SDH, nmole of succinate oxidized/min/mg protein; MDH, nmole of NADH oxidized/min/mg protein. Comparisons are made between: a- Group I and Group II; b- Group II and Group IV. *Statistically significant ($p < 0.05$); NS-non significant.

Therefore, through the above enzyme estimations, it was proved that quercetin is efficient in protecting degradation of hepatic mitochondria induced by administration of AZA.

IV. DISCUSSION

One of the most frequently employed drug as immunosuppressant therapy in organ transplantation is azathioprine [6-(1-methyl-4-nitro-5-imidazolyl) thioprine.Its complicacy in the transplantation therapy is due to its adverse reactions, which execute to profligation of liver. As rationalized earlier, AZA toxicity is related to its biotransformation and its oxidized mechanism is the principal pathway for generating the free radicals (12). QE, as assured by previous documents, is extremely virile to fight against mitochondrial degradation caused by free radicals.There is a substantial evidence to prove that QE protects azathioprine induced hepatic cellular damage (13). Therefore, we examined the protective effect of quercetin against azathioprine-induced deterioration at the subcellular level.

The most organized enzyme of TCA cycle is α-KGDH. It catalyzes the conversion of α-ketoglutarate, Co-A and NAD^+ to succinyl Co-A, CO_2 and NADH (Vizi et al., 2005). Due to the degradation of mitochondrial membrane via free radicals, aldehydic products are formed which inhibit the activity of this enzyme as corroborated earlier. Hydrogen peroxide attacks the enzyme; leading to its diminished activity thereby, stopping the formation of NADH, which consequently does not, participates in ETC, resulting in depleted ATP levels (14). ICDH controls the redox balance in mitochondria. It restores NADPH, which is adept in regenerating GSH. Due to the free radical attack, electron transfer gets hampered leading to its loss in activity (15,16). SDH, a component of ETC and MDH, both are susceptible to inactivation by oxidative stress. Their activity gets lost due to thiolation of cysteine residues (17,18). We observed a significant decrease in the levels of mitochondrial enzymes such as ICDH, SDH, MDH and α-KGDH in AZA intoxicated rats, which were in concordance with previous studies (19). In our experiment quercetin, protected rats depicted an increase in the activities of ICDH, SDH, MDH and α-KGDH.

V. CONCLUSION

The present observation quercetin may reduce oxidative mitochondrial damage by normalizing TCA enzymes, which get disproportionate by AZA intoxication;

moreover, QE maintains endogenous mitochondrial antioxidants status and exerts membrane stabilization action by declining lipid peroxidation. Thus, the present work highlights the cytoprotective role of QE in AZA induced hepatotoxicity at the subcellular level.

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Green Synthesis of Diaryl Imidazole Fused Heterocyclic Nucleus Derivatives and to Carry Out its Characterization

Harmanjit Kaur
Deptt. Of Pharmaceutical Chemistry
CTIPS
Jalandhar, Punjab, INDIA
harmanjit.kaur87@yahoo.com

Kharb Rajeev
Deptt. Of Pharmaceutical Chemistry
CTIPS
Jalandhar, Punjab, INDIA

Sharma Anil Kumar
Deptt. Of Pharmaceutical Chemistry
CTIPS
Jalandhar, Punjab, INDIA

Anshul Chawla
Deptt. Of Pharmaceutical Chemistry
CTIPS
Jalandhar, Punjab, INDIA

ABSTRACT:- A facile microwave synthesis of novel compounds of diaryl imidazoles containing fused heterocyclic nucleus has been reported. Imidazole drugs have broadened scope in remedying various dispositions in clinical medicines. The structures of newly synthesised compounds were confirmed by elemental analysis, IR, NMR and Mass spectral data.

Keyword:- Fungicides, Imidazoles, herbicides

I. INTRODUCTION

Heterocyclic systems containing mainly nitrogen, sulfur and oxygen atom constitutes a large class of compounds of biological and medicinal interest. Several such heterocyclic scaffolds have been successfully incorporated into novel drug leads. [1] The structures of trisubstituted imidazoles are prevalent in natural products and pharmacologically active compounds, such as p38 kinase inhibitor I and cyclooxygenase-2 (COX-2) inhibitor II, fungicides and herbicides and therapeutic agents. [2]Other activities shown by imidazole are: antioxidant activity, anti-inflammatory activity and analgesic activity, anticancer activity etc. [3] Aim of this study to synthesise some noval diaryl imidazole derivatives substituted with fused heterocyclic nucleus using microwave.

II. METHODS AND MATERIALS

A). Experimental:

R₁	R₂	R₃
H	H	H
H	H	Cl
H	Cl	H
H	NO₂	H
H	H	NO₂
H	H	Br
H	H	CH₂CH₃
CH₂CH₃	H	H
H	H	F
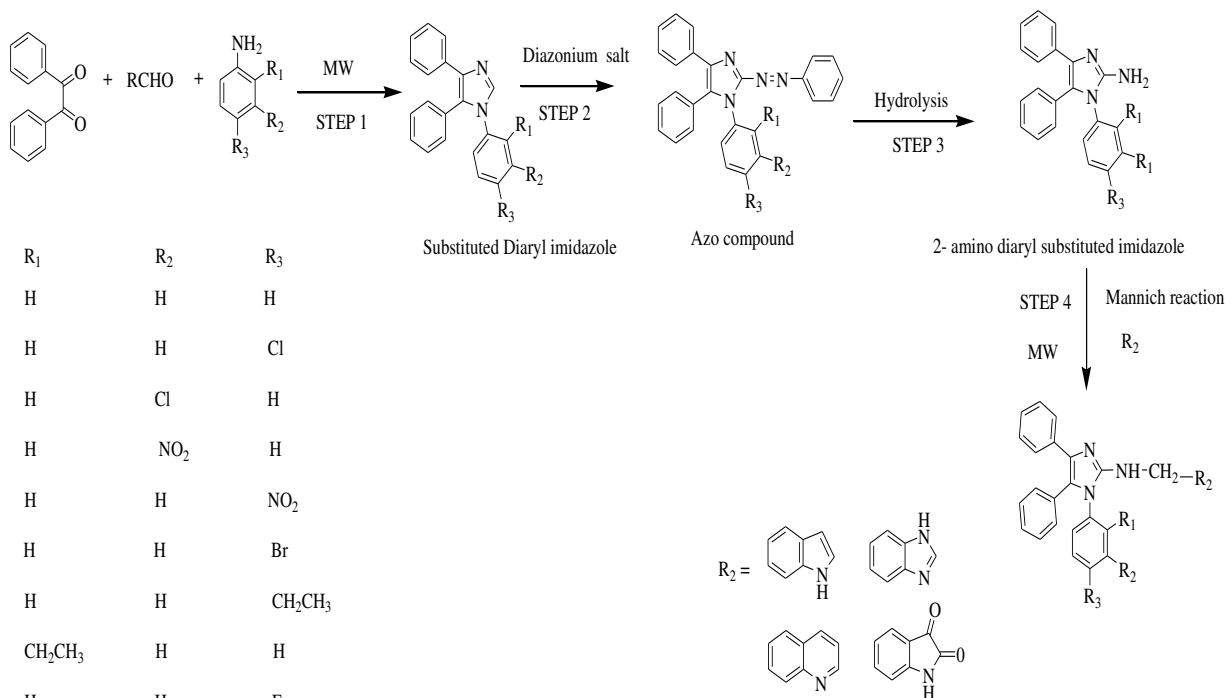
Fig.1 Shows experimental work

III.   RESULTS AND DISCUSSION

Table 1. Physicochemical properties of various synthesised noval diaryl imidazole derivatives.

Compound Code	Mol. Wt.	Mt Pt (^{0}C)	Time	Yeild (%)	R_f value
HJK 1	442.55	248 ^{0}C	2.2 min	67.00%	0.52
HJK 2	470.61	250 ^{0}C	2 min	72.86%	0.67
HJK 3	470.61	246 ^{0}C	1.5 min	68%	0.63
HJK 4	460.54	254 ^{0}C	1.2 min	65.07%	0.55
HJK 5	477	260 ^{0}C	2 min	78.08%	0.69
HJK 6	477	256 ^{0}C	2 min	75.67%	0.64
HJK 7	521.45	268 ^{0}C	1.8 min	89.92%	0.56
HJK 8	487.55	262 ^{0}C	1.5 min	92.67%	0.58
HJK 9	487.55	258 ^{0}C	2 min	70.05%	0.72
HJK 10	441.53	274 ^{0}C	3 min	69.03%	0.67
HJK 11	469.58	280 ^{0}C	3.5 min	62.52%	0.56
HJK 12	469.58	278 ^{0}C	3.5 min	61.92%	0.58
HJK 13	459.52	282 ^{0}C	3.2 min	72.33%	0.62
HJK 14	475.97	290 ^{0}C	2.8 min	81.56%	0.64
HJK 15	475.97	288 ^{0}C	3 min	77.89%	0.70
HJK 16	520.42	298 ^{0}C	2.5 min	84%	0.52
HJK 17	486.52	286 ^{0}C	2.2 min	90.45%	0.55
HJK 18	486.52	284 ^{0}C	2.5 min	89.34%	0.65
HJK 19	470.52	310 ^{0}C	3.5 min	68.03%	0.72
HJK 20	498.57	316 ^{0}C	3.2 min	82.19%	0.67
HJK 21	498.57	314 ^{0}C	3 min	80.63%	0.58
HJK 22	488.51	320 ^{0}C	2.8 min	66.04%	0.52
HJK 23	504.97	328 ^{0}C	2.2 min	79.46%	0.64
HJK 24	504.97	326 ^{0}C	2.8 min	72.78%	0.68
HJK 25	549.42	332 ^{0}C	2.6 min	63.06%	0.58
HJK 26	515.52	330 ^{0}C	3 min	72.05%	0.62
HJK 27	515.52	336 ^{0}C	3 min	78.53%	0,68
HJK 28	454.56	302 ^{0}C	2.5 min	64.89%	0.64
HJK 29	482.62	306^{0}C	2.4 min	73.23%	0.54
HJK 30	482.62	304 ^{0}C	1.8 min	68.69%	0.56

A). Spectral characterization of synthesised noval diaryl imidazole derivatives

1). HJK 1: IR (KBr) (cm^{-1}): 3105 = CH$_2$ (methylene), 3320 = NH (aromatic), 1048 = CN, 2196 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 6.54 -7.48 (benzene, 19H), NH = 4.0 (aromatic, 1H), CH$_2$ = 2.78- 5.18 (methylene, 6H) , MS (M$^+$): 443.22

2). HJK 2: IR (KBr) (cm^{-1}): 2950 = CH$_3$ (alkane), 3045 = CH$_2$ (methylene), 3398 = NH aromatic), 1167 = CN, 2275 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 6.54 -7.48 (benzene, 18H), NH = 4.0 (aromatic, 1H), CH$_2$ = 2.59- 5.18 (methylene, 8H), CH$_3$ = 1.24 (methyl, 3H), MS (M$^+$): 471.25

3). HJK 3: IR (KBr) (cm^{-1}): 3034 = CH$_3$ (alkane), 3178 = CH$_2$ (methylene), 3356 = NH (aromatic), 1134 = CN, 2224 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 6.54 -7.48 (benzene, 18H), NH = 4.0 (aromatic, 1H), CH$_2$ = 2.59- 5.18 (methylene, 8H), CH$_3$ = 1.24 (methyl, 3H), MS (M$^+$): 471.25

4). HJK 4: IR (KBr) (cm^{-1}): 1387 = C-F, 3267 = CH$_2$ (methylene), 3306 = NH (aromatic), 1290 = CN, 2396 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 6.54 -7.48 (benzene, 18H), NH = 4.0 (aromatic, 1H), CH$_2$ = 2.78 - 5.18 (methylene, 6H), MS (M$^+$): 461.21

5). HJK 5: IR (KBr) (cm^{-1}): 758 = C-Cl, 3267 = CH$_2$ (methylene), 3306 = NH (aromatic), 1290 = CN, 2396 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 6.54 -7.48 (benzene, 18H), NH = 4.0 (aromatic, 1H), CH$_2$ = 2.78 - 5.18 (methylene, 6H), MS (M$^+$): 477.18

6). HJK 6: IR (KBr) (cm^{-1}): 732 = C-Cl, 3245 = CH$_2$ (methylene), 3378 = NH (aromatic), 1284 = CN, 2376 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 6.54 -7.48 (benzene, 18H), NH = 4.0 (aromatic, 1H), CH2 = 2.78 - 5.18 (methylene, 6H), MS (M$^+$): 478.17

7). HJK 7: IR (KBr) (cm^{-1}): 540 = C- Br, 3387 = CH$_2$ (methylene), 3286 = NH (aromatic), 1203 = CN, 2390 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 6.54 -7.48 (benzene, 18H), NH = 4.0 (aromatic, 1H), CH$_2$ = 2.78 - 5.18 (methylene, 6H), MS (M$^+$): 522.12

8). HJK 8: IR (KBr) (cm^{-1}): 1543 = N-O , 3108 = CH$_2$ (methylene), 3323 = NH (aromatic), 1056 = CN, 2206 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 6.54 -8.2 (benzene, 18H), NH = 4.0 (aromatic, 1H), CH$_2$ = 2.78 - 5.18 (methylene, 6H), MS (M$^+$): 488.20

9). HJK 9: IR (KBr) (cm^{-1}): 1552 = N-O, 3156 = CH$_2$ (methylene), 3389 = NH (aromatic), 1090 = CN, 2219 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 6.54 -8.2 (benzene, 18H), NH = 4.0 (aromatic, 1H), CH$_2$ = 2.78 - 5.18 (methylene, 6H), MS (M$^+$): 488.20

10). HJK 10: IR (KBr) (cm^{-1}): 3267 = CH$_2$ (methylene), 3389 = NH (aromatic), 1034 = CN, 2134 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.22 -8.08 (benzene, 20H), NH = 4.0 (aromatic, 1H), CH$_2$ = 5.50 (methylene, 2H), MS (M$^+$): 442.20

11). HJK 11: IR (KBr) (cm^{-1}): 2998 = CH$_3$ (alkane), 3023 = CH$_2$ (methylene), 3278 = NH (aromatic), 1124 = CN, 2267 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.1 -8.08 (benzene, 19H), NH = 2.59- 4.0 (aromatic, 1H), CH$_2$ = 5.50 (methylene, 4H) , CH$_3$ = 1.23 (methyl, 3H), MS (M$^+$): 470.74

12). HJK 12: IR (KBr) (cm^{-1}): 3078 = CH$_3$ (alkane), 3112 = CH$_2$ (methylene), 3373 = NH (aromatic), 1191 = CN, 2285 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.1 -8.08 (benzene, 19H), NH = 2.59- 4.0 (aromatic, 1H), CH$_2$ = 5.50 (methylene, 4H) , CH$_3$ = 1.23 (methyl, 3H), MS (M$^+$) : 470.23

13). HJK 13: IR (KBr) (cm^{-1}): 1315 = C-F, 3212 = CH$_2$ (methylene), 3387 = NH (aromatic), 1230 = CN, 2329 = C=N, ^{1}H-NMR (DMSO-d6) δ : CH = 7.0 -8.08 (benzene, 19H), NH = 4.0 (aromatic, 1H), CH$_2$ = 5.50 (methylene, 2H), MS (M$^+$) : 460.19

14). HJK 14: IR (KBr) (cm^{-1}): 784 = C-Cl, 3212 = CH$_2$ (methylene), 3359 = NH (aromatic), 1235 = CN, 2357 = C=N, ^{1}H-NMR (DMSO-d6) δ : CH = 7.2 -8.08 (benzene, 19H), NH = 4.0 (aromatic, 1H), CH$_2$ = 5.50 (methylene, 2H), MS (M$^+$): 476.16

15). HJK 15: IR (KBr) (cm^{-1}): 789 = C-Cl, 3260 = CH$_2$ (methylene), 3313 = NH (aromatic), 1230 = CN, 2399 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.1 -8.08 (benzene, 19H), NH = 4.0 (aromatic, 1H), CH$_2$ = 5.50 (methylene, 2H), MS (M$^+$): 476.16

16). HJK 16: IR (KBr) (cm^{-1}): 503= C- Br, 3305 = CH$_2$ (methylene), 3289 = NH (aromatic), 1249 = CN, 2324 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.2 -8.08 (benzene, 19H), NH = 4.0 (aromatic, 1H), CH$_2$ = 5.50 (methylene, 2H), MS (M$^+$): 520.11

17). HJK 17: IR (KBr) (cm^{-1}): 1589 = N-O, 31143 = CH$_2$ (methylene), 3381 = NH (aromatic), 1095 = CN, 2259 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.22 -8.2 (benzene, 19H), NH = 4.0 (aromatic, 1H), CH$_2$ = 5.50 (methylene, 2H), MS (M$^+$): 487.18

18). HJK 18: IR (KBr) (cm^{-1}): 1513 = N-O, 3198 = CH$_2$ (methylene), 3332 = NH (aromatic), 1085 = CN, 2250 = C=N, ^{1}H-NMR (DMSO-d6) δ : CH = 7.22 -8.2 (benzene, 19H), NH = 4.0 (aromatic, 1H), CH$_2$ = 5.50 (methylene, 2H), MS (M$^+$): 487.18

19). HJK 19: IR (KBr) (cm^{-1}): 1783 = C =O (carbonyl), 3109 = CH$_2$ (methylene), 3325 = NH (aromatic),1055 = CN, 2191 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.19 -7.83 (benzene, 19H), NH = 4.O (aromatic, 1H), CH2 = 4.73 (methylene, 2H), MS (M$^+$): 471.18

20). HJK 20: IR (KBr) (cm^{-1}): 1705 = C =O (carbonyl), 2959 = CH$_3$ (alkane), 3046 = CH$_2$ (methylene), 3304 = NH (aromatic), 1120 = CN, 2294 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.1 -7.83 (benzene, 18H), NH = 4.O (aromatic, 1H), CH$_2$ = 2.59 - 4.73 (methylene, 4H) , CH$_3$ = 1.24 (methyl, 3H), MS (M$^+$): 499.21

21). HJK 21: IR (KBr) (cm^{-1}): 1684 = C=O (carbonyl), 3078 = CH$_3$ (alkane), 3136 = CH$_2$ (methylene), 3348 = NH (aromatic), 1139 = CN, 2278 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.1 -7.83 (benzene, 18H), NH = 4.O (aromatic, 1H), CH$_2$ = 2.59 - 4.73 (methylene, 4H) , CH$_3$ = 1.24 (methyl, 3H), MS (M$^+$): 499.21

22). HJK 22: 1784 = C=O (carbonyl), 1358 = C-F, 3298 = CH$_2$ (methylene), 3328 = NH (aromatic), 1267 = CN, 2378 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.0 -7.83 (benzene, 18H), NH = 4.O (aromatic, 1H), CH$_2$ = 4.73 (methylene, 2H), MS (M$^+$): 488.16

23). HJK 23: IR (KBr) (cm^{-1}): 1697 = C=O (carbonyl), 714 = C-Cl, 3276 = CH$_2$ (methylene), 3379 = NH (aromatic), 1247 = CN, 2343 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.19 -7.83 (benzene, 18H), NH = 4.O (aromatic, 1H), CH$_2$ = 4.73 (methylene, 2H), MS (M$^+$): 505.14

24). HJK 24: IR (KBr) (cm^{-1}): 1534 = C=O (carbonyl), 773 = C-Cl, 3278 = CH$_2$ (methylene), 3393 = NH (aromatic), 1274 = CN, 2375 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.19 -7.83 (benzene, 18H), NH = 4.O (aromatic, 1H), CH$_2$ = 4.73 (methylene, 2H), MS (M$^+$) : 505.14

25). HJK 25: IR (KBr) (cm^{-1}): 1673 = C=O (carbonyl), 584 = C- Br, 3374 = CH$_2$ (methylene), 3285 = NH (aromatic), 1286 = CN, 2383 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.2 -7.83 (benzene, 18H), NH = 4.O (aromatic, 1H), CH$_2$ = 4.73 (methylene, 2H), MS (M$^+$): 549.09

26). HJK 26: IR (KBr) (cm^{-1}): 1845 = C=O (carbonyl), 1575 = N-O , 3184 = CH$_2$ (methylene), 3389 = NH (aromatic), 1014 = CN, 2287 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.19 -8.2 (benzene, 18H), NH = 4.O (aromatic, 1H), CH$_2$ = 4.73 (methylene, 2H), MS (M$^+$): 516.16

27). HJK 27: IR (KBr) (cm^{-1}): 1578 = C=O (carbonyl), 1512 = N-O, 3191 = CH$_2$ (methylene), 3382 = NH (aromatic), 1034 = CN, 2289 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.19 -8.2 (benzene, 18H), NH = 4.O (aromatic, 1H), CH$_2$ = 4.73 (methylene, 2H), MS (M$^+$) : 516.16

28). HJK 28: IR (KBr) (cm^{-1}): 1489 = C=C (aromatic), 3267 = CH$_2$ (methylene), 3389 = NH (aromatic), 1034 = CN, 2134 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 3.99 -7.48 (benzene, 16H), NH = 4.O (aromatic, 1H), CH$_2$ = 4.32 (methylene, 2H), H = 5.28 – 6.44 (ethylene, 7H), MS (M$^+$): 455.22

29). HJK 29: IR (KBr) (cm^{-1}): 1534 = C=C (aromatic), 3067 = CH$_3$ (alkane), 3056 = CH$_2$ (methylene), 3219 = NH (aromatic), 1187 = CN, 2212 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 3.99 -7.48 (benzene, 15H), NH = 4.O (aromatic, 1H), CH$_2$ = 2.59 - 4.32 (methylene, 4H), H = 5.28 – 6.44 (ethylene, 7H), CH$_3$ = 1.24 (methyl, 3H), MS (M$^+$):483.25

30). HJK 30: IR (KBr) (cm^{-1}): 1605 = C=C (aromatic), 3023 = CH$_3$ (alkane), 3189 = CH$_2$ (methylene), 3336 = NH (aromatic), 1160 = CN,2221 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 3.99 -7.48 (benzene, 15H), NH = 4.O (aromatic, 1H), CH$_2$ = 2.59 - 4.32 (methylene, 4H), H = 5.28 – 6.44 (ethylene, 7H), CH$_3$ = 1.24 (methyl, 3H), MS (M$^+$): 483.25

IV. CONCLUSION

Microwave irradiation can be considered to reduce reaction period, the reactions are simple, general, and efficient. It is a clean technological process and a wide range of substrates can undergo reactions in high yield with attractive and environmentally-friendly approach.

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Synthesis, Structural Characterization and Pharmacological Evaluation of Some Novel Pyrazole Bearing Pyrimidine Derivatives

Meenakshi Tyagi	Anshul Chawla	Anil Kumar Sharma	Rajeev Kharb
Department of Pharmaceutical Chemistry	Department of Pharmaceutical Chemistry	Department of Pharmaceutical Chemistry	Department of Pharmaceutical Chemistry
CT Institute of Pharmaceutical Sciences	CT Institute of Pharmaceutical Sciences,	CT Institute of Pharmaceutical Sciences,	CT Institute of Pharmaceutical Sciences,
Jalandhar, Punjab, India	Jalandhar, Punjab, India	Jalandhar, Punjab, India	Jalandhar, Punjab,Inia
tyagi.meenakshi82@gmail.com			

Abstract-A novel series of pyrazole and pyrimidine derivatives were synthesized because most recent literature survey has established that pyrazole and pyrimidine heterocyclic derivatives are found to have a wide range of pharmacological activities particularly exhibiting superior antimicrobial activity. The structures of synthesized compounds were analyzed by elemental analyses, IR, NMR and Mass spectral data and screened them for antibacterial activity.

Keywords- Pyrazole, pyrimidine antimicrobial activitiy.

I. INTRODUCTION

Microbial resistance has become a global problem as it makes currently available antimicrobial therapies ineffective. Fused pyrazolo pyrimidine derivatives have attracted the attention of numerous researchers over many years due to their important biological activities [1]. An array of biological activities such as antibacterial, antifungal, anti- inflammatory has been reported to be shown by various pyrazolopyrimidines derivatives [2].

II. EXPERIMENTAL SECTION

Step 1: Synthesis of pyrimidine:
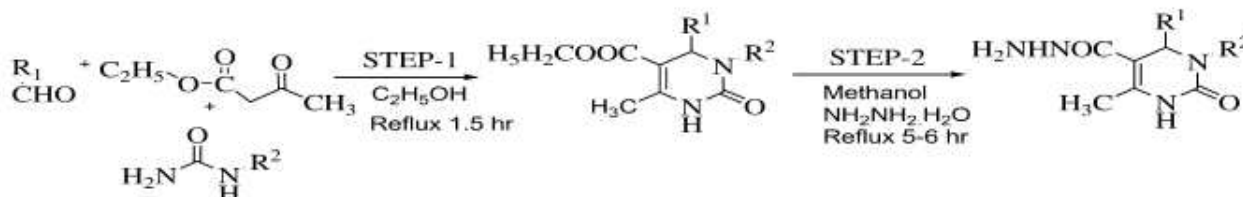
Step 2: Synthesis of pyrazole:
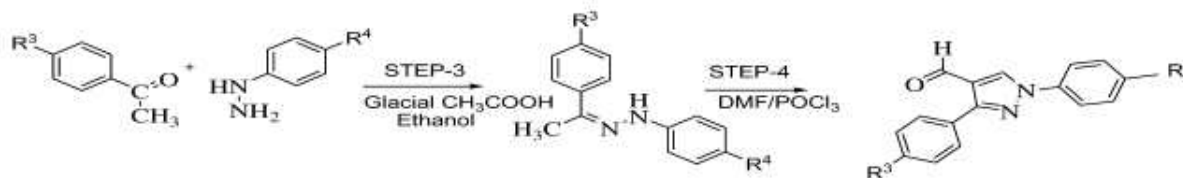
Step 3: Fusion of pyrimidine containing pyrazole nucleus:

Antibacterial activity of synthesized compounds was evaluated by using agar well diffusion method against Gram negative stain E. coli, Gram-positive stain S. aureus by comparing against standard drug Ciprofloxacin and expressed as zone of inhibition values (mm) [3].

III. RESULTS &DISCUSSION

TABLE I. PHYSICOCHEMICAL DATA OF SYNTHESIZED COMPOUNDS

Comp. Code	R^1	R^2	R^3	R^4	MOLECULAR FORMULA	M. W. (g/mol)	% YIELD	M. P. (^{0}C)	RF VALUES
AV1	H	H	H	H	$C_{36}H_{28}N_8O_7$	684.66	74	170	0.51
AV2	4-OCH$_3$	H	H	H	$C_{37}H_{30}N_8O_8$	714.68	68	197	0.46
AV3	3-Cl	H	H	H	$C_{36}H_{27}ClN_8O_7$	719.1	58	152	0.53
AV4	4-Br	H	H	H	$C_{36}H_{27}BrN_8O_7$	763.55	71	190	0.49
AV5	4-F	H	H	H	$C_{36}H_{27}FN_8O_7$	702.65	69	141	0.55
AV6	4-OH	H	H	H	$C_{36}H_{28}N_8O_8$	700.66	76	209	0.56
AV7	3,4,5-(OCH$_3$)$_3$	H	H	H	$C_{39}H_{34}N_8O_{10}$	774.73	55	192	0.48
AV8	H	H	CH$_3$	H	$C_{37}H_{30}N_8O_7$	698.68	51	138	0.53
AV9	4-OCH$_3$	H	CH$_3$	H	$C_{38}H_{32}N_8O_8$	728.71	72	223	0.52
AV10	3-Cl	H	CH$_3$	H	$C_{37}H_{29}ClN_8O_7$	733.13	61	210	0.59
AV11	4-Br	H	CH$_3$	H	$C_{37}H_{29}BrN_8O_7$	777.58	59	183	0.64
AV12	4-F	H	CH$_3$	H	$C_{37}H_{29}FN_8O_7$	716.67	70	145	0.72
AV13	4-OH	H	CH$_3$	H	$C_{37}H_{30}N_8O_8$	714.68	63	155	0.68
AV14	3,4,5-(OCH$_3$)$_3$	H	CH$_3$	H	$C_{40}H_{36}N_8O_{10}$	788.76	78	256	0.39
AV15	H	N-CH$_3$	H	H	$C_{37}H_{30}N_8O_7$	698.68	71	202	0.61
AV16	4-OCH$_3$	N-CH$_3$	H	H	$C_{38}H_{32}N_8O_8$	728.71	54	248	0.45
AV17	3-Cl	N-CH$_3$	H	H	$C_{37}H_{29}ClN_8O_7$	733.13	75	161	0.70
AV18	4-Br	N-CH$_3$	H	H	$C_{37}H_{29}BrN_8O_7$	777.58	61	186	0.59
AV19	4-F	N-CH$_3$	H	H	$C_{37}H_{29}FN_8O_7$	716.67	56	148	0.69
AV20	4-OH	N-CH$_3$	H	H	$C_{37}H_{30}N_8O_8$	714.68	77	157	0.55

TABLE II. SPECTRAL CHARACTERISATION DATA OF SYNTHESIZED COMPOUNDS

Comp. Code	FT-IR (KBr,cm^{-1})	1H-NMR δ (ppm)	MASS SPECTRA [M$^+$]
AV1	3271(N-H),2956(C-Hstr),2311(C-H Ar),1700(C=O,Pyrimidine),1354(N=O),1617(C=N)	6.0-7.0(3NH), 5.56-9.1(20 CH), 0.86-1.71(CH$_3$), 1.37-3.81(CH$_2$)	685.21
AV2	3272.3(N-H),2917.1(C-H str), 2353 (C-H Ar), 1680.3 (C=O, Pyrimidine), 1352(N=O),1606(C=N)	6.0-7.0(3NH), 5.56-9.1(19 CH), 0.86-1.71(CH$_3$),1.37-3.81(CH$_2$),0.11-0.49(-O-C)	715.21
AV3	3272(N-H),2917(C-Hstr),2311(C-H Ar),1680(C=O,Pyrimidine),1357(N=O),1610(C=N),751.2(C-Cl)	6.0-7.0(3NH), 5.56-9.1(19 CH), 0.86-1.71(CH$_3$),1.37-3.81(CH$_2$),0.11-0.12(- Cl)	720.17
AV4	3290(N-H),3062(C-Hstr),2354(C-H Ar),1683(C=O,Pyrimidine),1353(N=O),1616(C=N),723.7(C-Br)	6.0-7.0(3NH), 5.56-9.1(19 CH), 0.86-1.71(CH$_3$),1.37-3.81(CH$_2$),0.11-0.17(- Br)	764.12
AV5	3273(N-H),3054(C-Hstr),2349(C-H Ar),1688(C=O,Pyrimidine),1352(N=O),1623(C=N),1357.8(C-F)	6.0-7.0(3NH), 5.56-9.1(19 CH), 0.86-1.71(CH$_3$),1.37-3.81(CH$_2$),0.02-0.29(- F)	703.20
AV6	3271.9(N-H),2917.3(C-H str) ,2349.3 (C-H Ar), 1690(C=O,Pyrimidine), 1356(N=O),1637(C=N),3312(O-H)	6.0-7.0(3NH), 5.56-9.1(19 CH), 0.86-1.71(CH$_3$), 1.37-3.81(CH$_2$),5.0(Ar C-OH)	701.21
AV7	3272(N-H),2951.1(C-H str) ,2312.3 (C-H Ar), 1692.5(C=O,Pyrimidine), 1358(N=O),1623(C=N)	6.0-7.0(3NH), 5.56-9.1(19 CH), 1.71-3.73(4CH$_3$),1.37-3.81(CH$_2$),0.11-0.49(-C=O)	775.24
AV8	3272(N-H),2918(C-H str) ,2349.4 (C-H Ar),1680.3(C=O,Pyrimidine),1356.2 (N=O),1646(C=N)	6.0-7.0(3NH), 5.56-9.1(19 CH), 0.86-1.71(CH$_3$),1.37-2.88(2CH$_2$)	699.23
AV9	3272.1(N-H),2984.8(C-H str),2349.6 (C-H Ar), 1680.4(C=O,Pyrimidine), 1354.8(N=O),1578(C=N)	6.0-7.0(3NH), 5.56-9.1(19 CH), 1.71-3.73(2CH$_3$),1.37-2.88(2CH$_2$),0.11-0.49(-O-C)	729.24
AV10	3276(N-H),2956(C-Hstr),2354(C-H Ar),1692(C=O,Pyrimidine),1352.6(N=O) , 1637(C=N),751.6(C-Cl)	6.0-7.0(3NH), 5.56-9.1(19 CH), 1.71-3.73(2CH$_3$),1.37-2.88(2CH$_2$),0.01-0.12(Cl)	734.18
AV11	3272(N-H),2954.3(C-Hstr) ,2349.6 (C-HAr),1683.6 (C=O,Pyrimidine), 1356 (N=O),1658(C=N),723.4(C-Br)	6.0-7.0(3NH), 5.56-9.1(19 CH), 1.71-3.73(2CH$_3$),1.37-2.88(2CH$_2$),0.11-0.17(-Br)	778.13
AV12	3272(N-H),2918(C-Hstr) ,2311 (C-HAr),1687 (C=O,Pyrimidine), 1359.4 (N=O),1632(C=N),1357.2(C-F)	6.0-7.0(3NH), 5.56-9.1(19 CH), 1.71-3.73(2CH$_3$),1.37-2.88(2CH$_2$),0.02-0.29(-F)	717.22

AV13	3290.1(N-H),3062.05(C-Hstr) ,2354 (C-HAr),1683.20 (C=O,Pyrimidine), 1360.1 (N=O),1628(C=N),3314(O-H)	6.0-7.0(3NH), 5.56-9.1(19 CH), 1.71-3.73(2CH$_3$),1.37-2.88(2CH$_2$),5.0(Ar C-OH)	715.22
AV14	3425.44(N-H), 2968.32(C-Hstr) ,2067.11(C-HAr), 1682.40 (C=O, Pyrimidine) , 1352.9 (N=O), 1646 (C=N)	6.0-7.0(3NH),5.56-9.1(19CH),1.71 3.73 (4CH$_3$) ,1.37-2.88(2CH$_2$),0.11-0.49(-C=O)	789.26
AV15	3349(N-H),3183(C-Hstr) ,2268(C-HAr), 1684 (C=O, Pyrimidine) , 1357.3 (N=O), 1623 (C=N)	6.0-7.0(2NH), 5.56-9.1(17CH), 1.71-2.90(2CH$_3$),1.37-3.81(CH$_2$)	699.23
AV16	3283(N-H),3145(C-Hstr) ,2258(C-HAr), 1684.2 (C=O, Pyrimidine) , 1357.1(N=O), 1576 (C=N)	6.0-7.0(2NH), 5.56-9.1(17CH), 1.71-3.73(3CH$_3$),1.37-3.81(CH$_2$),0.11-0.49(-O-C)	729.24
AV17	3328(N-H),3213(C-Hstr) ,2315(C-HAr), 1692 (C=O, Pyrimidine) , 1358.7(N=O), 1594(C=N),751.2(C-Cl)	6.0-7.0(2NH), 5.56-9.1(17CH), 1.71-2.90(2CH$_3$),1.37-3.81(CH$_2$),0.01-0.12(-Cl)	734.19
AV18	3286(N-H),2992(C-Hstr) ,2352.8(C-HAr), 1687.3 (C=O, Pyrimidine) , 1356.2(N=O), 1600(C=N),723.3(C-Br)	6.0-7.0(2NH), 5.56-9.1(17CH), 1.71-3.73(2CH$_3$),1.37-3.81(CH$_2$),0.11-0.17(-Br)	778.13
AV19	3284.2(N-H),3112.8(C-Hstr),3082.06 (C-HAr),1700(C=O,Pyrimidine), 1358.4 (N=O),1606(C=N),1357.2(C-F)	6.0-7.0(2NH), 5.56-9.1(17CH), 1.71-3.73(2CH$_3$),1.37-3.81(CH$_2$),0.02-0.29(-F)	717.22
AV20	3272.3(N-H),2920.2(C-Hstr) ,2350.6(C-HAr), 1680.6 (C=O, Pyrimidine) , 1352.6(N=O), 1575(C=N),3312.3(O-H)	6.0-7.0(2NH), 5.56-9.1(17CH), 1.71-3.73(2CH$_3$),1.37-3.81(CH$_2$),5.0(Ar COH)	715.22

TABLE III. ANTIBACTERIAL ACTIVITY OF TEST COMPOUNDS

COMP. CODE	ZONE OF INHIBITION(mm)		
	EC	BC	SA
AV1	10.42	10.16	10.09
AV2	15.02	14.72	15.67
AV3	2.46	12.80	10.89
AV4	12.38	11.99	11.80
AV5	11.05	11.20	10.11
AV6	14.68	14.11	13.04
AV7	13.10	13.22	14.60
AV8	10.12	11.49	10.31
AV9	13.46	13.87	12.30
AV10	12.49	14.41	12.64
Control	-	-	-
Ciprofloxacin	15.78	15.14	15.39

Keys: SA − Staphylococcus aureus; EC − EscherichiaColi; BC-Bacillus subtilis

IV. CONCLUSION

This research paper has discussed about newer synthetic methodologies for synthesis of new pyrazole substituted pyrimidine derivatives and evaluation for their antibacterial potential. The vital information given in present manuscript may result in discovery of new antimicrobial drug molecules having increased potency and better patient compliance for effective treatment of deadly microbial disorders.

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Synthesis & SAR Studies of Novel Thiadiazole Fused with Oxadiazole Nucleus Derivatives as Antimicrobial Agents

Rupinder kaur
Department of
Pharmaceutical Chemistry
CT Institute of
Pharmaceutical Sciences,
Jalandhar, Punjab, India

Anshul Chawla
Department of
Pharmaceutical Chemistry
CT Institute of
Pharmaceutical Sciences,
Jalandhar, Punjab, India

Anil Kumar Sharma
Department of
Pharmaceutical Chemistry
CT Institute of
Pharmaceutical Sciences,
Jalandhar, Punjab, India

Rajeev Kharb
Department of
Pharmaceutical Chemistry
CT Institute of
Pharmaceutical Sciences,
Jalandhar, Punjab, India

Abstract- A novel series of thiadiazole containing oxadiazole derivatives was synthesized through Schiff base synthesis and their structures were confirmed by IR, NMR and Mass spectroscopy techniques. Titled compounds were screened for their antibacterial activity agianst bacterial species like S. aureus, P. aeroginosa and E. coli and comparison was done with standard drug.

Keywords-Thiadiazole derivatives, oxadiazole derivatives, antibacterial activity.

I.   INTRODUCTION

Many classes of thiadiazole & oxadiazole compounds were found to possess an extensive spectrum of pharmacological activities such as antimicrobial [1], antimycobacterium, anticonvulsant [2] and anti-inflammatory activities [3] etc. In view of these facts & increasing number of multi drug resistant gram positive pathogen, prompted us to synthesize new derivatives of thiadiazole substituted with oxadiazole derivatives and screening for their in-vitro antibacterial activity [4].

II.   MATERIALS AND METHODS
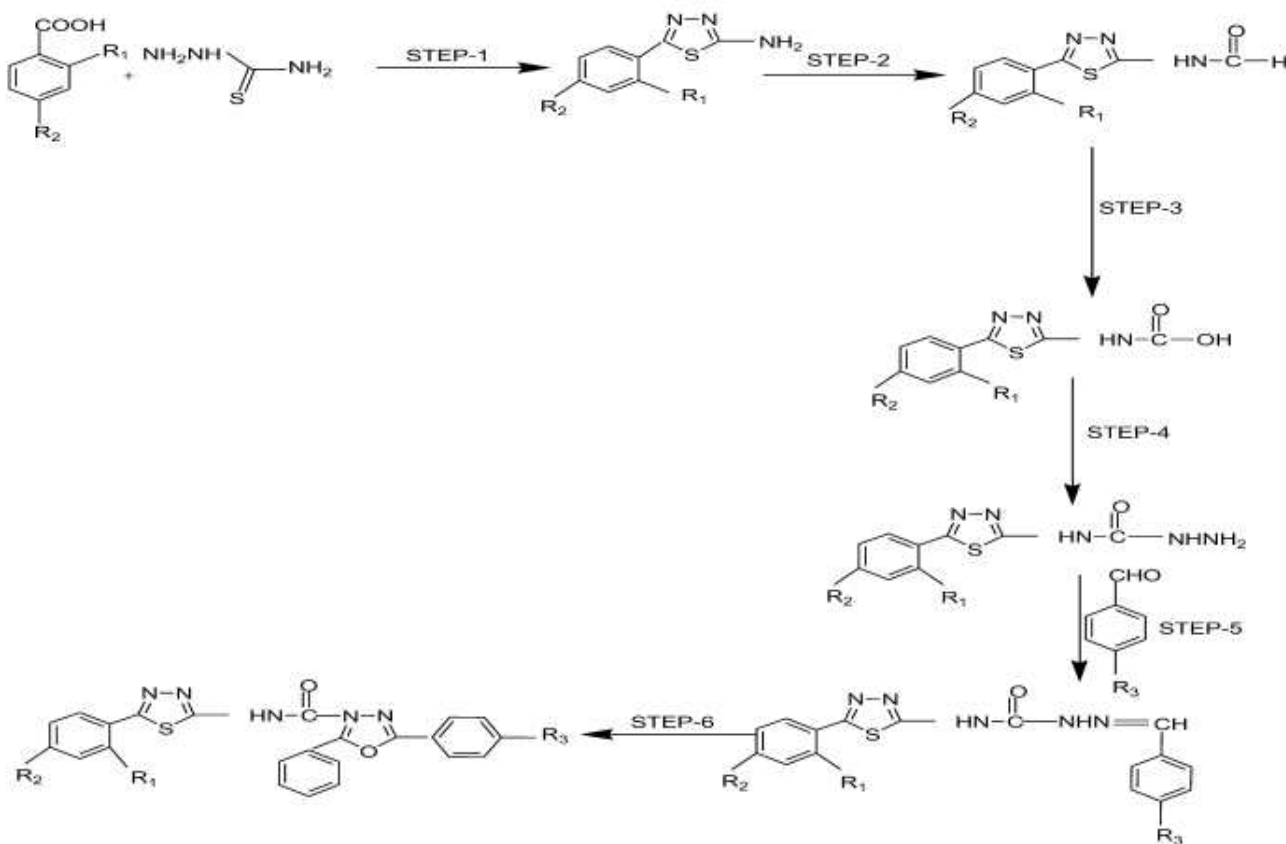
Fig.1. Synthesis of Thiadiazole containing Oxadiazole Derivatives

III. RESULT AND DISCUSSION

TABLE I. PHYSICOCHEMICAL PROPERTIES of SYNTHESIZED COMPOUNDS

Sr. No.	Compound code	R1	R2	R3	M.P (ºC)	Molecular formula	M.W.(gm/mole)	Yield(%)	Rf value
1.	RPK1	H	H	H	178	$C_{30}H_{39}N_5O_2S$	533.73	72	0.55
2.	RPK2	H	H	OH	180	C30H39N5O3S	549.73	58	0.63
3.	RPK3	H	H	Cl	182	C29H35ClN5O2S	553.14	78	0.67
4.	RPK4	H	H	F	183	$C_{26}H_{28}FN_4OS$	463.59	59	0.51
5.	RPK5	Br	H	H	188	C30H38BrN5O2S	612.62	64	0.56
6.	RPK6	Br	H	OH	190	C31H41BrN5O3S	643.66	77	0.49
7.	RPK7	Br	H	Cl	189	C31H40BrClN5O2S	662.1	82	0.63
8.	RPK8	Br	H	F	191	C31H40BrFN5O2S	644.21	80	O.54
9.	RPK9	H	Br	H	180	C30H38BrN5O2S	612.62	76	0.49
10.	RPK10	H	Br	OH	183	C31H41BrN5O3S	643.66	68	0.51
11.	RPK11	H	Br	Cl	184	C31H40BrClN5O2S	662.1	85	0.64
12.	RPK12	H	Br	F	182	C31H40BrFN5O2S	644.21	69	0.70
13.	RPK13	Cl	H	H	172	C30H38ClN5O2S	568.17	73	0.45
14.	RPK14	Cl	H	OH	174	C31H41ClN5O3S	599.21	78	0.73
15.	RPK15	Cl	H	Cl	173	C31H40Cl2N5O2S	617.64	81	0.69
16.	RPK16	Cl	H	F	174	C31H40ClFN5O2S	602.25	65	0.62
17.	RPK17	H	Cl	H	170	C30H38ClN5O2S	568.17	73	O.58
18.	RPK18	H	Cl	OH	173	C31H41ClN5O3S	599.21	80	O.62
19.	RPK19	H	Cl	Cl	175	C31H40Cl2N5O2S	617.64	65	O.51
20.	RPK20	H	Cl	F	173	C31H40ClFN5O2S	602.25	69	O.43

TABLE II. SPECTRAL CHRACTERIZATION of SYNTHESIZED COMPOUNDS

Compound Code	FT-IR (KBr,cm-1)	1H NMR(DMSO-d$_6$, δppm)	Mass(m/z) [M$^+$]
RPK1	3310(C-NH),1684(C=O),1610(C=N), 788(aromatic CH)	1.71-7.26(31H,aromatic CH),10.5-10.25(3H,N-CH$_2$)4.75(2H,C=C)	464.20
RPK2	1764(C=O)712(C-S-C)1623(C=N)1077(C-O-C)3025(C-OH)	7.06-7.26 (19H,aromaticCH),2.35(18H,aromatic CH$_3$)5.0(2H,C=C)	550.28
RPK3	1752(C=O)710(C-S-C)1614(C=N)1065(C-O-C)2945,2828(C-H asym,sym),745(C-Cl)	7.06-7.26 (18H,aromaticCH),2.35(15H,aromatic CH$_3$)5.0(2H,C=C)	554.22
RPK4	3180(C-NH)1686(C=O),1630(C=N),1319(CH), 1173(C-F)	2.35(12H, aromatic CH$_3$), 6.94-7.35(16H,aromatic CH).	472.27
RPK5	1732(C=O)717(C-S-C)1613(C=N)1075(C-O-C)782(C-Br)	7.06-7.26 (17H,aromaticCH),2.35(18H,aromatic CH$_3$)5.0(3H,C=C)	613.19
RPK6	1758(C=O)753(C-S-C)1635(C=N)1056(C-O-C)760(C-Br)	7.06-7.26 CH$_3$ (16H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(4H,C=C)	644.21
RPK7	1762(C=O)710(C-S-C)1632(C=N)1056(C-O-C)765(C-Br) 752(C-Cl)	7.06-7.26 CH$_3$ (16H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(3H,C=C)	663.18
RPK8	1734(C=O)698(C-S-C)1618(C=N)1057(C-O-C)782(C-Br)1240(C-F)	7.06-7.26 CH$_3$ (16H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(3H,C=C)	646.20
RPK9	1756(C=O)732(C-S-C)1614(C=N)1075(C-O-C)798(C-Br)	7.06-7.26 CH$_3$ (18H,aromaticCH),2.35(18H,aromatic CH$_3$)5.0(2H,C=C)	613.19
RPK10	1752(C=O)723(C-S-C)1616(C=N)1056(C-O-C)3025(C OH)780(C-Br)	7.06-7.26 CH$_3$ (17H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(3H,C=C)	644.21
RPK11	1772(C=O)724(C-S-C)1640(C=N)1098(C-O-C)798(C-Br)752(C-Cl)	7.06-7.26 CH$_3$ (17H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	663.18
RPK12	1764(C=O)712(C-S-C)1623(C=N)1077(C-O-C)748(CBr)1228(C-F)	7.06-7.26 CH$_3$ (17H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	646.20

RPK13	1764(C=O)712(C-S-C)1623(C=N)1077(C-O-C)762(C-Cl)	7.06-7.26 CH$_3$ (18H,aromaticCH),2.35(18H,aromatic CH$_3$)5.0(2H,C=C)	569.24
RPK14	1764(C=O)712(C-S-C)1623(C=N)1077(C-O-C)3015(C OH)750(C-Cl)	7.06-7.26 CH$_3$ (18H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	600.26
RPK15	1764(C=O)712(C-S-C)1623(C=N)1077(C-O-C)758(C-Cl)	7.06-7.26 CH$_3$ (17H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	618.23
RPK16	1764(C=O)712(C-S-C)1623(C=N)1077(C-O-C)769(C Cl)1238(C-F)	7.06-7.26 CH$_3$ (17H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	602.25
RPK17	1760(C=O)702(C-S-C)1613(C=N)1065(C-O-C) 742(C-Cl)	7.06-7.26 CH$_3$ (17H,aromaticCH),2.35(18H,aromatic CH$_3$)5.0(2H,C=C)	569.24
RPK18	1743(C=O)724(C-S-C)1630(C=N)1067(C-O-C)3040(C-OH) 758(C-Cl)	7.06-7.26 CH$_3$ (18H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	600.26
RPK19	1773(C=O)732(C-S-C)1643(C=N)1058(C-O-C)780(C-Cl)	7.06-7.26 CH$_3$ (17H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	618.23
RPK20	1764(C=O)710(C-S-C)1630(C=N)1070(C-O-C)1235(C-F) 750(C-Cl)	7.06-7.26 CH$_3$ (17H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	602.25

TABLE III. ANTIMICROBIAL ACTIVITY OF SYNTHESIZED COMPOUNDS

Compound Code	Zone of Inhibition (mm)		
	S. aureus	P. aeroginosa	E. coli
RPK1	28	22	25
RPK2	26	32	23
RPK3	39	33	29
RPK4	23	25	21
RPK5	29	30	31
RPK6	27	26	28
RPK7	41	38	39
RPK8	31	35	29
RPK9	24	28	20
RPK10	32	29	25
RPK11	43	40	41
RPK12	38	32	40
RPK13	36	32	35
RPK14	32	35	29
RPK15	43	40	42
RPK16	39	35	32
RPK17	34	29	42
RPK18	32	39	40
RPK19	42	45	41
RPK20	36	42	37

IV. CONCLUSION

A novel series of twenty derivatives of thiadiazole fused with oxadiazole heterocyclic nucleus were synthesized and screened for antibacterial activity. The results showed that one compound was found to have potent antibacterial activity whereas other compounds were having good to moderate activity in comparison with standard drug.The information provided in this research work may be utilized further for development of better antibacterial agents for future.

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Microwave Assisted Synthesis of Indole Derivatives Substituted with Antibiotic Drugs and their Characterization

Amanpreet Kaur
Deptt. of Pharmaceutical
Chemistry
CT Institute of
Pharmaceutical Sciences,
Shahpur, Jalandhar
amanpsaini@gmail.com

Anil Kumar Sharma
CT Institute of
Pharmaceutical Sciences,
Shahpur, Jalandhar

Rajeev Kharb
Deptt. of Pharmaceutical
Chemistry
CT Institute of
Pharmaceutical Sciences,
Shahpur, Jalandhar

Anshul Chawla
Deptt. of Pharmaceutical
Chemistry
CT Institute of
Pharmaceutical Sciences,
Shahpur, Jalandhar

Abstract- **A** **microwave-assisted** **regioselective synthesis of a series of novel indole derivatives substituted with antibiotic drugs using an environmentally benign procedure. Structures of the products thus obtained were confirmed by their elemental analysis, IR, NMR and Mass spectral data.**
Keywords- indole; microwave; characterization.

I. INTRODUCTION

The indole nucleus is a versatile heterocyclic system, occurring in a variety of compounds with a broad spectrum of biological activities [1]. Firstly, Indole derivatives can be prepared by microwave methods [2]. Then antibiotics can be substituted to the novel indole derivatives. By microwave method, indole derivatives can synthesized in less time and yield will increase [3].

II. EXPERIMENTAL SECTION
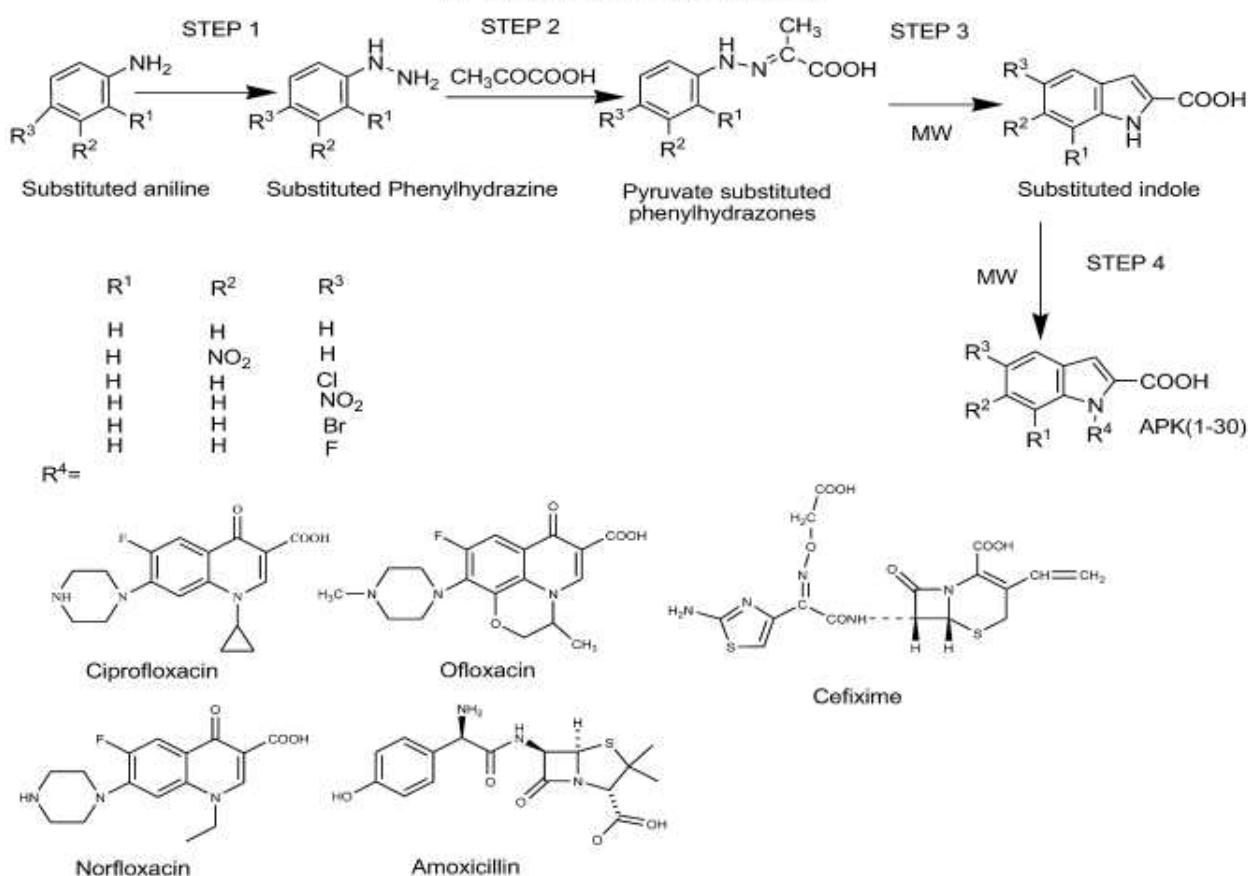
III. RESULT & DISCUSSION

TABLE I. PHYSICOCHEMICAL PROPERTIES OF SYNTHESIZED COMPOUNDS

S. No.	Compounds (code)	Mol. Wt. (gm/mole)	%age yield	Time (min)	M. P. (°C)	R_f value
1.	APK1	548.59	88	3	230	0.56
2.	APK2	519.54	76	2	226	0.62
3.	APK3	507.53	78	4	232	0.67
4.	APK4	553.61	80	2	230	0.57
5.	APK5	641.65	78	3	220	0.59
6.	APK6	582.19	83	3	226	0.61
7.	APK7	570.03	81	4	216	0.69
8.	APK8	541.98	79	4	218	0.74
9.	APK9	587.05	84	2	228	0.55
10.	APK10	676.1	76	2	212	0.68
11.	APK11	627.48	80	2	246	0.63
12.	APK12	614.48	75	4	238	0.53
13.	APK13	586.43	80	3	242	0.75
14.	APK14	632.5	81	2	236	0.64
15.	APK15	720.55	77	3	234	0.68
16.	APK16	566.58	79	2	238	0.69
17.	APK17	553.58	74	3	232	0.58
18.	APK18	525.52	73	2	240	0.73
19.	APK19	571.16	79	3	244	0.71
20.	APK20	659.54	80	3	234	0.61
21.	APK21	593.58	82	3	202	0.63
22.	APK22	580.58	80	4	196	0.57
23.	APK23	552.53	77	2	208	0.66
24.	APK24	598.6	75	2	204	0.57
25.	APK25	686.65	74	4	194	0.55
26.	APK26	593.58	80	3	190	0.73
27.	APK27	580.58	72	2	188	0.70
28.	APK28	552.53	78	2	196	0.64
29.	APK29	598.6	79	3	182	0.67
30.	APK30	686.65	78	2	186	0.56

A. Spectral characterization of synthesized compounds

1) APK1: IR(KBr)(cm^{-1}): 3418(CNH), 1690(C=O), 1282(C-N), 786(aromatic CH), 3256(OH), 1H NMR(DMSO-d$_6$, δ: 8.2(1H,NH),1.2-7.93(28H, aromatic CH),11.5 (1H,OH), 7.90(1H,H) Ms(M$^+$): 549.59

2) APK2: IR(KBr)(cm^{-1}): 3424(C-NH),1697(C=O),1266(C-N),778(aromatic CH),3245(OH) 1H NMR(DMSO-d$_6$, δ: 7.96(1H,H),1.23-7.96(25H, aromaticCH), 11.0 (2H,OH). Ms(M$^+$): 520.54

3) APK3: IR(KBr)(cm^{-1}): 3434(C-NH),1667(C=O),1245(C-N),778(aromatic CH),3290(OH). 1H NMR(DMSO-d$_6$, δ: 7.94(1H,H),1.20-7.91(25H, aromatic CH),11.0 (2H,OH). Ms(M$^+$): 508.53

4) APK4: IR(KBr)(cm^{-1}): 3445(CNH),1656(C=O),1254(C-N),734(aromatic CH),3243(OH). 1H NMR(DMSO-d$_6$, δ: 2.0-8.2(2H,NH),1.29-7.88 (23 H,aromaticCH),11.12(3H,OH), 7.92(1H,H). Ms(M$^+$): 553.61

5) APK5: IR(KBr)(cm^{-1}): 3445(CNH),1698(C=O),1281(C-N),778(aromatic CH),3299(OH). 1H NMR(DMSO-d$_6$, δ: 4.0-8.0(2H,NH),1.19 7.93(15H,aromatic CH),11.07 (3H,OH), 5.1-6.49(5H,H). Ms(M$^+$): 641.65

6) APK6: IR(KBr)(cm^{-1}): 3421(C-NH), 1694(C=O), 1232(C-N), 783(aromatic CH),651(C-Cl),3256(OH). 1H NMR(DMSO-d$_6$, δ: 8.0(1H,NH),1.4-7.97(27H, aromatic CH),11.3 (1H,OH), 7.93(1H,H). Ms(M$^+$): 583.19

7) APK7: IR(KBr)(cm^{-1}): 3478(C-NH),1687(C=O),1284(C-N), 767(aromatic CH),669(C-Cl),3222(OH). 1H NMR(DMSO-d$_6$, δ: 7.92(1H,H),1.20-7.92(28H, aromaticCH), 11.02(2H,OH). Ms(M$^+$): 571.03

8) APK8: IR(KBr)(cm^{-1}): 3478(C-NH),1654(C=O),1287(C-N), 737(aromatic CH),680(C-Cl),3212(OH). 1H NMR(DMSO-d$_6$, δ: 7.95(1H,H),1.29-7.95(24H, aromatic CH),11.05 (2H,OH). Ms(M$^+$): 542.98

9) APK9: IR(KBr)(cm^{-1}): 3489(C-NH),1667(C=O),1280(C-N),756(aromatic

CH),613(C-Cl),3278(OH). 1H NMR(DMSO-d$_6$, δ: 2.05-8.27(2H,NH),1.23-7.86(22H, aromaticCH),11.08 (3H,OH), 7.94(1H,H). Ms(M$^+$): 587.05

10) APK10: IR(KBr)(cm^{-1}): 3495(C-NH),1654(C=O),1268(C-N),754(aromatic CH),628(C-Cl),3226(OH). 1H NMR(DMSO-d$_6$, δ: 4.2-8.4(2H,NH),1.25-7.93(14H,aromatic CH),11.08 (3H,OH), 5.11-6.52(5H,H). Ms(M$^+$): 676.1

11) APK11: IR(KBr)(cm^{-1}): 3467(C-NH),1692(C=O),1235(C-N), 775(aromatic CH),787(C-Br), 3238(OH). 1H NMR(DMSO-d$_6$, δ: 8.06(1H,NH),1.48-7.91(27H, aromatic CH),11.37 (1H,OH), 7.90(1H,H). Ms(M$^+$): 628.48

12) APK12: IR(KBr)(cm^{-1}): 3421(C-NH),1694(C=O),1256(C-N), 783(aromatic CH),721(C-Br), 3275(OH). 1H NMR(DMSO-d$_6$, δ: 7.98(1H,H),1.27-7.93(28H, aromaticCH), 11.09 (2H,OH) Ms(M$^+$): 615.48

13) APK13: IR(KBr)(cm^{-1}): 3404(C-NH),1668(C=O),1224(C-N),767(aromatic CH),745(C-Br), 3232(OH). 1H NMR(DMSO-d$_6$, δ: 7.96(1H,H),1.23-7.97(24H, aromatic CH),11.03 (2H,OH). Ms(M$^+$): 587.00

14) APK14: IR(KBr)(cm^{-1}): 3497(C-NH),1663(C=O),1234(C-N), 721(aromatic CH),756(C-Br), 3284(OH). 1H NMR(DMSO-d$_6$, δ: 2.07-8.22(2H,NH),1.23-7.80(22H, aromaticCH),11.10 (3H,OH), 7.95(1H,H). Ms(M$^+$): 633.5

15) APK15: IR(KBr)(cm^{-1}): 3465(C-NH),1648(C=O),1267(C-N), 778(aromatic CH),786(C-Br), 3294(OH). 1H NMR(DMSO-d$_6$, δ: 4.0-8.1(2H,NH),1.19-7.95(14H, aromatic CH),11.09 (3H,OH), 5.11- 6.56 (5H,H). Ms(M$^+$): 721.55

16) APK16: IR(KBr)(cm^{-1}): 3456(C-NH),1692(C=O),1227(C-N), 704(aromatic CH),1373(C-Fl), 3229(OH). 1H NMR(DMSO-d$_6$, δ: 8.05(1H,NH),1.43-7.93(27H, aromatic CH),11.35 (1H,OH), 7.99(1H,H). Ms(M$^+$): 567.58

17) APK17 : IR(KBr)(cm^{-1}): 3487(C-NH),1645(C=O),1287(C-N), 712(aromatic CH),1309(C-Fl), 3203(OH). 1H NMR(DMSO-d$_6$, δ: 98(1H,H),1.20-7.91(28H, aromaticCH), 11.12 (2H,OH). Ms(M$^+$): 554.58

18) APK18 : IR(KBr)(cm^{-1}): 3467(C-NH),1697(C=O),1223(C-N), 737(aromatic CH),1395(C-Fl), 3263(OH). 1H NMR(DMSO-d$_6$, δ: 7.99(1H,H),1.22-7.95(24H, aromatic CH),11.17(2H,OH). Ms(M$^+$): 526.52

19) APK19 : IR(KBr)(cm^{-1}): 3487(C-NH),1655(C=O),1235(C-N), 705(aromatic CH),1335(C-Fl), 3223(OH). 1H NMR(DMSO-d$_6$, δ: 3487(C-NH),1655(C=O),1235(C-N), 705(aromatic CH),1335(C-Fl), 3223(OH). Ms(M$^+$): 572.16

20) APK20 : IR(KBr)(cm^{-1}): 3456(C-NH),1684(C=O),1293(C-N), 728(aromatic CH),1376(C-Fl), 3223(OH). 1H NMR(DMSO-d$_6$, δ: 4.2-8.2(2H,NH),1.24-7.89(14H, aromatic CH),11.16 (3H,OH), 5.14- 6.52(5H,H). Ms(M$^+$): 660.54

21) APK21 : IR(KBr)(cm^{-1}): 3378(C-NH),1732(C=O), 1256(C-N), 788(aromaticCH), 1376(C-NO$_2$), 3287(OH). 1H NMR(DMSO-d$_6$, δ: 8.15(1H,NH),1.45-7.91(27H, aromatic CH),11.32 (1H,OH), 7.97(1H,H). Ms(M$^+$): 594.58

22) APK22 : IR(KBr)(cm^{-1}): 3357(C-NH),1785(C=O), 1276(C-N), 745 (aromatic CH), 1336(C-NO$_2$), 3256(OH). 1H NMR(DMSO-d$_6$, δ: 7.91(1H,H),1.20-7.91(28H, aromatic CH), 11.08 (2H,OH). Ms(M$^+$): 581.58

23) APK23 : IR(KBr)(cm^{-1}): 3310(C-NH),1703 (C=O), 1211(C-N), 784 (aromatic CH), 1387(C-NO$_2$), 3247(OH). 1H NMR(DMSO-d$_6$, δ: 7.94(1H,H),1.17-7.84(24H, aromatic CH),11.32 (2H,OH). Ms(M$^+$): 553.53

24) APK24 : IR(KBr)(cm^{-1}): 3398(C-NH),1743 (C=O), 1287(C-N), 745 (aromatic CH), 1381(C-NO$_2$), 3291(OH). 1H NMR(DMSO-d$_6$, δ: 2.14-8.23(2H,NH),1.34-7.82(22H, aromatic CH),11.16(3H,OH),7.90(1H,H). Ms(M$^+$): 598.6

25) APK25 : IR(KBr)(cm^{-1}): 3362(C-NH),1786(C=O), 1231(C-N), 793 (aromatic CH), 1367(C-NO$_2$), 3203(OH). 1H NMR(DMSO-d$_6$, δ: 4.2-8.3(2H,NH),1.21-7.98(14H, aromatic CH), 11.17 (3H,OH), 5.10-6.50(5H,H). Ms(M$^+$): 686.65

26) APK26 : IR(KBr)(cm^{-1}): 3367(CNH),1787(C=O),1654(C-N),732 (aromatic CH), 1335(C-NO$_2$), 3205(OH). 1H NMR(DMSO-d$_6$, δ: 8.18(1H,NH),1.43-7.90(27H, aromatic CH),11.34 (1H,OH), 7.90(1H,H). Ms(M$^+$): 593.58

27) APK27 : IR(KBr)(cm^{-1}): 3376(CNH),1784(C=O),1634(C-N),703 (aromatic CH), 1331(C-NO$_2$), 3276(OH). 1H NMR(DMSO-d$_6$, δ: 7.80(1H,H),1.20-7.91(28H, aromatic CH), 11.21 (2H,OH). Ms(M$^+$): 581.58

28) APK28 : IR(KBr)(cm^{-1}): 3323(CNH),1745(C=O),1682(C-N),729 (aromatic CH), 1320(C-NO$_2$), 3239(OH). 1H NMR(DMSO-d$_6$, δ: 7.98(1H,H),1.27-7.94(24H, aromatic CH),11.04 (2H,OH). Ms(M$^+$): 553.53

29) APK29 : IR(KBr)(cm^{-1}): 3367(CNH),1793(C=O),1605(C-N),795 (aromatic CH), 1367(C-NO$_2$), 3291(OH). 1H NMR(DMSO-d$_6$, δ: 2.14-8.24(2H,NH),1.32-7.86(22H, aromaticCH),11.18 (3H,OH), 7.98(1H,H). Ms(M$^+$): 598.6

30) APK30 : IR(KBr)(cm^{-1}): 3321(CNH),1773(C=O),1686(C-N),743 (aromatic CH), 1373(C-NO$_2$), 3297(OH). 1H NMR(DMSO-d$_6$, δ: 4.2-8.1(2H,NH),1.19-7.99(14H, aromatic CH),11.12 (3H,OH), 5.11-6.52(5H,H). Ms (M$^+$): 686.65

IV. CONCLUSION

The microwave-assisted process, in contrast to conventional heating, gives the desired compounds in higher overall yield with shorter reaction times and products that are more easily purified. The specific non thermal microwave effects are attributed to enhancements in microwave-materials interaction due to polarity increase during the reaction. This work confirms that reaction mixtures exposed to microwaves allow an easy and rapid access to original heterocyclic indole.

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A Valuable Insight in Phytochemistry and Pharmacological Studies of Syzygium Cumini Linn

Anshul Chawla
Department of Pharmaceutical
Chemistry
CTIPS
Jalandhar, Punjab, India
anshul_chawla123@yahoo.com

Sanjana Piplani
Department of
Pharmacognosy
CTIPS
Jalandhar, Punjab, India

Sharuti Mehta
Department of
Pharmacognosy
CTIPS
Jalandhar, Punjab, India

Jasdeep Kaur
Department of
Pharmaceutical Chemistry
CTIPS
Jalandhar, Punjab, India

Abstract- Syzygium cumini Linn (syn. Eugenia Jambolana) is a multipurpose large, evergreen native tree species belongs to the Myrtaceae family. The present review has been primed to describe the existing data on the information on Phytochemistry, pharmacognosy and pharmacological uses of Syzygium cumini Linn. (Jambolan).

Keywords- Jamun, Syzygium cumini, Eugenia jambolana (EJ) and Phytochemistry.

I. INTRODUCTION

In recent era of globalization, medicinal plants have attracted global interest. The scientific name of jamun is Eugenia jambolana (EJ) or Syzygium cumini Linn and it belongs to myrtaceae family. Other common names for jamun are Java plum, black plum, jambul, Indian blackberry, doowet, faux pistachier etc. [1-2] The fruits of Syzygium cumini are oval to elliptical, 1.5–3.5 cm long, dark purple or nearly black, luscious, fleshy and edible.[3] The genus syzygium consists of about 85 species .Some of the Species of Syzygium are[4] S. ampliflorum, S. amplifolium, S. andamanicum, S. anisatum, S. aqueum , S. australe , S. aromaticum , S. beddomei, S. benthamianum, S. bourdillonii, S. caryophyllatum , S. chavaran, S. cordatum , S. cormiflorum, S. corynanthum , S. corynocarpa , S. courtallense, S. crebrinerve , S. cumini. In english-black plum, black plum tree, Indian blackberry, jambolan, hindi-duhat, jamun. [5]
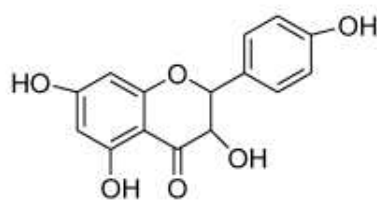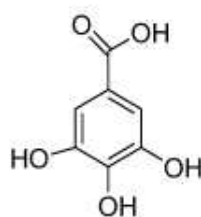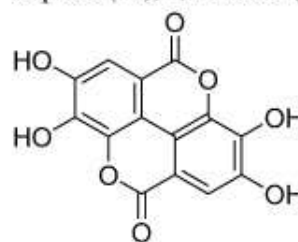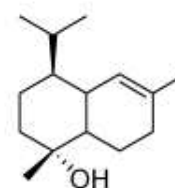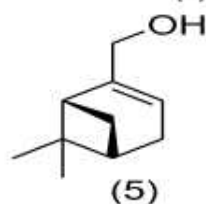
II. TAXONOMICAL CLASSIFICATION

Taxonomically it is classified as, Kingdom- Plantae; Subkingdom- Tracheobionta; Superdivision- Spermatophyta; Division- Magnoliophyta; Class- Magnoliopsida; Subclass- Rosidae; Order- Myrtales; Family- Myrtaceae; Genus- Syzygium; Species- Cumini. [6] It is a large tree found in all forests over the greater part of India from the sub-Himalayan tract to extreme south. [7]

III. PHYTOCONSTITUENTS REPORTED

Jamun extract contains variety of phytoconstituents viz. kaemferol (1), gallic acid (2), ellagic acid (3), α –cadinol (4), myrtenol (5) quercetin (6), lupeol (7), citric acid (8), malic acid (9), muurolol (10), pinacarvone (11), myricetin (12), petunidin (13), anthocyanins (14), eucarvone (15), α-terpenol (16), 1,8-cineole (17), delphidin (18) . [8-10]

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(5)
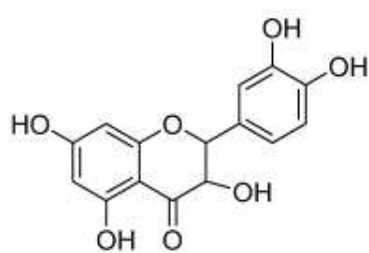
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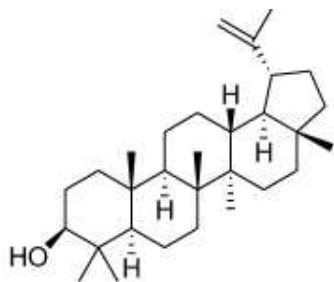
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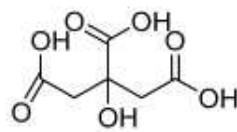
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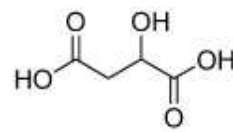
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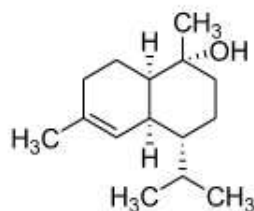
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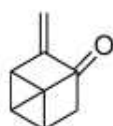
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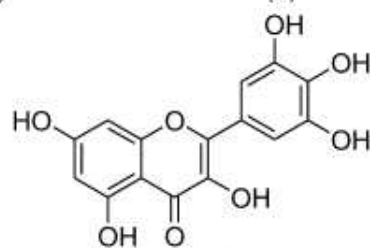
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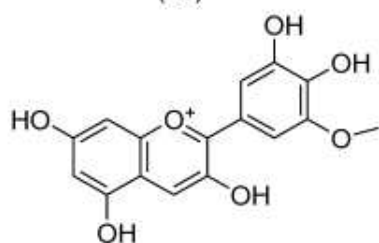
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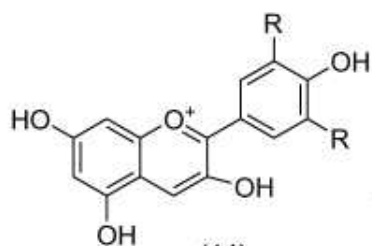
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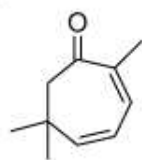
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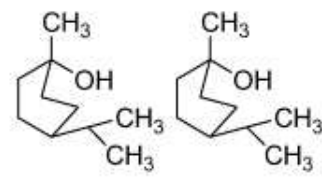
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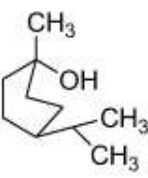
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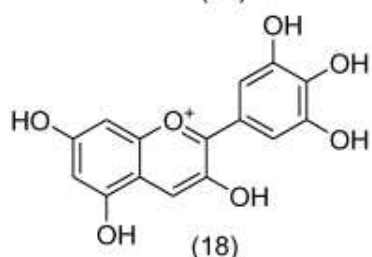
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Spectroscopic Data of Some Important Compounds
Friedlein (4R,4aS,6aS,6bR,8aR,12aR,12bS,14aS,14bS)-4,4a,6b,8a,11,11,12b,14a-octamethyl-docosahydropicen-3-one)

M.P-258-260 °C, **EIMS** m/z (% intensity): 426 ([M]$^+$ **IR** (KBr disc): cm^{-1} 3432, 2930, 2870, 1716, 1460, 1388, 1188, 1110, 1074. **^{1}HNMR** (600 MHz, CDCl$_3$): δ 0.65 (s, 3H, H-24), 0.80 (s, 3H, H-25), 0.81 (d, 3H, H-23), 0.88 (s, 3H, H-30), 0.90 (m, 1H, (H-22b), 0.93 (s, 3H, H-29), 0.94

(s, 3H, H-26), 0.98 (s, 3H, H-27), 1.11 (s, 3H, H-28), 1.14 (m, H-19b), 1.19 (m, 1H, H-11b), 1.31 (dd, 1H, H-19a), 1.21 (m, H-6b), 1.24 (m, H-12b), 1.27 (m, H-15b), 1.35 [11]

Betulinic acid ((3β)-3-Hydroxy-lup-20(29)-en-28-oic acid)

M.P-295-298°C **^{1}HNMR** (C$_5$ D$_5$ N, 600 MHz, δ (TMS)= 0 ppm: 0.65 (CH$_3$-18, s), 0.85 and 0.87 (CH$_3$-26, CH$_3$-27, d,3 J = 6.6), 0.88 (CH$_3$-29, t, 31 =3 = 7.2), 0.92 (CH$_3$-19, s), 0.98 (CH$_3$-21, d, 3J = 6.6), 2.47 and 2.73 (2H-4, m),

3.95 (H-3,m), 3.99 (H-5, m), 4.07 (H-2, t, 3J 1 = 3J2 = 7.8), 4.29-4.31 (H-3 and H-4, m), 4.42 (H-6a dd, J = 12, 3J = 4.8), 4.57 (H-6b, dd, 2J = 12, 3J = 1.2), 5.06 (H-1 d, 3J = 7.8), 5.34 (H-6, m). [11]

Muurolol (4-Isopropyl-1,6-dimethyl-1,2,3,4,4a,7,8,8a-octahydro-1-naphthalenol)

Colorless crystal, **M.P**- 80-81°C, (**EIMS**: 222), **^{1}HNMR** (in CDCl$_3$): d (ppm) 0.80 (d, J=7.0, H-12), 0.86 (d, J=7.0, H-13), 1.17 (s, H-14), 1.62 (s, H-15), 2.24 (m, H-11) 5.53(d, J=7.0, H-4). [12]

α- Cadinol (10α-hydroxy-4-cadinene)

Colorless needle crystal, **M.P**-.74-75 °C, **^{1}HNMR** (in CDCl$_3$): d (ppm) 0.74 (d, J=7.0, H-12), 0.89 (d, J=7.0, H-13), 1.08 (s, H-14), 1.64 (s, H-15), 2.13 (m, H-11) 5.47 (s, H-14). [12]

Ursolic acid (3-beta-3-hydroxy-urs-12-ene-28-oic-acid)

Amorphous white powder, **M.P-** 283-285°C, **[α] D** 25$^+$78.2(c1.0, Me OH); **FABMS** m/z 641 [M $^+$Na] $^+$ **IR vmax** (KBr) 3419, 2925, 1687 cm^{-1}; **^{1}HNMR** (1H, dd, J= 6.0, 10.0 Hz, H-3), 5.52 (1H, br s, H-12), 2.68 (1H, d, J= 11.0 Hz, H-18), 1.27 (3H, s, H-23), 0.91 (3H, s, H-24), 1.08 (3H, s, H-25), 1.05 (3H, s, H-26), 1.25 (3H, s,H-27), 1.03 (3H, d, J= 6.0 Hz, H-29), 0.98 (3H, d, J= 6.0 Hz,H-30). [12]

IV. ETHNOMEDICINAL USES

It is used for enlarged spleen, chronic diarrhea and urine retention. Water diluted juice is used as a gargle for sore throat and as a lotion for ringworm of the scalp. The extract of jamun seed lowers blood pressure more than 30% and this action is attributed to the ellagic acid content of the extract. Jamun fruit is used for the prevention of stomachache, astringent, dieresis and diabetes. It is also dried with salt and preserved as a digestive powder or churan. The juice is carminative, diuretic and gives a soothing effect on human digestive system. [13]

V. PHARMACOLOGICAL ACTIVITY

Anti-diabetic activity, anti-inflammatory activity, anti-oxidant activity, anti-ulcer activity, anti-hyperglycemic activity, larvicidal activity, hepatoprotective activity, anti-bacterial activity, anti-allergic activity, chemo preventive activity, anti-diarrheal activity. [13-15]

VI. DOSE

Ayurvedic reports suggested that 1 - 3 g of seed powder per day is an average dose 44 additionally, Juice of ripe fruits in the amount of 0.5 - 2 tsp at least three times daily have been recommended for the treatment of diabetes. The decreased body weight in diabetic rats is due to excessive breakdown of tissue proteins. [16]

VII. CONCLUSION

Syzygium cumini Linn also having various pharmacological activity such as anti-diarrheal, astringent, digestive, antibacterial, antioxidant, antiviral but most important activity is anti-diabetic. Most pharmacological works on diabetes were carried out with seeds but the pharmacological potential of the other parts of the plant is required to explore in detail.

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Synthesis, Structural Characterization and Pharmacological Investigation of Novel Furan Substituted Coumarin Derivatives

Sweety Birla
Dept. of Pharmaceutical Chemistry
CTIPS
Jalandhar, Punjab, India
sweetybirla123@gmail.com

Anil Kumar Sharma
Dept. of Pharmacognosy
CTIPS
Jalandhar, Punjab, India

Anshul Chawla
Dept. of Pharmaceutical Chemistry
CTIPS
Jalandhar, Punjab, India

Rajeev Kharb
Dept. of Pharmaceutical Chemistry
CTIPS,
Jalandhar, Punjab, India

Abstract- A novel series of furan and coumarin derivatives was synthesized. The structures of synthesized compounds were confirmed by elemental analysis, IR, NMR and Mass analytical data. The titled compounds were screened for antibacterial activity. Some of the synthesized compounds may show potent activity in comparison to standard drug.

Keywords- Coumarin, furan, antibacterial activity.

I. INTRODUCTION

Recent most literature show that furan and coumarin derivatives have broad spectrum of biological activities especially antibacterial and antifungal activities [1, 2]. In view of these facts and as a continuation of our research work, it was significant to synthesize some novel furan substituted coumarin derivatives and to screen them for their in-vitro antibacterial activity [3].

II. EXPERIMENTAL SECTION
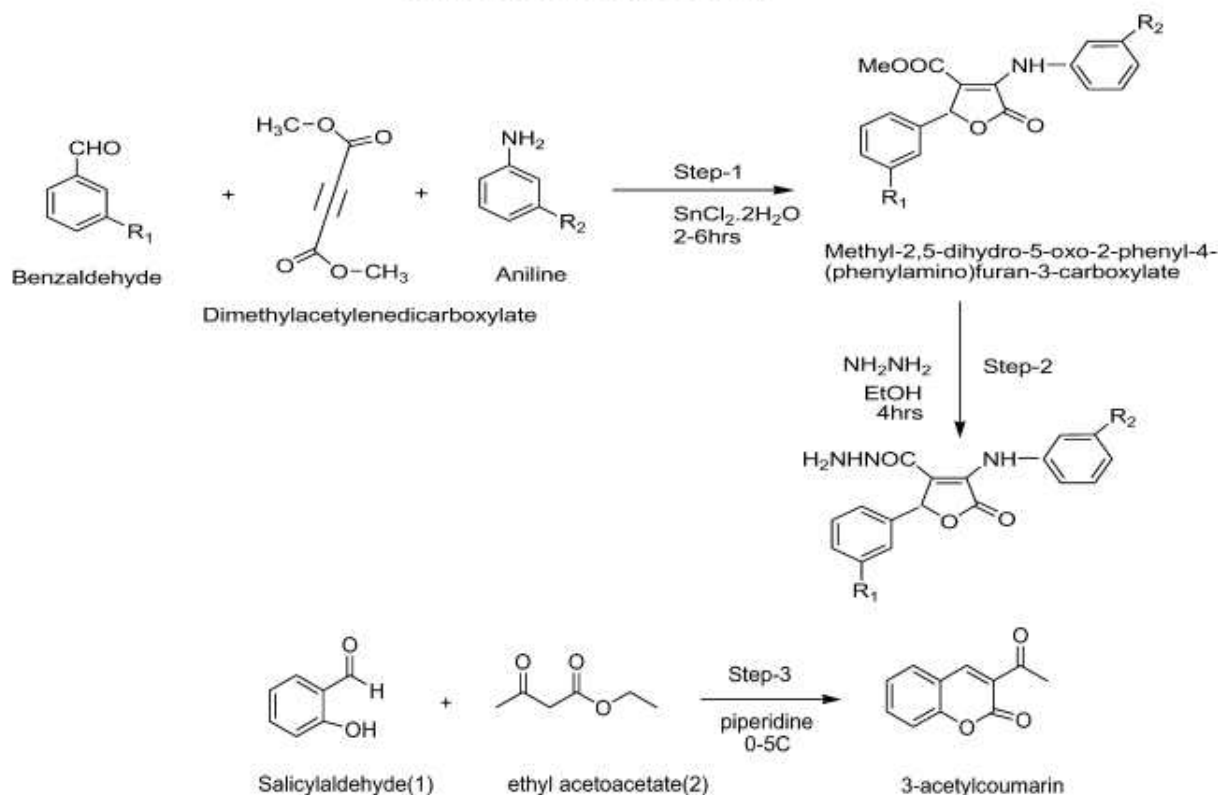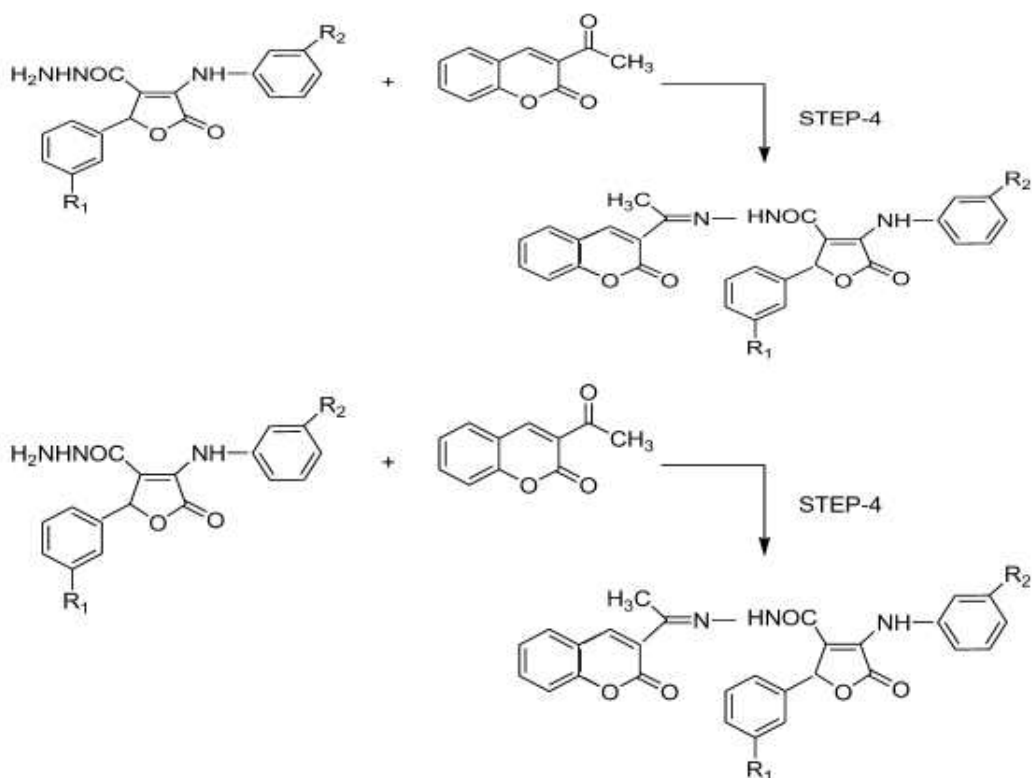
The synthesized compounds were evaluated for their in-vitro antibacterial activity against pathogenic bacteria by paper disc diffusion method to determine zone of inhibition (mm) values [4].

III. RESULT AND DISCUSSION

Table I Physicochemical properties of synthesized compounds

S.No.	Compound code	R_1	R_2	Molecular formula	M.W.(gm/mo le)	% Yield	M.P. (^oC)	Rf Value
1.	SB1	Br	Br	$C_{25}H_{14}BrO_6$	314.22	72	180^{0}C	0.56
2.	SB2	F	Br	$C_{25}H_{12}FO_6$	224.21	59	184 ^oC	0.49
3.	SB3	3,4,5 OCH$_3$	Br	$C_{27}H_{13}BrO_7$	316.22	78	189°C	0.37
4.	SB4	Cl	Br	$C_{25}H_{14}ClO_8$	214.21	58	190^{0}C	0.75
5.	SB5	OH	Br	$C_{25}H_{14}BrO_7$	225.22	65	189°C	0.69
6.	SB6	Br	F	$C_{25}H_{14}FO_7$	345.20	77	191°C	0.70
7.	SB7	F	F	$C_{25}H_{14}FO_6$	220.23	82	182^{0}C	0.72
8.	SB8	3,4,5 OCH$_3$	F	CHO	214.22	658	175°C2	0.65
9.	SB9	Cl	F	CHO	225.23	80	184^{0}C	0.70
10.	SB10	OH	F	CHO	214.23	75	182^{0}C	0.45
11.	SB11	Br	m-NO$_2$	CHO	244.34	88	174^{0}C	0.65
12.	SB12	F	m-NO$_2$	CHO	340.34	75	176^{0}C	0.70
13.	SB13	3,4,5 OCH$_3$	m-NO$_2$	CHO	350.69	85	173^{0}C	0.59
14.	SB14	Cl	m-NO$_2$	CHO	214.34	69	174^{0}C	0.65
15.	SB15	OH	m-NO$_2$	CHO	220.32	72	170^{0}C	0.70
16.	SB16	Br	p-Cl	CHO	226.45	78	170^{0}C	0.75
17.	SB17	F	p-Cl	CHO	340.23	80	178^{0}C	0.69
18.	SB18	3,4,5 OCH$_3$	p-Cl	CHO	240.32	73	180^{0}C	0.70
19.	SB19	Cl	p-Cl	CHO	217.34	80	182^{0}C	0.75
20.	SB20	OH	p-Cl	CHO	214.65	65	187^{0}C	0.65
21.	SB21	Br	p-NO$_2$	CHO	215.09	69	190^{0}C	0.70
22.	SB22	F	p-NO$_2$	CHO	210.65	78	189^{0}C	0.50
23.	SB23	3,4,5 OCH$_3$	p-NO$_2$	CHO	340.89	81	191^{0}C	0.45
24.	SB24	Cl	p-NO$_2$	CHO	220.67	73	180^{0}C	0.75
25.	SB25	OH	p-NO$_2$	CHO	236.78	65	183^{0}C	0.85

Table II. Spectral characterization of synthesized compounds

S. No.	Compound Code	FT-IR (KBr ,cm-1)	1H NMR(DMSO-d$_6$, ppm)	Mass(m/z)[M$^+$]
1.	SB1	3416(CH),1675(C=O),785(Aromatic C-H)	1.72-7.36(31H,aromatic CH),10.6-10.27(3H,N CH$_2$)4.76(2H,C=C)	464.20
2.	SB2	3324(C-NH),1684(C=O),673(Aromatic C-H)	7.06-7.26 (19H,aromaticCH),2.35(18H,aromatic CH$_3$)5.0(2H,C=C)	550.28
3.	SB3	3200(C-NH),1697(C=O),1697(CO),1316(CH)	7.06-7.26 (18H,aromaticCH),2.35(15H,aromatic CH$_3$)5.0(2H,C=C)	554.22
4.	SB4	3422(C-NH),1697(C=O),788(aromatic CH)	2.35(12H, aromatic CH$_3$), 6.94-7.35(16H,aromatic CH).	472.27
5.	SB5	3400(NH),1685(C=O),1615(C=N)	7.06-7.26 (17H,aromaticCH),2.35(18H,aromatic CH$_3$)5.0(3H,C=C)	644.21
6.	SB6	3374(C-NH),1697(C=O),785(aromatic CH)	7.06-7.26 CH$_3$(16H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(4H,C=C)	473.28
7.	SB7	1687(C=O),1317(CH)1632(C=N)	7.06-7.26 CH$_3$(16H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(3H,C=C)	532.16
8.	SB8	3310(C-NH),1684(C=O),1610(C=N), 788(aromatic CH)	7.06-7.26 CH$_3$(18H,aromaticCH),2.35(18H,aromatic CH$_3$)5.0(2H,C=C)	472.27
9.	SB9	1764(C=O)712(C-S-C)1623(C=N)1077(C-O-C)3025(C-OH)	7.06-7.26 CH$_3$(17H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(3H,C=C)	613.19
10.	SB10	1752(C=O)710(C-S-C)1614(C=N)1065(C-O-C)2945,2828(C-H asym,sym),745(C-Cl)	7.06-7.26 CH$_3$(17H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	644.21
11.	SB11	3180(C-NH)1686(C=O),1630(C=N),1319(CH),1173(C-F)	7.06-7.26 CH$_3$(17H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	663.18
12.	SB12	1732(C=O)717(C-C)1613(C=N)1075(C-O-C)782(C-Br)	7.06-7.26 CH$_3$(18H,aromaticCH),2.35(18H,aromatic CH$_3$)5.0(2H,C=C)	646.20
13.	SB13	1758(C=O)753(C-C)1635(C=N)1056(C-O-C)760(C-Br)	7.06-7.26 CH$_3$(18H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	613.19
14.	SB14	1762(C=O)710(C-C)1632(C=N)1056(C-O-C)765(C-Br) 752(C-Cl)	7.06-7.26 CH$_3$(17H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	644.21
15.	SB15	1734(C=O)698(C-C)1618(C=N)1057(C-O-C)782(C-Br)1240(C-F)	7.06-7.26 CH$_3$(17H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	663.18
16.	SB16	1756(C=O)732(C-C)1614(C=N)1075(C-O-C)798(C-Br)	7.06-7.26 CH$_3$(17H,aromaticCH),2.35(18H,aromatic CH$_3$)5.0(2H,C=C)	646.20
17.	SB17	1752(C=O)723(C-C)1616(C=N)1056(C-O-C)3025(COH)780(C-Br)	7.06-7.26 CH$_3$(18H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	569.24
18.	SB18	1772(C=O)724(C-C)1640(C=N)1098(C-O-C)798(C-Br)752(C-Cl)	7.06-7.26 CH$_3$(17H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	600.26
19	SB19	1764(C=O)712(C-C)1623(C=N)1077(C-O-C)748(C-Br)1228(C-F)	7.06-7.26 CH$_3$(17H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	618.23
20	SB20	1764(C=O)712(C-C)1623(C=N)1077(C-O-C)762(C-Cl)	7.06-7.26 CH$_3$(17H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	602.25
21.	SB21	1764(C=O)712(C-C)1623(C=N)1077(C-O-C)3015(COH)750(C-Cl)	7.06-7.26 CH$_3$(17H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	569.24
22.	SB22	1764(C=O)712(C-C)1623(C=N)1077(C-O-C)758(C-Cl)	7.06-7.26 CH$_3$(17H,aromaticCH),2.35(18H,aromatic CH$_3$)5.0(2H,C=C)	600.26
23.	SB23	1764(C=O)712(C-C)1623(C=N)1077(C-O-C)769(C-Cl)1238(C-F)	7.06-7.26 CH$_3$(18H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	618.23
24.	SB24	1760(C=O)702(C-C)1613(C=N)1065(C-O-C) 742(C-Cl)	7.06-7.26 CH$_3$(17H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	602.25
25.	SB25	1743(C=O)724(C-S-C)1630(C=N)1067(C-O-C)3040(C-OH) 758(C-Cl)	7.06-7.26CH$_3$ (17H,aromaticCH),2.35(21H,aromatic CH$_3$)5.0(2H,C=C)	603.45

Table III. Antibacterial data of synthesized compounds (sb1-sb25)

Compound Code	Zone of Inhibition (mm)		
	S. aureus	P. aeroginosa	E. coli
SB1	28	23	25
SB2	21	34	24
SB3	31	34	23
SB4	28	24	30
SB5	21	25	29
SB6	27	24	26
SB7	30	25	23

SB8	28	25	24
SB9	24	31	25
SB10	27	25	29
SB11	31	27	26
SB12	26	30	24
SB13	23	28	25
SB14	24	24	20
SB15	30	29	28
SB16	26	21	27
SB17	24	30	25
SB18	21	27	28
SB19	25	29	31
SB20	28	21	24
SB21	24	31	28
SB22	21	30	22
SB23	23	23	21
SB24	26	24	32
SB25	29	28	22

IV. CONCLUSION

A novel series of twenty five furan substituted coumarin derivatives was synthesized and screened for antibacterial activity. The results showed that one compound showed most potent antibacterial activity whereas other compounds exhibited mild to moderate activity as compared with standard drug. The biological profile of synthesized compounds showed synergestic effect on antibacterial activity therefore this concept may be utilized for drug design and development of better antimicrobial agents.

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Docking Studies on Leishmanial Trypanothione Reductase

M. Rama
Department of Chemistry,
Manipal Institute of
Technology, Manipal.
E-mail id:
ramarams5@gmail.com

N.V. Anil Kumar
Department of
Chemistry,
Manipal Institute of
Technology, Manipal.

S. Balaji
Department of Chemistry,
Manipal Institute of
Technology, Manipal.

Abstract-Leishmaniasis is one among 17 Neglected Tropical Diseases (NTDs) caused by different leishmanial species. Trypanothione reductase is a unique enzyme in trypanosomatid parasites which play an important role in trypanothione biosynthesis. Hence, it is one of the experimentally validated targets for leishmaniasis. This paper describes the inhibition of leishmanial trypanothione reductase by randomly selected ligands from PDB. Here, the interaction between the ligand and the target were analyzed using Surflex dock module of Sybyl software 7.3 version. Highly interacted ligands were selected and reported based on interaction score and its number of hydrogen bonds between the active site of the target and the ligands. The interactions of these ligands were compared with already available trypanothione reductase ligands in PDB. This comparative study may help in designing the potent inhibitors for leishmanisis.

Keywords—Leishmaniasis, tropical disease, trypanothione reductase, inhibitors, docking.

I. INTRODUCTION

Neglected tropical diseases are a group of infections which cause misery and disability in very poor populations [1]. Leishmaniasis is one among 17 NTDs caused by Leishmania spp. As per the WHO report, it is one of the serious public health problem affecting more than 350 billion people worldwide [2].Trypanothione reductase is one the major enzyme in Trypanothione pathway. Even though leishmanial drugs are available in the market, it is not so efficient. Most of the leishmanial drugs are antimonials. There are some limitations in available drugs such as parasitic resistance, nephrotoxicity, short clinical usage [3]. Hence, there is a need to design some drugs with more efficiency.

Virtual screening of compounds and docking with the target is one of the best methods to find the lead molecules for target diseases.

II. MATERIALS AND METHODS

Protein structure of Leishmanial Trypanothione reductase was retrieved from PDB [4] (PDB ID: 2jk6 [5]). This is a homodimer structure with sulphate ion and FAD. The protein preparation was done and protomol was generated based on template ligand for docking using Sybyl 7.3 [6]. From PDB, various ligands with structures of Trypanothione reductase were taken. Those ligands are Bis(Gamma-Glutamyl-Cysteinyl-Glycinyl)Spermidine (GCG), Flavin adenine dinucleotide (FAD), 4-[[1-(4-ethylphenyl)-2-methyl-5-(4-methylsulfanylphenyl)pyrrol-3-yl]methyl]thiomorpholine (JVO), NADPH Dihydro-Nicotinamide-Adenine-Dinucleotide Phosphate (NDP), 3,4,5-Triacetyloxy-6-(Acetyloxymethyl) Oxane-2-Thiol (TS8) and it was considered as template ligands. Ligands were randomly selected from PDB as a test set for docking process. The selected 190 ligands from PDB were subjected to interaction studies after preparing the ligands. Docking of the target was performed using Surflex module of Sybyl and the results were analysed. Total score of interaction, generated for best conformation of each molecule was taken as a docking score. Based on the number of hydrogen bonds and docking score, best interacted molecules were reported.

III. RESULTS AND DISCUSSION

The structure of Trypanothione reductase (2jk6) from Leishmania infantum was docked with both the template (5) and test (190) ligands obtained from PDB. Based on the number of hydrogen bonds and interaction score between the target and ligand, template and best interacted test molecules were analysed and reported (Table 1 and 2). They are, Nicotinamide adenine dinucleotide (NAD), Ubiquinone 10 (U10), 3 aminopyridine adenine dinucleotide phosphate (M3AA), 2-deoxyadenosine 5-triphosphate (DTP). The best interacted molecule FDA with 2JK6 (Fig 1) showed 15.65 dock score with 11 hydrogen bonds. Comparatively, test compounds showed better interaction than the template ligands.

TABLE I. INTERACTION OF TEMPLATE LIGANDS WITH 2JK6

S.No.	Molecule name	Hydrogen bonds	Docking Score
1	FAD	16	13.96
2	GCG	13	14.42
3	JVO	-	8.37
4	NDP	13	12.29
5	TS8	2	3.80

TABLE II. BEST INTERACTION OF TEST SET LIGANDS WITH 2JK6

S.No.	Molecule name	Hydrogen bonds	Docking Score
1	NAD	11	15.65
2	U10	-	12.86
3	M3AA	14	12.56
4	DTP	11	12.21
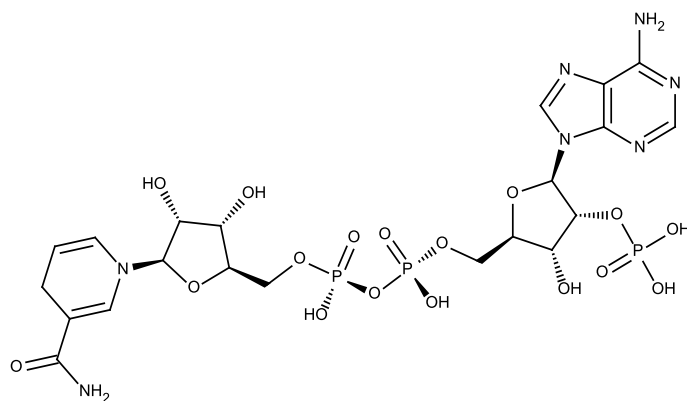
d.NDP
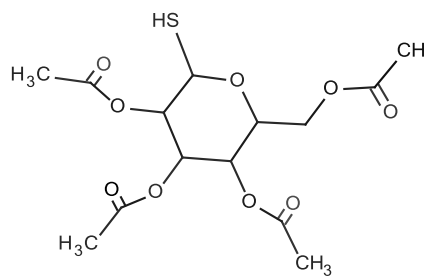
e.TS8

FIGURE I. STRUCTURE OF TEMPLATE LIGANDS

a.FAD

b.GCG

c.JVO

a.NAD

b.U1O

c.3AA

d.DTP
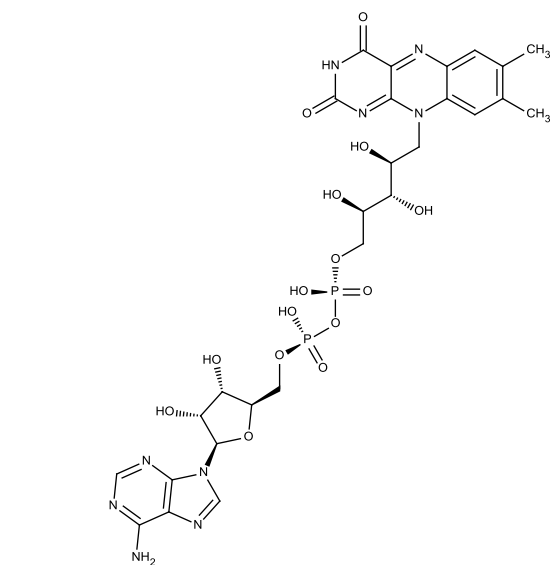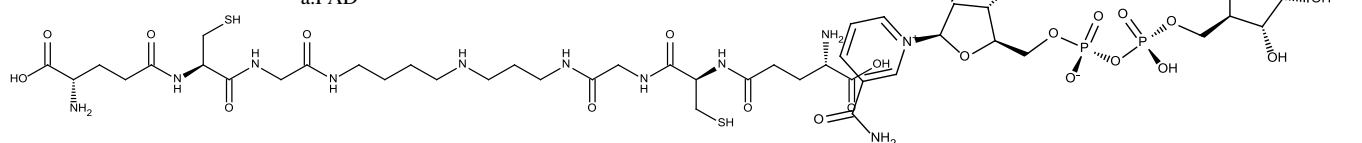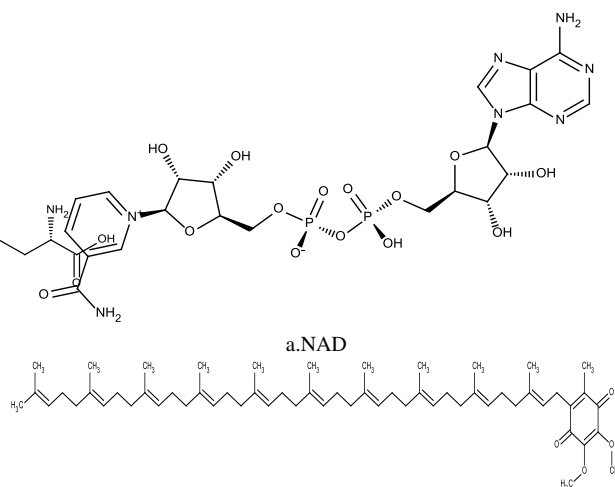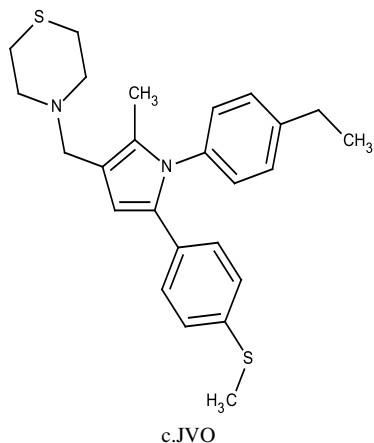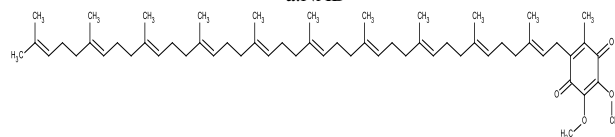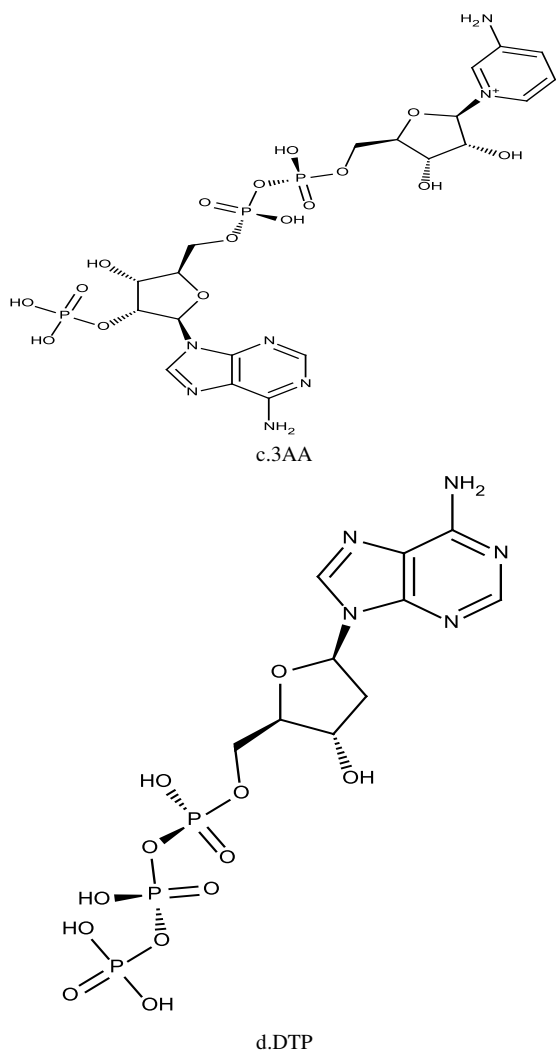
FIGURE II. STRUCTURE OF BEST TEST LIGANDS

IV. CONCLUSION

Some of the molecules collected from PDB showed good interaction. These molecules will pave the way for designing new compounds for anti-leishmanial activity.

V. ACKNOWLEDGMENT

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Synthesis and Characterization of Isatin Derivatives Substituted with Different Heterocyclic Nucleus

Amandeep Kaur
Dept. of Pharmaceutical
Chemistry
CT Institute of
Pharmaceutical Sciences,
Jalandhar, India
aamnasaini826@gmail.com

Rajeev Kharb
Dept. of Pharmaceutical
Chemistry
CT Institute of
Pharmaceutical Sciences,
Jalandhar, India

Anshul Chawla
Dept. of Pharmaceutical
Chemistry
CT Institute of
Pharmaceutical Sciences,
Jalandhar, India

Anil Kumar Sharma
Dept. of Pharmaceutical
Chemistry
CT Institute of
Pharmaceutical Sciences,
Jalandhar, India

Abstract- A novel series of N-substituted isatin derivatives with different heterocylic nucleus were synthesized to meet the novel structural requirements essential for different pharmacological activities. The final structures of synthesized compounds were confirmed by IR, NMR, mass spectral.

Keyword- Isatin; Heterocyclic compounds; Characterization.

I. INTRODUCTION

It is evident from literature that isatin derivatives are known to be associated with broad spectrum of biological activity like antibacterial,anti-inflammatory, analgesic, anti-viral,antifungal, anti-tubercular, anticonvulsant activity [1-4]. In view of these facts and as a continuation of our work in the laboratory, prompted us to synthesize some novel isatin derivatives substituted with different heterocyclic compounds & were screened for their in vitro anti-bacterial activity.

II. EXPERIMENTAL SECTION

Step I.
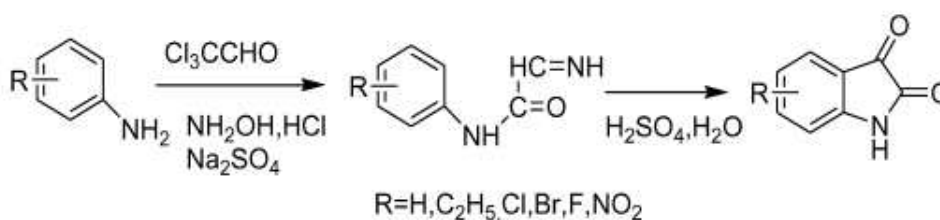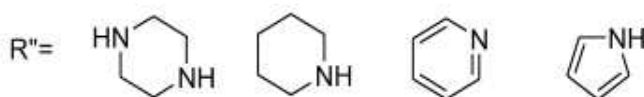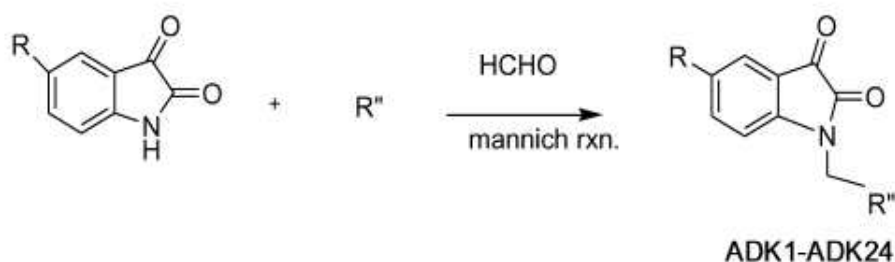
R=H,C₂H₅,Cl,Br,F,NO₂

Step II.

Step III.

ADK1-ADK24

III. RESULT & DISCUSSION

TABLE I. PHYSICOCHEMICAL PROPERTIES OF SYNTHESIZED COMPOUNDS

Sr. No.	Compound code	M.P. (°C)	Molecular formula	M.W. (gm/mole)	Yield (%)	Rf value
1.	ADK1	198	$C_{14}H_{19}N_3O_2$	261.32	75.62	0.55
2.	ADK2	194	$C_{16}H_{23}N_3O_2$	289.37	78.45	0.48
3.	ADK3	186	$C_{14}H_{18}N_3O_2Cl$	295.76	70.65	0.67
4.	ADK4	190	$C_{14}H_{18}N_3O_2Br$	340.22	68.24	0.70
5.	ADK5	192	$C_{14}H_{18}N_3O_2F$	279.31	67.72	0.72
6.	ADK6	184	$C_{14}H_{18}N_2O_4$	306.32	69.69	0.39
7.	ADK7	202	$C_{15}H_{20}N_2O_2$	260.33	61.92%	0.52
8	ADK8	198	$C_{17}H_{24}N_2O_2$	288.38	72.33%	0.67
9	ADK9	204	$C_{15}H_{19}N_2O_2Cl$	294.78	81.56%	0.63
10	ADK10	188	$C_{15}H_{19}N_2O_2Br$	239.23	77.89%	0.55
11	ADK11	190	$C_{15}H_{19}N_2O_2F$	278.32	84%	0.69
12	ADK12	196	$C_{15}H_{19}N_3O_4$	305.33	90.45%	0.64
13	ADK13	178	$C_{15}H_{14}N_2O_2$	254.28	89.34%	0.56
14	ADK14	172	$C_{17}H_{18}N_2O_2$	282.34	68.03%	0.58
15	ADK15	168	$C_{15}H_{13}N_2O_2Cl$	288.73	82.19%	0.72
16	ADK16	170	$C_{15}H_{13}N_2O_2Br$	233.18	80.63%	0.67
17	ADK17	166	$C_{15}H_{13}N_2O_2F$	272.27	66.04%	0.56
18	ADK18	174	$C_{15}H_{13}N_3O_4$	299.28	79.46%	0.58
19	ADK19	206	$C_{14}H_{14}N_2O_2$	242.27	72.78%	0.62
20	ADK20	204	$C_{16}H_{18}N_2O_2$	270.33	63.06%	0.64
21	ADK21	198	$C_{14}H_{13}N_2O_2Cl$	276.72	72.05%	0.70
22	ADK22	188	$C_{14}H_{13}N_2O_2Br$	321.17	78.53%	0.52
23	ADK23	202	$C_{14}H_{13}N_2O_2F$	260.26	64.89%	0.55
24	ADK24	196	$C_{14}H_{13}N_3O_4$	287.27	73.23%	0.65

A. Spectral characterization of synthesized compounds

1) ADK1: IR (KBr) (cm^{-1}): 3267 = CH_2 (methylene), 3306 = NH (aromatic), 1290 = CN, 2396 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 6.54 -7.48 (benzene, 18H), NH = 4.0 (aromatic, 1H), MS (M$^+$): 261.32

2) ADK2: IR (KBr) (cm^{-1}): 3267 = CH_2 (methylene), 3306 = NH (aromatic), 1290 = CN, 2396 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 6.54 -7.48 (benzene, 18H), NH = 4.0 (aromatic, 3H), CH_2 = 2.78 - 5.18 (methylene, 2H), MS (M$^+$): 289.37

3) ADK3: IR (KBr) (cm^{-1}): 732 = C-Cl, 3245 = CH_2 (methylene), 3378 = NH (aromatic), 1284 = CN, 2376 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 6.54 -7.48 (benzene, 17H), NH = 4.0 (aromatic, 1H), MS (M$^+$): 296.76

4) ADK4: IR (KBr) (cm^{-1}): 540 = C- Br, 3387 = CH_2 (methylene), 3286 = NH (aromatic), 1203 = CN, 2390 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 6.54 -7.48 (benzene, 17H), NH = 4.0 (aromatic, 1H), MS (M$^+$): 341.22

5) ADK5: IR (KBr) (cm^{-1}) , 3108 = CH_2 (methylene), 3323 = NH (aromatic), 1056 = CN, 2206 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 6.54 -8.2 (benzene, 17H), NH = 4.0 (aromatic, 1H), MS (M$^+$): 280.31

6) ADK6: IR (KBr) (cm^{-1}): 1552 = N-O, 3156 = CH_2 (methylene), 3389 = NH (aromatic), 1090 = CN, 2219 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 6.54 -8.2 (benzene, 17H), NH = 4.0 (aromatic, 1H), MS (M$^+$): 306.32

7) ADK7: IR (KBr) (cm^{-1}): 3267 = CH$_2$ (methylene), 3389 = NH (aromatic), 1034 = CN, 2134 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.22 -8.08 (benzene, 20H), NH = 4.0 (aromatic, 1H), CH$_2$ = 5.50 (methylene, 2H), MS (M$^+$): 260.33

8) ADK8: IR (KBr) (cm^{-1}): 2998 = CH$_3$ (alkane), 3023 = CH$_2$ (methylene), 3278 = NH (aromatic), 1124 = CN, 2267 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.1 -8.08 (benzene, 19H), NH = 2.59- 4.0 (aromatic, 1H), CH$_2$ = 5.50 (methylene, 4H) , CH$_3$ = 1.23 (methyl, 3H), MS (M$^+$): 289.38

9) ADK9: IR (KBr) (cm^{-1}): 3078 = CH$_3$ (alkane), 3112 = CH$_2$ (methylene), 3373 = NH (aromatic), 1191 = CN, 2285 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.1 -8.08 (benzene, 19H), NH = 2.59- 4.0 (aromatic, 1H), CH$_2$ = 5.50 (methylene, 4H) , CH$_3$ = 1.23 (methyl, 3H), MS (M$^+$) : 295.78

10) ADK10: IR (KBr) (cm^{-1}): 1315 = C-F, 3212 = CH$_2$ (methylene), 3387 = NH (aromatic), 1230 = CN, 2329 = C=N, ^{1}H-NMR (DMSO-d6) δ : CH = 7.0 -8.08 (benzene, 19H), NH = 4.0 (aromatic, 1H), CH$_2$ = 5.50 (methylene, 2H), MS (M$^+$) : 240.23

11) ADK11: IR (KBr) (cm^{-1}): 784 = C-Cl, 3212 = CH$_2$ (methylene), 3359 = NH (aromatic), 1235 = CN, 2357 = C=N, ^{1}H-NMR (DMSO-d6) δ : CH = 7.2 -8.08 (benzene, 19H), NH = 4.0 (aromatic, 1H), CH$_2$ = 5.50 (methylene, 2H), MS (M$^+$): 279.32

12) ADK12: IR (KBr) (cm^{-1}): 789 = C-Cl, 3260 = CH$_2$ (methylene), 3313 = NH (aromatic), 1230 = CN, 2399 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.1 -8.08 (benzene, 19H), NH = 4.0 (aromatic, 1H), CH$_2$ = 5.50 (methylene, 2H), MS (M$^+$): 305.33

13) ADK13: IR (KBr) (cm^{-1}): 503= C- Br, 3305 = CH$_2$ (methylene), 3289 = NH (aromatic), 1249 = CN, 2324 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.2 -8.08 (benzene, 19H), NH = 4.0 (aromatic, 1H), CH$_2$ = 5.50 (methylene, 2H), MS (M$^+$): 254.28

14) ADK14: IR (KBr) (cm^{-1}): 1589 = N-O, 31143 = CH$_2$ (methylene), 3381 = NH (aromatic), 1095 = CN, 2259 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.22 -8.2 (benzene, 19H), NH = 4.0 (aromatic, 1H), CH$_2$ = 5.50 (methylene, 2H), MS (M$^+$): 283.34

15) ADK15: IR (KBr) (cm^{-1}): 1513 = N-O, 3198 = CH$_2$ (methylene), 3332 = NH (aromatic), 1085 = CN, 2250 = C=N, ^{1}H-NMR (DMSO-d6) δ : CH = 7.22 -8.2 (benzene, 19H), NH = 4.0 (aromatic, 1H), CH$_2$ = 5.50 (methylene, 2H), MS (M$^+$): 289.73

16) ADK16: IR (KBr) (cm^{-1}): 1783 = C =O (carbonyl), 3109 = CH$_2$ (methylene), 3325 = NH (aromatic),1055 = CN, 2191 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.19 -7.83 (benzene, 19H), NH = 4.O (aromatic, 1H), CH2 = 4.73 (methylene, 2H), MS (M$^+$): 234.18

17) ADK17: IR (KBr) (cm^{-1}): 1705 = C =O (carbonyl), 2959 = CH$_3$ (alkane), 3046 = CH$_2$ (methylene), 3304 = NH (aromatic), 1120 = CN, 2294 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.1 -7.83 (benzene, 18H), NH = 4.O (aromatic, 1H), CH$_2$ = 2.59 - 4.73 (methylene, 4H) , CH$_3$ = 1.24 (methyl, 3H), MS (M$^+$): 273.27

18) ADK18: IR (KBr) (cm^{-1}): 1684 = C=O (carbonyl), 3078 = CH$_3$ (alkane), 3136 = CH$_2$ (methylene), 3348 = NH (aromatic), 1139 = CN, 2278 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.1 -7.83 (benzene, 18H), NH = 4.O (aromatic, 1H), CH$_2$ = 2.59 - 4.73 (methylene, 4H) , CH$_3$ = 1.24 (methyl, 3H), MS (M$^+$): 299.28

19) ADK19: 1784 = C=O (carbonyl), 1358 = C-F, 3298 = CH$_2$ (methylene), 3328 = NH (aromatic), 1267 = CN, 2378 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.0 -7.83 (benzene, 18H), NH = 4.O (aromatic, 1H), CH$_2$ = 4.73 (methylene, 2H), MS (M$^+$): 242.27

20) ADK20: IR (KBr) (cm^{-1}): 1697 = C=O (carbonyl), 714 = C-Cl, 3276 = CH$_2$ (methylene), 3379 = NH (aromatic), 1247 = CN, 2343 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.19 -7.83 (benzene, 18H), NH = 4.O (aromatic, 1H), CH$_2$ = 4.73 (methylene, 2H), MS (M$^+$): 271.33

21) ADK21: IR (KBr) (cm^{-1}): 1534 = C=O (carbonyl), 773 = C-Cl, 3278 = CH$_2$ (methylene), 3393 = NH (aromatic), 1274 = CN, 2375 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.19 -7.83 (benzene, 18H), NH = 4.O (aromatic, 1H), CH$_2$ = 4.73 (methylene, 2H), MS (M$^+$) : 277.72

22) ADK22: IR (KBr) (cm^{-1}): 1673 = C=O (carbonyl), 584 = C- Br, 3374 = CH$_2$ (methylene), 3285 = NH (aromatic), 1286 = CN, 2383 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.2 -7.83 (benzene, 18H), NH = 4.O (aromatic, 1H), CH$_2$ = 4.73 (methylene, 2H), MS (M$^+$): 322.17

23) ADK23: IR (KBr) (cm^{-1}): 1845 = C=O (carbonyl), 1575 = N-O , 3184 = CH$_2$ (methylene), 3389 = NH (aromatic), 1014 = CN, 2287 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.19 -8.2 (benzene, 18H), NH = 4.O (aromatic, 1H), CH$_2$ = 4.73 (methylene, 2H), MS (M$^+$): 261.26

24) ADK24: IR (KBr) (cm^{-1}): 1578 = C=O (carbonyl), 1512 = N-O, 3191 = CH$_2$ (methylene), 3382 = NH (aromatic), 1034 = CN, 2289 = C=N, ^{1}H-NMR (DMSO-d6) δ: CH = 7.19 -8.2 (benzene, 18H), NH = 4.O

(aromatic, 1H), CH_2 = 4.73 (methylene, 2H), MS (M^+) : 287.27

IV. CONCLUSION

Isatin and heterocyclic compounds used in synthesis of novel series having different pharmacological activities. Thus in our project we are club both to show potent antibacterial activities and others. If the considered activity found to be satisfactory then the project will be clubbed with the pharmaceutical industries for future aspects in devolpment of drug discovery.

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Synthesis and Biological Screening of Some Novel Quinazolinone & Quinazolin Thione Derivatives

Pankaj K Singh
Dept. of chemistry,
Narain Degree College, Shikohabad
Uttar Pradesh - India

Sanjeev K Mishra
Dept. of chemistry,
Narain Degree College, Shikohabad
Uttar Pradesh - India

Rakesh K Paliwal
Dept. of chemistry
Narain Degree College, Shikohabad
Uttar Pradesh - India
rkpaliwal.skb@gmail.com

Abstract- Many of the quinazolinones derivatives shows antibacterial, antifungal, antiviral, antitumor, anticonvulsant activities as well as the inhibitory effects for thymidylate synthase and poly- (ADP-ribose) polymerase. On the other hand, heterocyclic containing substituted aminothiazole nucleolus also exhibit various pharmacological activities and because of the established biological activities, our own interest to synthesize 2-substituted thiazolyl quinazoline-4(3H) one and 2-substituted thiazolyl quinazoline-4(3H)-thione derivatives. In this work, an efficient synthesis for the preparation of some novel quinazolinones by 2 steps.In the step-I, various 2-substituted benzoazin-4-ones are formed by the reaction of cheap anthranilic acid and benzoyl chloride /acetic anhydride/propanoic anhydride. In step II, 2-substituted benzoxazine 4-ones, which are formed in step I are coupled with various substituted thaizole compounds. The resulting novel thazolyl quinazolinone derivatives were characterized by 1_H NMR spectra analysis. The resulting quinazolinone further converted in to thio quinazolinone derivatives using phosphorous pentasulfide as sulfonation agent. Anthranilic used as cheap raw material for preparation of 2-substituted quinazoliones 4-ones & 2-sustituted quinazolinone 4-thiones which was further coupled with various amino thiazole to prepare target molecules.

Keywords—: Anthranilic acid, substituted 2-aminothiazole, quinazoline -4(3H) -4 one, Quinazoline -4(3H) -4 thione, NMR

I. INTRODUCTION

Since many years there has been an increasing interest in the chemistry of 4(3H)-quinazolinones, because of their broad biological activities. Many of the quinazolinones derivatives shows antibacterial, antifungal, antiviral, antitumor, antimalarial [1-7], diuretic, sedative and hypotension, antihypertensive, [8] antitubercular [9] antiHIV, anticonvulsant. Antiviral, anticancer [9], hypolipedimic analgesic activities and also known to act as protein tyrosin kinase inhibitor [10]. In light of the increasing interest among chemist and biologists in their synthesis and bioactivity of quinazolinones derivatives, expecting an enhancement of biological activity sites i have introduced two potential bioactivity sites; a quinazolinone moiety and thiazole ring in my system. Most common anticancer molecule which is currently in the market having quinazolinone ring system and to enhance biological activity of quinazolinone compounds, ketone functionality is substituted with other aromatic moieties. Common anticancer molecule which is currently in the market having quinazolinone ring system and to enhance biological activity of quinazolinone compounds, ketone functionality is substituted with other aromatic moieties **(Fig. 1)** [9]**.**
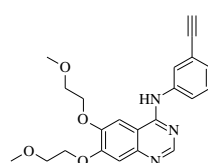
Erlotinib (Anticancer)
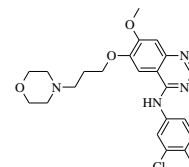
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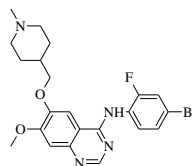
Vandetanib (Anticancer)

Fig. 1. Tyrosine kinase-targeting anti-cancer drugs

II. EXPERIMENTAL SECTION

A. Synthesis of quinazolinone compounds

1) Synthesis of 2-phenyl-3, 1 benzoazine-4-one (PBO-1)

To a solution of anthranilic acid (0.1 mol) and in pyridine (20 ml) was added benzoylchloride (0.02 mol), and the mixture was stirred for 1 hrs at room temperature. The reaction mixture was washed with 5% sodium carbonate solution (20 ml) to remove the pyridine and unreacted benzoyl chloride, again washed with water and then filtered, dried to get crude product which was further purified in ethyl acetate and hexanes solvent mixture afforded the pure compound. The yield & characterization data were given in **Tables I & II**.

2) Synthesis of 2-methyl-3, 1 benzoazine-4-one (PBO-2)

To a solution of anthranilic acid (0.1 mol) and in acetic anhydride (0.2 mol) was reflux 6 hr under anhydrous conditions. Product formation was monitored by TLC. The excess acetic anhydride distilled off under reduced pressure and cooled to room temperature to afforded pale yellow crude product. This was purified in methanol. The yield & characterization data were given in **Tables I & II**.

3) Synthesis of 2-ethyl-3, 1 benzoazine-4-one (PBO-3)

To a solution of anthranilic acid (0.1mol) and in propanoic anhydride (0.2mol) was reflux 6 hr under anhydrous conditions. Product formation was monitored by TLC. The excess propanoic anhydride distilled off under reduce pressure and cooled to room temperature to afforded pale yellow sold as crude product, this was further purified in methanol. The yield & characterization data were given in **Tables I & II**.

B. Synthesis of quinazoline 4-thione compounds [11-15]

1) Synthesis of 2-phenyl-3, 1 benzoazine-4-thione (PBT-1)

To a solution of 2-phenyl-3, 1 benzoazine-4-one (0.1mol) in THF (10 ml) was added phosphorous pentasulfide (0.03mol) lot wise in 1 hr and reaction mixture stirred again d for 3 hr at room temperature. The reaction mixture washed with 5% NaOH solution. Material extracted in ethyl acetate and again washed with water. The solvent distilled off under reduced pressure and cool to room temperature to afforded yellow coloured compound. The yield & characterization data were given in **Tables I & II**.

2) Synthesis of 2-methyl-3, 1 benzoazine-4-thione (PBT-2)

To a solution of 2-methyl-3,1 benzoazine-4-one (0.1mol) in THF (10 ml) was added phosphorous pentasulfide (0.03mol) lot wise in 1 hr and reaction mixture stirred again d for 3 hr at room temperature. The reaction mixture washed with 5% NaOH solution. Material extracted in ethyl acetate and again washed with water. The solvent distilled off under reduced pressure and cool to the room temperature to afforded yellow coloured compound. The yield & characterization data were given in table **Tables I & II**.

3) Synthesis of 2-ethyl-3, 1 benzoazine-4-thione (PBT-3)

To a solution of 2-ethyl-3,1 benzoazine-4-one (0.1mol) in THF (10 ml) was added phosphorous pentasulfide (0.03mol) lot wise in 1hr and reaction mixture stirred again d for 3 hr at room temperature. The reaction mixture washed with 5% NaOH solution. Material extracted in ethyl acetate and again washed with water. The solvent distilled off under reduced pressure and cool to the room temperature to afforded yellow coloured compound. The yield & characterization data were given in **Tables I & II**.

4) Synthesis of 3-[4-(chloromethyl)-1,3-thiazol-2-yl]-2-phenylquinazolin-4(3H)-one (PTQ-1)

To solution of (0.1mol) 2-phenyl-3,1 benzoazine-4-one in 15 ml dry pyridine was added 4-(chloromethyl)-1, 3-thiazol-2-amine (0.2mol) in lot wise and reaction was stirred continued. The resulted reaction mixture was refluxed for 10 hr. After the reaction was completed cool the reaction mixture and reaction mixture was poured in to ice with continuous stirring. The compound was crystallized and filter, dried to provided off white colored compound. The yield & characterization data were given in **Tables I & II**.

5) Synthesis of 3-[4-(chloromethyl)-1, 3-thiazol-2-yl]-2-methylquinazolin-4(3H)-one (PTQ-2)

To solution of (0.1mol) 2-methyl-3,1 benzoazine-4-one in 15 ml dry pyridine was added 4-(chloromethyl)-1, 3-thiazol-2-amine (0.2mol) in lot wise and reaction was stirred continued. The resulted reaction mixture was refluxed for 10 hr. After the reaction was completed cool the reaction mixture and reaction mixture was poured in to ice with continuous stirring. The compound was crystallized and filter, dried to provided compound. The yield & characterization data were given in **Tables I & II**.

6) Synthesis of 3-[4-(chloromethyl)-1, 3-thiazol-2-yl]-2-ethylquinazolin-4(3H)-one (PTQ-3)

To solution of (0.1mol) 2-ethyl-3,1 benzoazine-4-one in 15 ml dry pyridine was added 4-(chloromethyl)-1, 3-thiazol-2-amine (0.2mol) in lot wise and reaction was stirred continued. The resulted reaction mixture was refluxed for 10 hr. After the reaction was completed cool the reaction mixture and reaction mixture was poured in to ice with continuous stirring. The compound was crystallized and filter, dried to provided compound. The yield & characterization data were given in **Tables I & II**.

7) Synthesis of 3-[4-(chloromethyl)-1,3-thiazol-2-yl]-2-phenylquinazolin-4(3H)-thione (PTT-1)

To solution of (0.1mol) 2-phenyl-3,1 benzoazine-4-thione in 15 ml dry pyridine was added 4-(chloromethyl)-1, 3-thiazol-2-amine (0.2mol) in lot wise and reaction was stirred continued. The resulted reaction mixture was refluxed for 10 hr. After the reaction was completed cool the reaction mixture and reaction mixture was poured in to ice with continuous stirring. The compound was crystallized and filter, dried to provided compound. The yield & characterization data were given in **Tables I & II**.

8) Synthesis of 3-[4-(chloromethyl)-1,3-thiazol-2-yl]-2-methyllquinazolin-4(3H)-thione (PTT-2)

To solution of (0.1mol) 2-methyl-3,1 benzoazine-4-thione in 15 ml dry pyridine was added 4-(chloromethyl)-1, 3-thiazol-2-amine (0.2mol) in lot wise and reaction was stirred continued. The resulted reaction mixture was refluxed for 10 hr. After the reaction was completed cool the reaction mixture and reaction mixture was poured in to ice with continuous stirring. The compound was crystallized and filter, dried to provided desired compound. The yield & characterization data were given in **Tables I & II**.

9) Synthesis of 3-[4-(chloromethyl)-1,3-thiazol-2-yl]-2-ethylquinazolin-4(3H)-thione (PTT-3)

To solution of (0.1mol) 2-ethyll-3,1 benzoazine-4-thione in 15 ml dry pyridine was added 4-(chloromethyl)-1, 3-thiazol-2-amine (0.2mol) in lot wise and reaction was stirred continued. The resulted reaction mixture was refluxed for 10 hr. After the reaction was completed cool the reaction mixture and reaction mixture was poured in to ice with continuous stirring. The compound was crystallized and filter, dried to provided desired compound. The yield & characterization data were given in **Tables I & II**.

III. RESULTS AND DISCUSSION

In the recent work attempts has been made to undertake the synthesis of quinazoline 4(3H)-one and quinazoline 4(3H)-thione derivatives through two step process. Total eight novel quinazolinone and quinazoline thione derivatives were synthesized and characterized by spectra data. For this purpose the required 2-phenyl-3, 1 benzoazine-4-one, 2-methyl-3,1 benzoazine-4-one and 2-ethyl-3, 1 benzoazine-4-one were prepared through reaction between anthranilic acid and benzoyl chloride, acetic anhydride and propanoic anhydride in presence of pyridine base and different solvents. The desired

quinazolinone and quinazolinone thiones compound were prepared from coupling between benzoxazinone, benzoxazine thione and 4-(chloromethyl)-1, 3-thiazol-2-amine. The purity and reaction progress were monitored by TLC using silica gel G as an absorbent, CHCl₃ and methanol (9:1) were used as mobile phase. The spot was visualized in UV light, iodine and some of in potassium permagnet solution. The structure of the synthesized compound was characterized by 1_H NMR analysis which complies with normal values.

SCHEME

Step-1 (Synthesis of 2-substituted-3, 1 benzoxazin-4-one)
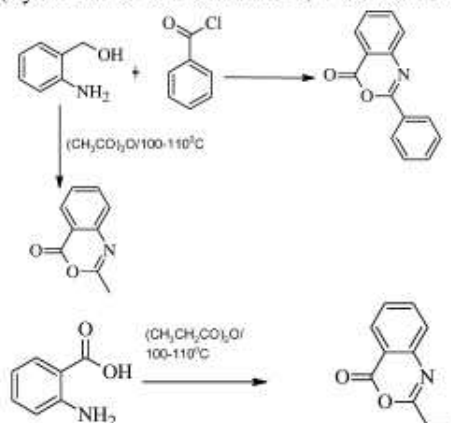
Step-IA (Synthesis of 2-substituted-3, 1-benzoazine-4-thione

R = Phenyl , ethyl , methyl
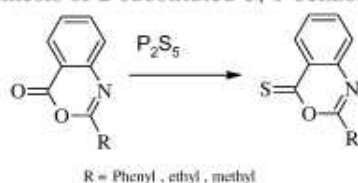
Step-II (3-[4-(chloromethyl)-1, 3-thiazol-2-yl]-2-ethylquinazolin-4(3H)-one and 3-[4-(chloromethyl)-1, 3-thiazol-2-yl]-2-ethylquinazolin-4(3H)-thione

R = Phenyl , ethyl and methyl group
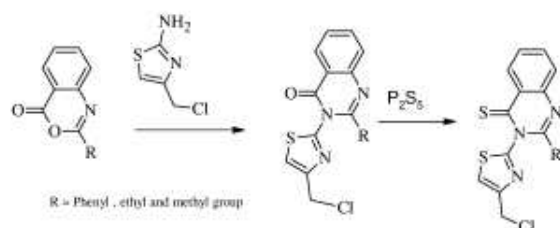
TABLE-I. SPECTRAL DATA OF SYNTHESIZED COMPOUNDS

| Comp. No. | Spectral data of the synthesized compounds [16,17,18] | |
	Molecular formula	1_HNMR(400MHZ)
PBO-1	$C_{14}H_9NO_2$	δ 7.54-8.31 (m9H,Ar-H)
PBO-2	$C_9H_7NO_2$	δ 7.38-8.10(4mH,Ar-H), δ 1.1-2.1(3m,C-H)
PBO-3	$C_{10}H_9NO_2$	δ6.45-8.02(4mH,Ar-H), δ 1.09-2.23(5m,C-H)
PBT-1	C_4H_9NOS	δ 7.92-8.54 (m9H,Ar-H)
PBT-2	C_9H_7NOS	δ7..21-8.15(4mH,Ar-H), δ 1.1-2.13(3m,C-

| Comp. No. | Spectral data of the synthesized compounds [16,17,18] | |
	Molecular formula	1_HNMR(400MHZ)
		H)
PBT-3	$C_{10}H_9NOS$	δ7.89 -8.86(4mH,Ar-H), δ 1.12-2.35(5mH,C-H)
PTQ-1	$C_{18}H_{12}ClN_3OS$	δ 7.51 -8.21(9mH,Ar-H), δ 3.01-3.16(1sH, C-H thiazole))
PTQ-2	$C_{13}H_{10}ClN_3OS$	δ 7.51 -8.21(4mH,Ar-H), δ 3.01-3.16(3mH, C-H), δ 2.93-2.96(1sH)
PTQ-3	$C_{14}H_{12}ClN_3OS$	δ 7.51 -8.21(4mH,Ar-H), δ 3.01-3.16(3sH, C-H), δ 2.89-2.91(1sH)
PTT-1	$C_{14}H_{12}ClN_3OS_2$	δ 7.41 -8.41(9mH,Ar-H), δ 3.11-3.26(1sH, C-H thiazole))
PTT-2	$C_{13}H_{10}ClN_3OS_2$	δ 7.51 -8.23(4mH,Ar-H), δ 3.05-3.13(3mH, C-H), δ 2.93-2.96(1sH)
PTT-3	$C_{14}H_{12}ClN_3OS_2$	δ 7.51 -8.23(4mH,Ar-H), δ 3.05-3.13(3mH, C-H), δ 2.93-2.96(1sH)

TABLE-II. PHYSICAL DATA OF SYNTHESIZED COMPOUNDS

| Comp. name | Physical data of synthesized compounds | | |
	Molecular formula	Melting point (°C)	% yield
PBO-1	$C_{14}H_9NO_2$	118	85
PBO-2	$C_9H_7NO_2$	105	82
PBO-3	$C_{10}H_9NO_2$	125	80
PBT-1	C_4H_9NOS	121	85
PBT-2	C_9H_7NOS	102	90
PBT-3	$C_{10}H_9NOS$	115	88
PTQ-1	$C_{18}H_{12}ClN_3OS$	152	65
PTQ-2	$C_{13}H_{10}ClN_3OS$	145	85
PTQ-3	$C_{14}H_{12}ClN_3OS$	140	90
PTT-1	$C_{14}H_{12}ClN_3OS_2$	172	75
PTT-2	$C_{13}H_{10}ClN_3OS_2$	158	85
PTT-3	$C_{14}H_{12}ClN_3OS_2$	160	90

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Pharmacognostical Standardization of Harshingar Leaf

Sudhir Saini
Rajendra Institue of
Technology & Sciences
Sirsa, Haryana, India

Sharuti Abrol
CT Institute of
Pharmaceutical Sciences
Jalandhar, Punjab, India

Santosh Kumar Verma
CT Institute of
Pharmaceutical Sciences
Jalandhar, Punjab, India

Anil Kumar Sharma
CT Institute of
Pharmaceutical Sciences
Jalandhar, Punjab, India

Abstract: Medicinal plants have remained the major sources of drugs; in fact many of the currently available drugs were derived either directly or indirectly from them. The approach to new drugs through natural products has proved to be the single most successful strategy for the discovery of new drugs. In the past decade, research has been focused on scientific evaluation of traditional drugs of plant origin for the treatment of various diseases. Nyctanthes arbortristis, commonly known as Harshingar, is a large shrub or a small tree, up to 10 m high, occurring as wild plant in the sub-Himalayan region, Madhya Pradesh and southwards to Godavari. It is widely used in several traditional medicines to cure various diseases. The drug has not yet been studied vastly on Pharmacognostical view, hence an attempt has been taken to establish the morphological & phyto-chemical features & characters of drug.

Key Words: Nyctanthes arbortristis, macroscopical, microscopical, phyto-chemical etc.

I.   INTRODUCTION

Nyctanthes arbortristis is an indigenous plant native of India, flourishing wild in sub-Himalayan regions ranges from the Chenabs to Nepal, Assam, Burma, Bengal, Central India like Chotanagpur, Rajasthan, Madhya Pradesh and South words to Godavari [1]. It is a small tree with a crooked trunk. The fragrant, star like flowers arise in loose clusters, they bloom at night and fall on the ground below by morning [2]. In its natural habitat, it grows gregariously and covers dry steep hill sides and rocky grounds [3]. The decoction of leaves is extensively used by Ayurvedic physicians for the treatment of arthritis, obstinate sciatica, malaria, intestinal worms, cholagogue and as laxative [4, 5, 6, 7]. The plant has been reported to possess anti-inflammatory, analgesics, antipyretic activity along with ulcerogenic potency [8, 9]. This plant has also been found to possess anti-allergic [10], antimalarial [11], leishmanicidal [12] amoebicidal [13] and anthelmintic [14] activities.

II.   MATERIAL AND METHODS

A). Collection, drying and extraction of plant:

The leaves of Nyctanthes arbortristis Linn., were collected from Jalandhar (Punjab) and authenticated from F. R. I., Dehradun. The plant material was shade dried and powdered. Powder was passed through the sieve # 44 and extracted with hexane and ethanol by solvent extraction 24 h/cycle. The extracts were studied for phytoconstituents and chromatographic study.

B). Macroscopy, microscopy, physiochemical parameters and chromatography study:

The macroscopical character of whole leaf was studied. Then T. S. of petiole, midrib and lamina were studied. Microscopical study of powder was also performed. Various physical parameters like foreign value, ash value, extractive value etc. were studied.

III.   RESULTS

A) Macroscopic:

Leaves of the plant are simple opposite, 6-15 cm long, 3-7 cm wide, ovate, acute to acuminate with reticulate venation; venation pattern is more conspicuous on the lower side of the leaf, showing about 4-6 pairs of lateral veins. Both the surfaces are rough, scabrous, and densely pubescent; the margins of the leaf are distinctly toothed and the base of the leaf is almost round. The petiole is about 0.4 - 1.4 cm long, clearly channelled on upper side and pubescent.

B) Microscopic:

1) Petiole

T.S. shows semicircular outline, lower epidermis with cuticle having striations, numerous unicellular elongated trichomes upto 320 µ in length. 3-4 layers of collenchymas at lower epidermis. Below collenchymas and xylem are parenchymatous cells. Phloem and xylem is present in the centre. Upper epidermis cuticle is more thick. Pericycle fibres are seen around phloem. Epidermis is single layered.

2) Midrib

T.S. shows semicircular outline ; epidermis on both surfaces covered by cuticle; abundant glandular and non-glandular, unicellular trichomes measuring upto 240-490 µ length and up to 24-36 µ in width present on epidermis; 4 to 6 layered collenchyma cells situated just beneath the epidermis followed by 3-4 layers cortical parenchymatous cells; vascular bundle surrounded by parenchyma cells; phloem located on the outer peripheral part of xylem; xylem mainly consists of tracheids and vessels, central part of midrib occupied by thick walled parenchyma cells.

3) Lamina

T.S. shows dorsiventral structure ;epidermis on both the sides covered by cuticle ; in surface view the lower epidermis shows straight walled, polygonal cells with prominent cuticle

striations and anomocytic stomata; upper epidermis is devoid of stomata; unicellular trichomes are present on both the surfaces; upper epidermis followed by two layered palisade cells; mesophyll traversed by veins; palisade ratio is 5-7, vein islet no. is 16-18; vein termination number is 10 - 14; stomatal index is 11-13.

4) Powder microscopy

Dark Green powder, bitter in taste; shows lignified fibre, calcium oxalate crystals, strach granules, fragments of upper epidermis and lower epidermis with abundant anomocytic stomata. Epidermal cells with striated cuticle covering warty glandular trichomes of various size with unicellular stalk, fragments showing epidermis and bilayered palisade cells, and fragments of annular vessels.

C) Phytochemical screening:

Preliminary phytochemical analysis of the plant extracts showed the presence of alkaloids, Steroids, glycosides, flavanoids, saponins, phenolic compounds and tannins.

D) Physical parameters:

Foreign matter	1.22 ± 0.34 (Mean ± SD)
Total ash	13.39 ± 1.52 (Mean ± SD)
Acid insoluble ash	5.51 ± 1.23 (Mean ± SD)
Alcohol soluble extractive	9.76 ± 1.39 (Mean ± SD)
Water soluble extractive	16.92 ± 2.66 (Mean ± SD)

E) Chromatography:

TLC of alcoholic extract on silica gel G plates (0.2 mm thick) using Toluene: Ethyl Acetate: Chloroform (3:1:1) using Anisaldehyde-sulphuric acid as spraying agent under UV light (365 nm) (Figure: 13) shows seven spots at Rf values 0.29 (Light Blue), 0.41, 0.50, 0.61 (Bluish Green), 0.73 (Violet), 0.80 (Light Blue), 0.91 (Dark Blue). The TLC of alcoholic extract using Toluene: Ethyl Acetate (2:1) & Anisaldehyde-sulphuric acid as spraying agent under UV light (365 nm) (Figure: 15) shows nine spots at RF values: 0.13 , 0.27(Greenish Violet), 0.38, 0.47, 0.57 (Bluish Violet), 0.63(Violet), 0.75 (Light Green), 0.81 (Light Violet), 0.88(Violet). The TLC of alcoholic extract using Toluene: Ethyl Acetate (4:1) & Anisaldehyde-sulphuric acid as spraying agent under UV light (365 nm) (Figure: 14) shows seven spots at RF values: 0.32 (Bluish Green), 0.44 (Light Violet), 0.52 (Yellow), 0.63 (Light Green), 0.74 (Blue), 0.81 (Light Brownish), 0.88 (Violet) whereas the n-Hexane extract under similar condition shows five spots: 0.32 (Greenish Blue), 0.41, 0.60 (Violet), , 0.66 (Light Violet), 0.83 (Violet). TLC of n-Hexane extract of leaf using Toluene: Chloroform (7:3) using Anisaldehyde-sulphuric acid as spraying agent under UV light (365 nm) (Figure: 16) shows six spots at Rf values 0.08, 0.12, 0.36, 0.47, 0.80 and 0.88.

IV. CONCLUSION

Nyctanthes arbortristis, a valuable medicinal plant is a unique source of unique metabolites. For the last few years, there has been an increasing awareness for this medicinal plant. Several therapeutically and industrially useful preparations and compounds have also been marketed, which generate enough encouragement among the Scientists in exploring more information about this plant. Therefore Pharmacognostical studies including macroscopic and microscopic evaluation of various parts of Nyctanthes arbortristis would be of considerable use in the identification of this drug. These findings may be useful to supplement existing information with regard to the identification and standardization of Nyctanthes arbortristis to distinguish it from substitutes and adulterants. In conclusion, the present manuscript may be useful to supplement information with regard to its identification and in carrying out further research of its use in the treatment of various diseases.

Fig. 1: TS of leaf

Fig. 2: TS of Leaf

Fig. 3: Palisade cells
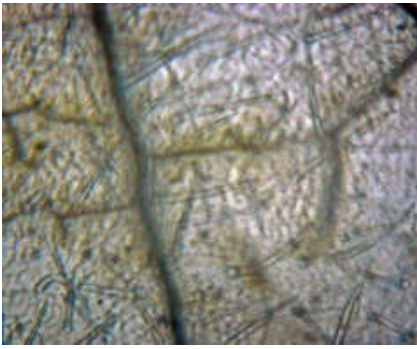
Fig. 4: Leaf Lamina
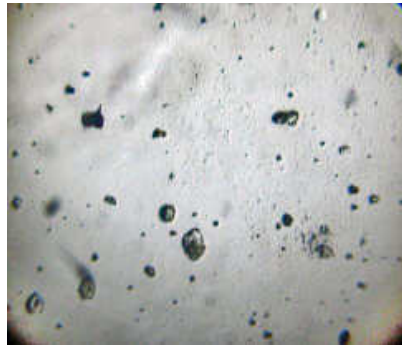
Fig. 5: Crystals in Powder

Fig. 6: Trichomes in Powder
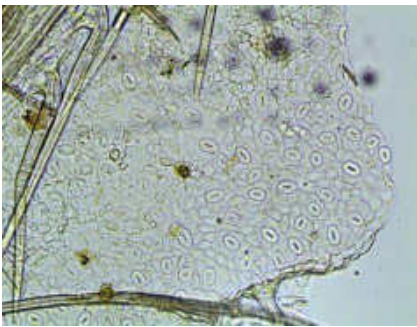
Fig. 7: Epidermal Fragments
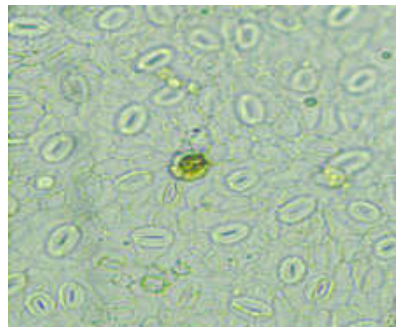
Fig. 8: Stomatal Arrangement
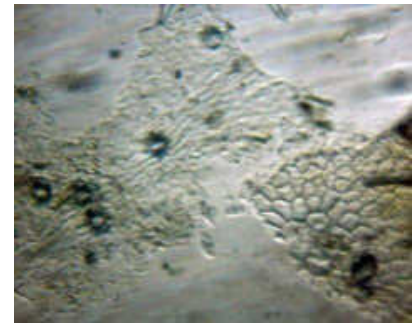
Fig. 9: Annular vessels

Fig. 10: TS Petiole
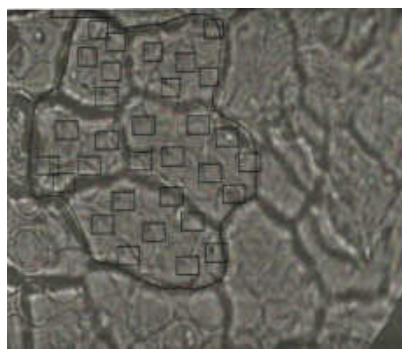
Fig. 11: Palisade Ratio

Fig. 12: Stomatal Index
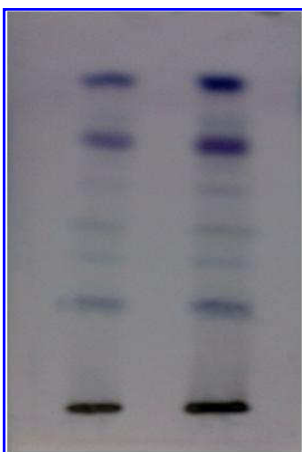
Fig. 13
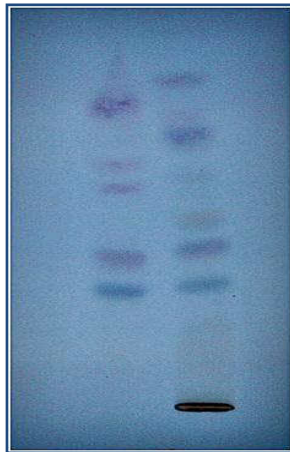
Fig. 14
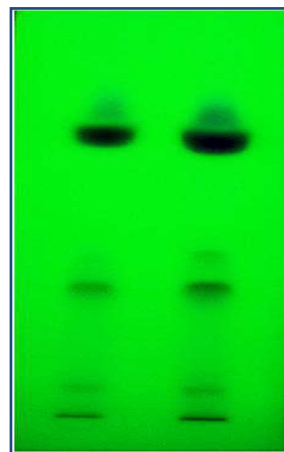
Fig. 15
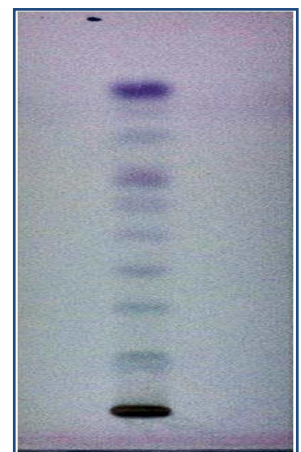
Fig. 16

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Effect of Aqueous extract of Ganoderma Lucidum on Antibacterial Activity of Bark of Some herbal Drugs against Dental Pathogens

Kshitij Agarwal
Dev Bhoomi Institute of Pharmacy and Research
Dehradun, Uttar Pardesh, INDIA
ksmv56@rediffmail.com

Vidhu Aeri
Faculty of Pharmacy,
Jamia Hamdard, New Delhi, INDIA
vidhuaeri@yahoo.com

ABSTRACT: The aqueous extract of Ganoderma lucidum mycelium and powdered barks of Azadirachta indica, Eucalyptus globulus and Cinnamomum zeylanicum were made and all the extracts were evaluated for antibacterial activity against different Gram positive(Bacillus subtilis, Staphylococcus aureus, and Clostridium perfringens), Gram negative(Klebsiella pneumoniae, Escherichia coli and Salmonella paratyphi B.) microorganisms and Dental pathogens isolated from tooth dental patients and compared with chloremphenicol as a reference standard. The result showed that Ganoderma lucidum extract showed prominent antibacterial activity against all organisms specifically Dental pathogens with low percentage yield.

Key Words: Dental Pathogens, Antimicrobial, Medicinal plant, Herbal formulations.

I. INTRODUCTION

Ganoderma lucidum is a Basidiomycetes fungus belonging to the family Polyporaceae.[1] It has been in use for thousands of years for its medicinal properties in Traditional Chinese Medicine. It is known to have many biologically active components like triterpenes, polysaccharides, ganoderic acids, and so on, giving it, its antimicrobial, antiviral, immunomodulatory, antioxidant, antitumour and anticancer properties.[2] As the antimicrobial and antiviral activity of Ganoderma has already been documented scientifically. The Neem tree (Azadirachta indica, Maliaceae) has been known as the wonder tree for centuries in the Indian subcontinent[3] Neem comprises of 40 different active compounds called Tetranortriperpernoids, or more specifically liminoids, chief ingredient is Azadirachtin[4], isoprenoid glycosides, Flavanoids and their glycoside, amino acid etc[5].The eucalyptus plant (Eucalyptus globulus, Myrtaceae) is native to Australia and comprises essential oil which comprise cineole, pinene, globulol, camphene, limonene, pinocarvone, resin, tannins and flavonoids as the major chemical constituents.[6] The cinnamon is the inner bark of a tropical evergreen tree obtain from Cinnamomum zeylanicum., Lauracae. Bark contain essentail oil, include ethyl cinnamate, eugenol, cinnamaldehyde, β-caryophyllene, linalool and methyl chavicol[7]. There are few reports on antibacterial activity of above fungi and plants against various organisms and antifungal activity. However no research work has been carried out so far to determine antibacterial activity of aqueous extract of GL and its effect on bark extract of above plants though the plant extract has been incorporated in many commercially available herbal dental formulations. Hence the present study carried out to investigate synergism effect of GL extract on antibacterial activity of plants extract against different microorganisms.

II. MATERIAL AND METHODS

A. Preparation of extracts

Bark of all three plants and Ganoderma lucidum were collected from the botanical garden of Forest Research Institute Dehardun, U.K. and authenticated at Department of Botany, FRI, Dehradun. 10 gm Air-dried drug was finely pulverized and extracted successively with 250 ml distilled water at 1000C, in reflux condenser for 9-10 hours. The distilled water evaporated under vacuum and percentage yield of each extract was calculated. (Table 1)

B. Test Organsim

- Gram positive- Bacillus subtilis, Staphylococcus aureus, and Clostridium perfringens
- Gram negative- Klebsiella pneumoniae, Escherichia coli and Salmonella paratyphi B.

1. Bacteria isolated from plaque samples of dental patients:

First patient Streptococci, Second patient Bacillus, Third patient Streptococci, Fourth patient Streptobacilli.

2. Procedure for isolation of dental pathogens

The plaque samples from the dental patients were collected with sterile forceps and incubated in sterile fluid thioglycollate medium for 18 hours at 370C. A loopful of this culture was mixed with sterile saline and transferred to sterile petriplates containing nutrient agar medium. The plates were incubated and observed for different types of colonies. Each colony was sub cultured and the morphological characters of each organism were noted. Plaque samples obtained from first patient, and third were found to contain Gram positive, non-motile, noncapsulated and non-sporing Streptococci arranged in chains of varying length. Plaque sample of second patient contained rod shaped bacillus, which were Gram positive, motile, and form endospores. Plaque sample of fourth patient contained

rod shaped Streptobacilli, which were Gram positive, non-motile, non-capsulated and non-sporing[8].

C. Experimental methods

Individual aqueous extracts and all the combination of extracts were screened for antibacterial activity by cup plate technique[9], a previously liquefied and sterilized medium was poured in to twenty petriplates and solidified. Four holes were made in each plate with borer having 6 mm inner diameter. Aqueous extract of all three plants and fungi in conc. 10 mg/ml were made in Dimethyl sulfoxide (DMSO). Chloremphenicol 10 µm/ml were used as standard. Micropipette was used for delivered the extracts in petriplate. The volume of solution to each hole of petri plate was kept uniform; one hole in each plate was kept for standard and is stand for one hr for proper diffusion of sample. They were incubated for about for 24 hrs at 37°C. After 24 hrs plates were examined and the diameters of zones of inhibition were accurately measured. [10, 11, 12]

III. RESULT AND DISCUSSION

The result showed that maximum yield obtained from Azadirachta indica (Table1) in antibacterial screening by cup plate technique, individual aqueous extracts and in combination exhibited prominent antibacterial activity against all the test microorganisms (Table2).Out of three combination the combination of Ganoderma lucidum, Azadirachta indica-. Cinnamomum zeylanicum shows good activity against all micro-organism. The results were compared with chloremphenicol as standard antibiotic. From the above observation, it can be concluded that combination of Ganoderma lucidum, Azadirachta indica-Cinnamomum zeylanicum can be regarded as potent antimicrobial combination and need to develop Polyherbal dental caries formulation.

Table 1. Nature and Percentage Yield of aqueous Extracts of all three plants

S. No.	Extracts	Nature	Yield %
1	Ganoderma Lucidum	Dark brown semisolid	15.3
2	Azadirachta indica	Dark brown semisolid	20.5
3	Eucalyptus globulus	Dark brown semisolid	9.12
4	Cinnamomum zeylanicum	Dark brown semisolid	19.34

Table 2 Anti-bacterial Activity of Aqueous Extract and Combinations of Azadirachta indica, Eucalyptus globulus and Cinnamomum zeylanicum, Ganoderma lucidum by Cup Plate Technique.

Micro-organism	Aqueous Extract (Zone of Inhibition in mm)				Combination (Zone of Inhibition in mm)			Standard (Zone of Inhibition in mm)
	A_1	A_2	A_3	A_4	$A_1+A_2+A_4$	$A_1+A_3+A_4$	$A_2+A_3+A_4$	Chloremphenicol
Bacillus subtilis,	9.0	5.6	11.0	9.1	10.0	13.0	10.5	9.4
Staphylococcus aureus	11.2	5.0	13.0	12.0	10.0	15.0	9.3	17
Clostridium perfringens	5.0	3.4	7.5	8.5	4.3	6.0	9.0	9.33
Klebsiella pneumoniae,	6.5	----	5.0	5.5	3.2	6.7	3.4	18.5
Escherichia coli	10.5	6.0	10.0	11.1	9.0	12.0	8.7	17.5
Salmonella paratyphi	11.2	4.0	7.0	6.8	9.4	7.2	9.0	15.0
First patient Streptococci	14.3	6.1	15.7	14.7	13.3	19.5	15.0	18
Second patient Bacillus	12.7	2.5	12.0	11.7	9.4	14.5	10.5	10.2
Third patient Streptococci	15.0	5.5	16.0	17.4	11.7	20.0	16.8	19
Fourth patient Streptobacilli	13.3	7.8	14.2	15.3	13.3	19.8	12.0	18.5

A_1 Azadirachta indica Extract, A_2 Eucalyptus globulus Extract and A_3 Cinnamomum zeylanicum Extract, A_4 Ganoderma lucidum extract

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Phytochemical and Pharmacological Review of Palash (Butea Monosperm)

Sharuti Mehta
CT Institute of
Pharmaceutical
Sciences,
Shahpur, Jalandhar-
Punjab India
sharuti15k@gmail.com

Anshul Chawla
CT Institute of
Pharmaceutical
Sciences,
Shahpur, Jalandhar
Punjab India

Sanjana Piplani
CT Institute of
Pharmaceutical
Sciences,
Shahpur, Jalandhar
Punjab India

Vishal Prashar
CT Institute of
Pharmaceutical
Sciences,
Shahpur, Jalandhar
Punjab India

Abstract: Plant-based medicinal products have been known since ancient times, and several medicinal plants and their products (active natural principles and crude extracts) have been used. These products have long been recognized as an important source of therapeutically effective medicines. An enormous variety of medicinal plants are used worldwide by about 80% of the world population, although in most cases no scientific studies have been done to prove the efficacy of these medicinal plants. The present review is to discuss the pharmacognostical importance of Butea monosperma commonly known as palash, family Fabaceae.

Keywords: Palash, phytochemistry, pharmacognosy, pharmacology

I. INTRODUCTION

Butea monosperma is a moderate sized deciduous tree which is widely distributed throughout India, Burma and Ceylon, popularly known as 'palash', commonly known as 'Flame of forest'. The family Fabaceae compromises of 630 genera and 18,000 species.[1]

A. Taxonomy Kingdom: Plantae; Division: Magnoliophyta; Class: Magnoliopsida; Order: Fabales; Family: Fabaceae; Genus: Butea; Species:-Monosperma Local names- Bengali-palas, kinaka, peras, polashi; English :-flame-of-the-forest, bastard tea; Hindi-chichratesu, polak, tellamoduga, dhak, palas, desukajhad, khankrei, chalcha; Urdu- palash, papra, Sanskrit-brahmopadapa, lakshataru, palasha [1]

B. Distribution

Butea monosperma is a tree of tropical and subtropical climate. Found throughout the drier parts of India, often gregarious in Forests, open grasslands and wastelands.

C. Ethnomedicinal uses

The crude extracts of various parts and pure isolates of Butea monosperma was reported to possess antibacterial, antifungal, hypoglycaemic, anti-inflammatory activities. Butea monosperma have been found to possess tonic, astringent, aphrodisiac and diuretics properties. The widespread uses of Butea monosperma in traditional systems of medicine have resulted in their extensive chemical analysis for their bioactive principles. [2, 3]

D. Phytochemical review

Flower- Triterpene, Butein (4), Butin (3), Isobutrin (2), Coreopsin(5),isocoreopsin (6) (butin 7-glucoside), Sulphurein (10), monospermoside (12) (butein 3-e-D-glucoside) and isomonospermoside (7), chalcones, aurones, flavonoids (palasitrin (9), prunetin (11) and steroids; Seed- Oil (yellow, tasteless), proteolytic and lipolytic enzymes, plant proteinase and polypeptidase.(Similarto yeast tripsin). A nitrogenous acidic compound, along with palasonin (13) is present in seeds. It also contains monospermoside (12) (butein 3-e-D-glucoside) and Isomonospermoside (7). From seed coat allophonic acid has been isolated and identified; Bark- Kino-tannic acid, Gallic acid, pyrocatechin. The plant also contains palasitrin (9), and major glycosides asbutrin, alanind, allophanic acid, butolic acid, cyanidin,histidine, Lupenone (14), lupeol (15), (-)-medicarpin (20),palasimide (21) and shellolic acid; Stem- 3-Z-hydroxyeuph-25-ene (22) and 2,14-dihydroxy-11,12- dimethyl-8-oxo-octadec-11-enylcyclohexane (23). Stigmasterol-e-D-glucopyranoside (25) and non acosanoic acid; Leaves-Glucoside, Kino-oil containing oleic and linoleic acid, palmitic and lignoceric acid; Gum- Tannins, mucilaginous material, pyrocatechin; Resin- Jalaric esters I, II and laccijalaric esters III, IV,Z- amyrin, e-sitosterone its glucoside and sucrose (26), lactone-nheneicosanoic acid-delta-lactone. [4]

STRUCTURES OF REPORTED ACTIVE CONSTITUENTS
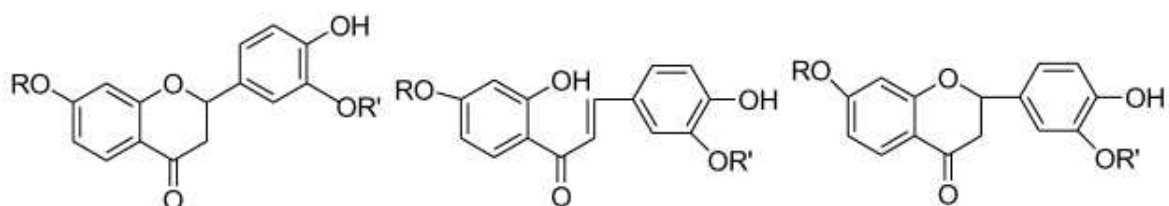
Butyrin; R=R'=Glucosyl (1)

Isobutyrin;R=R'=Glucosyl (2)

Butin; R=R'=H (3)
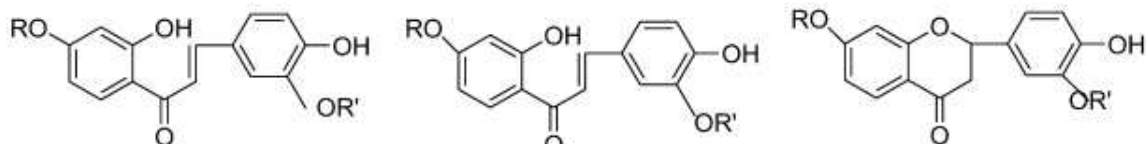
Butein; R=R'=H (4)

Coreopsin R= Glucosyl ,R'=H (5)

Isocoreopsin; R= Glucosyl ,R'=H (6)
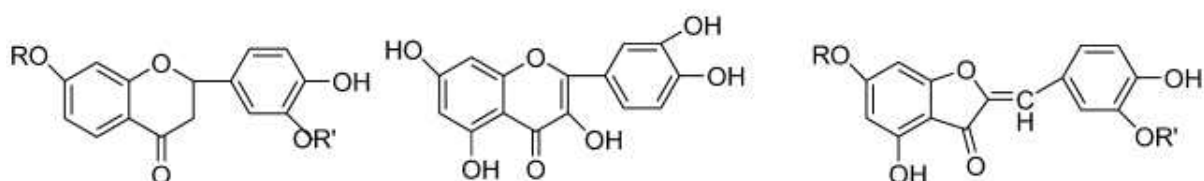
Isomonospermoside R= H, R'= Glucosyl (7)

Querocitin (8)

Palasitrin;R=R'=Glucosyl (9)
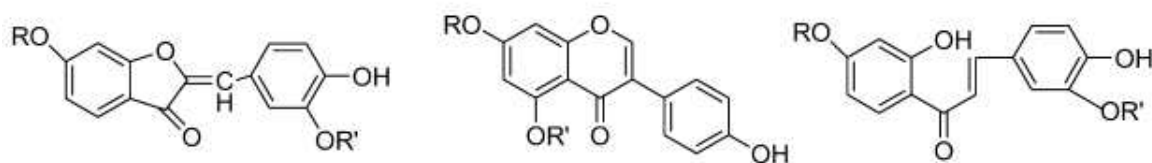
Sulphurein; R= Glucosyl R'=H (10)

Prunetein; R = CH3. R' =H (11)

Monospermoside;R=H, R'=Glucosyl (12)
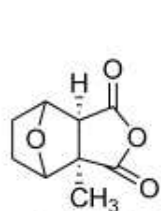
Palasonin (13)
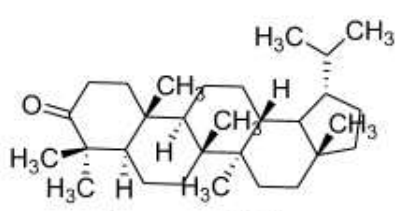
Lupenone (14)
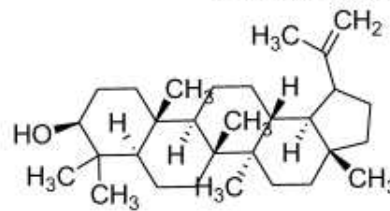
Lupeol (15)
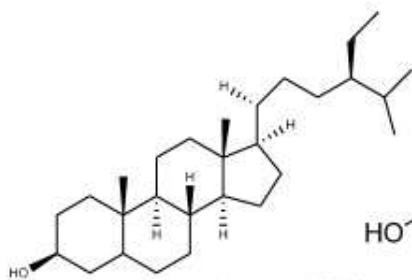
beta-sitosterol (16)
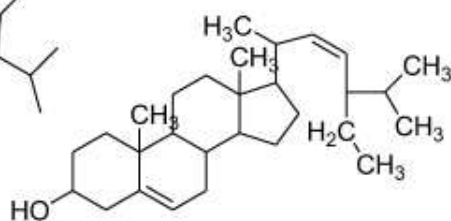
Stigmasterol (17)

Proanthocyanidin (18)

alpha-amyrin (19)

Medicarpin (20)

Palasimide (21)

3-Hydroxy-euph-25-ene (22)

2,14-dihydroxy-11,12- dimethyl-8-oxo-octadec-11-enylcyclohexane (23)

Palasonin

Stigmasterol-e-D-glucopyranoside

Sucrose
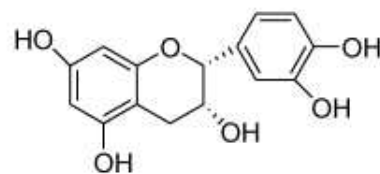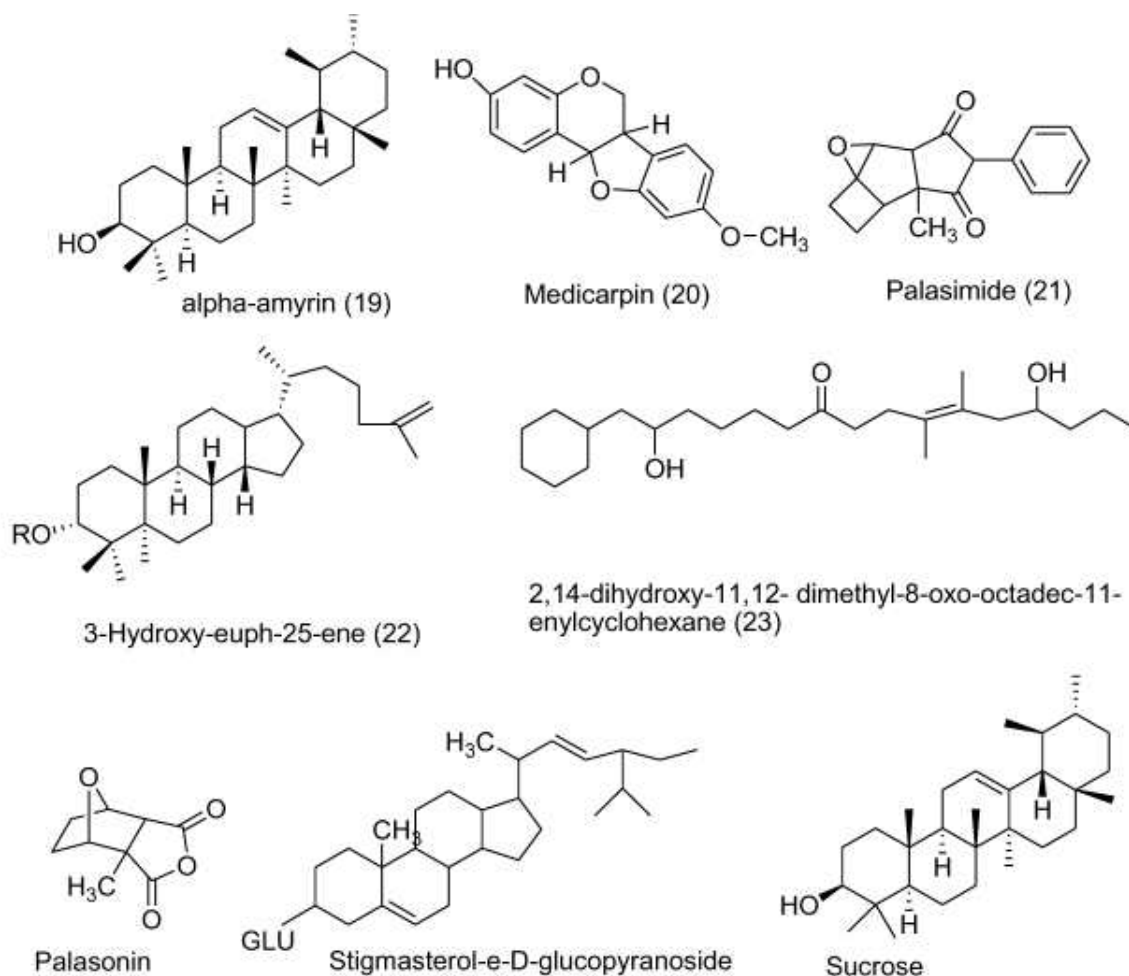
II. PHARMACOLOGICAL REVIEW

Anthelmintic activity (5), Anti-diabetic (6), Anti-diarrhoeal activity (7), Anti-inflammatory activity (8), Antimicrobial, antifungal activity, anti-bacterial activity (9), Anti-conceptive activity (10), Anti-convulsant activity (11), Anti-estrogenic and anti-fertility activity (12), Anti-stress activity (13), Thyroid inhibitory, anti-per oxidative andhypoglycemic effects (14) Wound healing (15).

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Phytochemistry and Pharmacological Review of Flavonoids

Sanjana Piplani
CT Institute of
Pharmaceutical Sciences,
Jalandhar Punjab India

Sharuti Mehta
CT Institute of
Pharmaceutical Sciences,
Jalandhar-Punjab India

Anshul Chawla
CT Institute of
Pharmaceutical Sciences,
Jalandhar Punjab India

Manraj Kaur
CT Institute of
Pharmaceutical Sciences,
Jalandhar Punjab India

Abstract: Flavonoids are the polyphenolic compounds that have been widely known from centuries for possessing broad spectrum of biological activities and are known for their beneficial effects on health long before flavonoids were isolated as the effective compounds. These colouring pigments are, responsible for the colour of leaves, flowers etc. These are found in vegetables, fruits, nuts, seeds, stem, flowers, tea, wine etc. and are an integral part of our daily diet and potential antioxidant components.

Keywords- Flavonoids, Phytochemistry, Anthocyanidins and catechins

I. INTRODUCTION

Flavonoids are low molecular weight [1] bioactive polyphenols, collectively known as Vitamain P and citrin, play a vital role in photosynthesising cells [2] and are commonly found in stems, flowers, fruits, nuts, seeds, tea, wine, propolis and honey. Flavonoids are prominent components of citrus fruits and are consumed regularly with the human diet [3] and are plant pigments, responsible for various colours of bark, leaves, flowers, fruits, seeds of plants and biological activities in mammals and important one being the antioxidant activity [4].

A. Chemistry and Classification

Flavonoids, are the largest group of naturally occurring polyphenolic compounds which possess 15 carbon atoms (C_6 - C_3 - C_6), two benzene rings are joined by a linear three carbon chains [5].
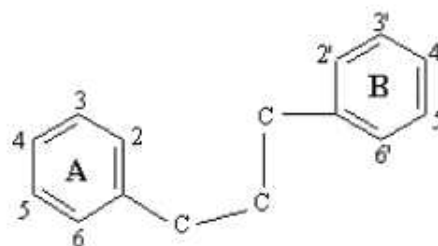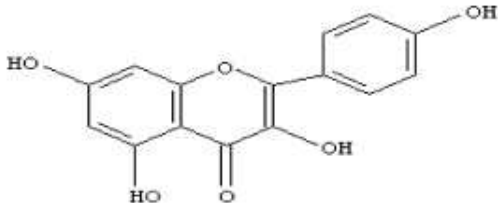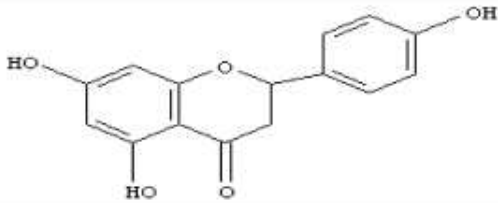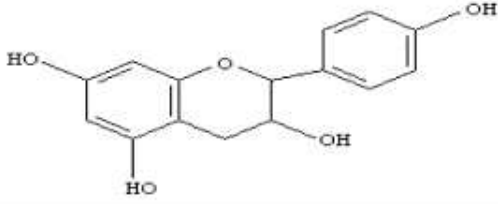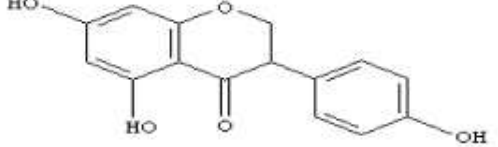
Flavonoids are usually subdivided according to their substituents into chalcone (1), flavones (2), flavanol (3), flavanones (4), anthocyanins (5) and isoflavonoids (6). The basic structure of flavonoid is comprised of two benzene rings (A and B) linked through a heterocyclic pyran or pyrone (with a double bond) ring (C) in the middle.

Flavonoids can also be classified on the basis whether additional hydroxyl or methyl groups have been introduced to the different positions of the molecule. Based on this flavonoids are classified within two families, those containing a hydroxyl group in position C-3 of the C ring as 3-hydroxyflavonoids (flavonols, anthocyanidins, leucoanthocyanidins and catechins), and those lacking it as 3- desoxyflavonoids (flavanones, flavones). Isoflavonoids differ from the other groups as in this the B ring is bound to C-3 of ring C instead of C-2. Anthocyanidins and catechins, on the other hand, lack the carbonyl group on C-4 [6].

Table 1: Classification of Flavonoids

S. No.	Name of Flavonoid	Structure	Example
1.	Chalcones		Phlorizin Phloretin Arbutin
2.	Flavone		Apigenin Luteolin Rhoifolin Baicalin Chrysin Techtochrysin

3.	Flavonol		Quercetin Kaempferol Myrcetin Myrcitrin Rutin Retusin
4.	Flavanone		Hesperitin Hesperidin Naringin Narigenin Eriodictyol Pinocembrin
5.	Anthocyanins		Cyanidin Delphinidin Malvidin Peonidin Pelargonidin
6.	Isoflavonoids		Genistein Daidzein Retusin

B. Role of Flavonoids in plants

Flavonoids, in leaves promote physiological survival of plant by protecting it from fungal infections, UV radiations and further more they are also involved in photosensitisation, energy transfer, respiration, photosynthesis control, morphogenesis. Anthocyanin pigment present in flowers helps in pollination [2]

C. Pharmacological Potential of Flavonoids

Table 2: Pharmacological Activities of flavonoids along with their mechanism of action

S. No.	Pharmacological Activity	Name of Flavonoid	Mechanism of Action	Reference
1	Cardiovascular effect	Quercetin Kaempferol, Myricetin	Decrease in LDL oxidatiob by LOX inhibition, decrease in oxidative stress	7,8
2	Antidiabetic	Quercetin, Catechin, Epicatechin	Regeneration of pancreatic islets, increase in insulin release	9
3	Antiinflammatory	Fisetin,Kaempferol Myricetin	Inhibitors of COX and LOX	10
4	Anti-oxidant	Silybinin, Morin,Dosmetin, Apigenin, Catechin	Free radical scavengers	11
5	Antibacterial	Morin-O-Lyxoside, Quercetin-3-O-arabinoside, Quercetin	Bacterostatic against Salmonella enteric, Vibrio cholera, Staphyloccus aureus	12
6	Antiallergic	Quercetin	Inhibit cyclic AMP phosphodiesterase and calcium-dependent ATPase (responsible for release of histamine from mast cells and basophils)	13
7	Lipid lowering activity	Liquritigenin	Decrease in cholesterol, LDL cholesterol, atherogenic index	14

Table 3: Medicinal plants rich in flavonoids content

S. No.	Plant	Part used	Family	Flavonoid present	Type of flavonoid
1.	Aloe vera	Leaves	Liliaceae	Luteolin	Flavone
2.	Acalypha indica	Leaves, Flowers	Euphorbiaceae	Kaempferol	Flavonol
3.	Azadirachta indica	Seeds	Meliaceae,	Quercetin, kaempferol, myricetin	Flavonol
4.	Andrographis	Dried	Acanthaceae	Monohydroxytrimethylflavones,	Flavone

	paniculata	leaves, shoots			
5.	Bacopa moneirra	Leaves, stem	Scrophulariaceae	Luteolin,	Flavone
6.	Betula pendula	Bark	Betulaceae	Quercetrin, kaempferol, myricetin	Flavonol
7.	Butea monospermea	Dried seeds, fruits,	Fabaceae	Genistein, prunetine	Isoflavone
8.	Bauhinia monandra	Bark	Fabaceae	Quercetin	Flavonol
9.	Brysonima crassa	Leaves	Malphigaceae	Quercetin-pyranoside	Flavonol
10.	Glycyrrhiza glabra	root, stolon	Leguminosae	Liquiritin, isoliquiritin, liquritigenin	Flavone
11.	Cannabis sativa	Flowering tops	Cannabaceae	Orientin, luteolin,	Flavone
12.	Citrus medica	Seeds	Rutaceae	Hesperidin, naringin	Flavanone

II. CONCLUSION

Flavonoids are group of biological active compounds, found abundantly in plant kingdom and dietary intake. These compounds are gaining interest due to their wide variants and number of members. These are reported to be effective in pathogenesis of majority of diseases. Antioxidant activity is the foundation of many actions which lead to its beneficial effects in majority of the diseases. Commercially flavanoids are marketed under the name of Flavedone, Daflon, and CVP.

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Spectrophotometric Methods for Determination of Azithromycin in Tablet Formulation

Balram
Institute of Pharmaceutical Sciences
Kurukshetra University
Haryana, India

Gurvirender Singh
Institute of Pharmaceutical Sciences
Kurukshetra University
Haryana, India

Samita Narwal
Guru Govind Singh College of Pharmcy
Yamunanagar, Haryana, India

Santosh Kumar Verma
CT Institute of Pharmaceutical Sciences
Jalandhar, Punjab, India

Abstract-Three simple, economical, precise and reproducible visible spectrophotmetric methods have been developed for the estimation of azithromycin in tablet formulation. The developed methods are based on the formation of chloroform extractable complex of azithromycin with bromocresol green, bromophenol blue and zincon GR in double distilled water. The complex with bromocresol green shows absorbance maxima at 414.5 nm and linearity in the concentration range of 50-300 µg/ml. The extracted complex with bromophenol blue shows absorbance maxima at 415.0 nm and the linearity in the concentration range of 25-200 µg/ml. The complex with zincon GR shows absorbance maxima at 434.0 nm and linearity in the concentration range of 20-150 µg/ml. Results of analysis for both the methods were validated statistically and by recovery studies.

Keywords- Azithromycin; visible spectrophotometry; quantitative estimation; bromocresol green; bromophenol blue, zincon GR.

I. INRODUCTION

Azithromycin, chemically (2R, 3S, 4R, 5R, 8R, 10R, 11R, 12S, 13S, 14R) – 13 - [(2, 6 -dideoxy-3 – C – methyl – 3 – O – methyl – a – L – ribo - hexopyranosyl) oxy] – 2 – ethyl - 3, 4, 10 – trihydroxy - 3, 5, 6, 8, 10, 12, 14 – heptamethyl – 11 - [[3, 4, 6 – trideoxy – 3 -(dimethylamino) – β – D - xylo hexopyranosyl] oxy]- 1 – oxa – 6 – azacyclopentadecan -15 – one, is an anti-bacterial agent [1]. It produces anti-bacterial effect by competitively inhibiting the bacterial protein synthesis by binding to 50S ribosomal subunit. It is official in BP [2], USP [3] and IP [4] which describes liquid chromatographic method for its quantitation. Literature survey reveals one flow injection chemiluminescence method [5], one spectrofluorimetric method [6] and four liquid chromatographic methods [7, 10] has been developed for estimation of azithromycin in tablet formulation. The objective of the present investigation was to develop simple, accurate and economical spectrophotometric methods for quantitation of azithromycin in tablet formulation. Shimadzu UV 1700, UV/Vis double beam spectrophotometer with spectral band width of 1 nm, wavelength accuracy of ± 0.3 nm and 1.0 cm matched quartz cells was used for analytical method development. All the chemicals and reagent used were of analytical grade. Bromocresol green (Loba Chemie, Mumbai) reagent, bromophenol blue (Loba Chemie, Mumbai) reagent and zincon GR ((Loba Chemie, Mumbai) were prepared in double distilled water. All the reagents were extracted several times with chloroform so as to remove chloroform soluble impurities. Tablet formulations of azithromycin [Azifast, Azibact (Ipca Labs Ltd., Dehradun)] were procured from local pharmacy. Standard solution of azithromycin was prepared by dissolving 50 mg in 100 ml of 0.1N HCl to give stock solution of concentration 500 µg/ml of drug.

II. MATERIAL AND METHODS

A. Procedure for preparation of calibration curve

For method I, in a series of 10 ml volumetric flask, aliquots of standard drug solution (500 µg/ml) in 0.1N HCl were transferred and diluted with same so as to give several dilutions in concentration range of 50-300 µg/ml of azithromycin. To 5 ml of each dilution taken in a separating funnel, 5 ml of bromocresol green (0.1 % w/v) reagent and 5 ml of chloroform was added. Reaction mixture was shaken gently for 5 min and allowed to stand so as to separate aqueous and chloroform layer. The chloroform layer was separated out and absorbance maxima measured at 414.5 nm (Fig. I) against a reagent blank. Calibration curve (Fig. I) was plotted between concentration of azithromycin and measured absorbance. Spectral characteristics of azithromycin are given in Table I. For method II, in a series of 10 ml volumetric flask, aliquots of standard drug solution (500 µg/ml) in 0.1N HCl were transferred and diluted with same so as to give several dilutions in concentration range of 25-200 µg/ml of azithromycin. To 5 ml of each dilution taken in a separating funnel, 5 ml of bromophenol blue reagent (0.2 % w/v) and 5 ml of chloroform was added. Reaction mixture was shaken gently for 5 min and allowed to stand so as to separate aqueous and chloroform layer. The chloroform layer was separated out and absorbance maxima measured at 415.0 nm (Fig. II) against a reagent blank. Calibration curve (Fig. II) was plotted between concentration of azithromycin and measured absorbance. Spectral characteristics of azithromycin are given in Table I. For method II, in a series of 10 ml volumetric flask, aliquots of standard drug solution (500 µg/ml) in 0.1N HCl were transferred and diluted with same so as to give several dilutions in concentration range of 20-150 µg/ml of azithromycin. To 5 ml of each dilution taken in a separating funnel, 5 ml of zincon GR reagent (0.1 % w/v) and 5 ml of chloroform was added. Reaction mixture was shaken gently for 5 min and allowed to stand so as to separate aqueous and chloroform layer. The chloroform layer was separated out and absorbance maxima measured at 434.0 nm (Fig. III) against a reagent blank. Calibration curve (Fig. III) was plotted between concentration of azithromycin and

measured absorbance. Spectral characteristics of azithromycin are given in Table I.

B. Procedure for Analysis of Tablet Formulation

For analysis of tablet formulation 20 tablets (250 mg, 500 mg) of azithromycin were weighed accurately and finely powdered. An accurately weighed powdered sample 50 mg of azithromycin was taken in a 100 ml volumetric flask containing 40 ml of 0.1N HCl, sonicated for 10 min. The resultant was filtered through Whatman filter paper no. 41 into another 100 ml volumetric flask. The filter paper was washed several times with 0.1N HCl. The washings were added to the filtrate and final volume was made up to the mark with 0.1N HCl. For method I, 3 ml of filtrate of the sample solution was diluted to 10 ml with 0.1N HCl. These were treated as per the procedure for preparation of calibration curve and amount of the drug present in sample was computed from respective calibration curve. For method II, 2.0 ml of filtrate of the sample solution was diluted to 10 ml with 0.1N HCl. These were treated as per the procedure for preparation of calibration curve and amount of the drug present in sample was computed from respective calibration curve. For method III, 2.0 ml of filtrate of the sample solution was diluted to 10 ml with 0.1N HCl. These were treated as per the procedure for preparation of calibration curve and amount of the drug present in sample was computed from respective calibration curve. The procedure of analysis from tablet formulations for both the methods was repeated five times with two different tablet formulations and results are reported in Table II.

C. Recovery Studies

Recovery studies were carried out for both the developed methods by addition of known amount of standard drug solution of azithromycin to pre-analyzed tablet sample solution at three different concentration levels. The resulting solutions were analyzed by proposed methods. The recovery was in the range of 100.35-100.98 % for Method I, 99.15-100.18 % for Method II and 100.03-100.61 % for Method III. The results of recovery studies are reported in Table II.

III. RESULT AND DISCUSSION

These proposed methods were found to be simple, accurate, economical and rapid. Recovery studies were found close to 100 % that indicates accuracy and precision of the proposed methods. The statistical analysis was carried out and results of which were found satisfactory. Standard deviation values were found low that indicated reproducibility of the proposed methods. It was observed that excipients did not interfere in the determination of azithromycin. Hence these developed methods could be used for routine estimation of azithromycin from tablet formulations.

TABLE I: SPECTRAL CHARACTERISTICS OF AZITHROMYCIN

PARAMETERS	METHOD I	METHOD II	METHOD III
λ max	414.5 nm	415.0 nm	434.0 nm
Beer's law limit (μg/ml)	50-300 μg/ml	25-200 μg/ml	20-150 μg/ml
Regression equation* ($y = a + bc$)	$y = 0.2302 +$ 0.0035c	$y = 0.1282 +$ 0.0098c	$y = 0.1288 +$ 0.0093c
Slope (b)	0.0035	0.0098	0.0093
Intercept (a)	0.2302	0.1282	0.1288
Correlation coefficient(R^2)	0.9993	0.9993	0.9993

* $y = a + bc$, where c is the concentration in μg/ml, y is the absorbance unit of five replicate samples and b is the slope of line equation.

TABLE II: RESULTS ANALYSIS AND RECOVERY STUDIES OF COMMERCIAL FORMULATIONS OF AZITHROMYCIN

METHOD	FORMULATION	LABEL CLAIM (mg/tab)	% LABEL CLAIM*	% RECOVERY**	SD
I	Azifast	250	99.73	100.98	0.578
	Azibact	500	99.77	100.35	0.314
II	Azifast	250	99.96	100.18	0.123
	Azibact	500	99.59	99.15	0.358
III	Azifast	250	99.84	100.61	0.217
	Azibact	500	99.59	100.03	0.176

* Average of five determinations.
** Average of determinations at three different concentration levels
SD- Standard Deviation
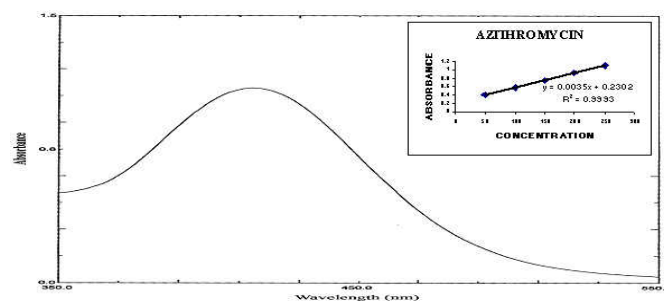
Figure I: UV spectra of azithromycin with bromo cresol green reagent (Spectra and calibration curve of Azithromycin using Method I)
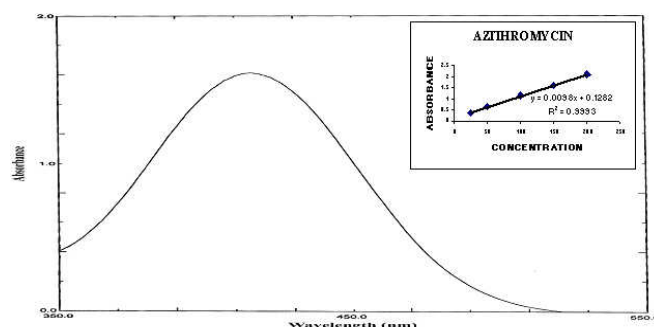
Figure II: UV spectra of azithromycin with bromo phenol blue reagent (Spectra and calibration curve of Azithromycin using Method II)
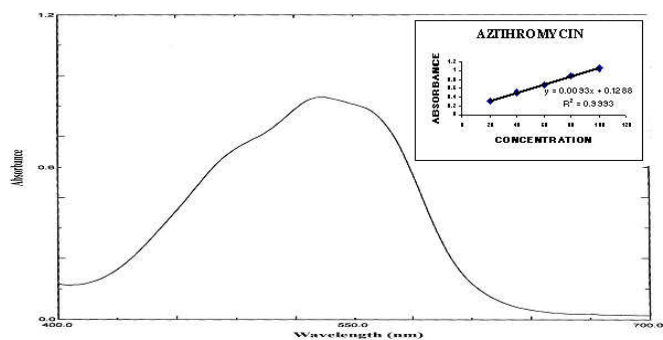
Figure III: UV spectra of azithromycin with zincon GR reagent
(Spectra and calibration curve of Azithromycin using Method III)

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Track 3

Technical Session : 4

Pharmacology

Antiurolithiatic Potential of Parmelia Perlata Extract against AMPH Crystals

Parveen Kumar Goyal
Hindu College of Pharmacy
Sonepat, Haryana
parveen.k.goyal@gmail.com

Santosh Kumar Verma
CT Institute of Pharmaceutical Sciences
Shahpur, Jalandhar, Punjab

Anil Kumar Sharma
CT Institute of Pharmaceutical Sciences
Shahpur, Jalandhar, Punjab

Abstract— The present study belongs to the inhibitory effect of Parmelia perlata (Parmeliaceae) extract against AMPH (Ammonium Magnesium Phosphate Hexahydrate) i.e. struvite crystals which are mainly produced due to UTI with urea splitting micro-organisms and usually form staghorn-calculi which are highly painful conditions. Materials and Methods: Single diffusion gel growth technique was used to form struvite crystals. For setting gel, sodium metasilicate (specific gravity 1.05) and 0.5 M ammonium dihydrogen phosphate aqueous solutions were mixed and pH of the mixture was set at 7.0. Equal amounts of supernatant solution of 1.0 M magnesium acetate prepared with 0.0%, 0.75%, 1.5%, 3.0% and 4.5% concentrations of extract were gently poured on set gels in aseptic medium. The growth of crystals in gel media was monitored. Results & Conclusion inhibition of AMPH crystals growth in the gel media was increased along with the concentration of extract hence it can be used as antiurolithiatic drug.

Keywords—Anti-urolithiatic; Parmelia perlata; AMPH crystals; Staghorn-calcul; Gel growth technique

I. INTRODUCTION

Urolithiasis or urinary stone, presence of one or more calculi in urinary tract, is a serious debilitating problem throughout the world, affecting approximately 12% of population. It is a recurrent renal disease which affects about 4-8% population in UK, 15% in US, 20% in Gulf countries and 11% in India. It is more prevalent between the ages of 20 to 40 in both sexes [1, 2]. The risk of developing urolithiasis in adults appears to be 5-9% in Europe, 12% in Canada, and 13-15% in USA and 1-5% in eastern hemisphere. The highest risks have been reported in some Asian countries such as Saudi Arabia (20.1%) with lifetime recurrence rates upto 50% [3].The interval between recurrences is variable, with approximately 10% within one year, 35% in five years, and 50% by 10 years [4, 5]. Pathogenesis of Urolithiasis is multi-factorial, strongly related to dietary habits and lifestyle practices. It requires supersaturated urine that depends on urinary pH, solute concentration and complexation. Urine supersaturation is then followed by nucleation, growth, aggregation and crystal retention [6, 7]. Usually the renal calculi are composed of the crystals of calcium oxalate i.e. CaOx monohydrate (Whewellite) and/or CaOx dihydrate (Weddelite), calcium hydroxyl phosphate (Brushite), basic calcium phosphate (Apatite), ammonium magnesium phosphate hexahydrate (Struvite), uric acid and cystine [8, 10].

AMPH i.e. ammonium magnesium phosphate hexahydrate also known as struvite or triple phosphate or urase or infection stones which constitute about 30% of all kidney stones and formed in humans by urinary tract infection associated with ureolithic microorganisms usually of Proteus species that split urea in to ammonia and carbon dioxide. Ammonia is then hydrolysed to ammonium ions and increases the urinary pH producing persistently alkaline urine. This increased urinary pH reduces the solubility of magnesium ammonium phosphate and stimulate precipitation of struvite crystals. For struvite crystal formation usually three conditions i.e. alkaline urine, presence of urea or ammonia and higher concentration of minerals in urine should coexist. AMPH stones may grow rapidly and if not properly treated, can develop into branched calculus or staghorn that covers entire renal pelvis and calyces leading to 50% chances of renal failure [11, 13]. In modern system of medicine, treatment of urolithiasis depends on size and location of stones. Stones, larger tahn 5mm or that fail to pass through urinary tract, are treated by surgical procedures like Percutaneous Nephrolithotomy (PNL), Ureteroscopy (URS), Extracorporeal Shock Wave Lithotripsy (ESWL) etc that are costly for common man with quite high recurreance and the patient has also to be subjected to careful follow up for many years. Actually there is no satisfactory drug in modern system of medicine which can be used in clinical therapy to dissolve stones or prevention of stone formation or recurrence and the physicians have to depend on alternative system of medicine for better relief [14, 15].

In alternative system of medicine, many remedies have been employed during ages to treat urinary stone and most of these have originated from plant. These remedies have proved to be quite useful though rationale behind their use is not well established through systematic pharmacological and clinical studies except for some composite herbal formulations and few individual plants.

In light of the above discussion and in the interest of society, we considered it worth to study the antiurolithiatic profile Parmelia perlata (PP) against struvite stones. Parmelia perlata (family: Parmeliaceae) is a lichen which is commonly known as 'stone flowers' and 'chharila' in India. It is usually used as a spice to enhance the taste and flavour of the foods. It is useful to treat sores, boils, inflammations, seminal weakness, amenorrhoea etc [16]. It also has been used as an important component of multi-composite herbal formulations for urolithiasis but lacking scientific evidences.

II. MATERIALS AND METHODS

A). Chemicals

Sodium metasilicate (SMS), ammonium dihydrogen phosphate, magnesium acetate and all other chemicals of analytical grade were obtained from qualigens fine chemicals.

B). Plant materials

The authenticated dried thalli of lichen Parmelia perlata were procured from Aimil Pharmaceuticals (India) Ltd., New Delhi.

C). Extraction:

The dried thalli were cleaned, coarsely powdered and hydro-alcoholic extract was prepared using soxhlet's apparatus. The extract was concentrated in a rotary vacuum evaporator to a syrupy mass and then dried to constant weight at 45-50°C in hot air oven. The dried extract was stored in air-tight container in a refrigerator.

D). Single diffusion gel growth technique

Aqueous sodium metasilicate solution (SMS) of specific gravity 1.05 was used to prepare the gel. An aqueous solution of Ammonium Dihydrogen Phosphate (0.5M) was mixed with SMS solution in appropriate ammount so that pH value becomes 7.0 for the mixture. The 20 ml gel solution was transferred to autoclaved (120°C for 15 min) test tubes of 140 mm length and 25 mm diameter. After gelation, 20 ml supernatant solutions of pure 1.0 M magnesium acetate (without inhibitor) and 1.0 M magnesium acetate prepared with 0.75% (0.15 g PP extract in 20 ml solution), 1.5% (0.30 g PP extract in 20 ml solution), 3.0% (0.60 g PP extract in 20 ml solution) and 4.5% (0.90 g PP extract in 20 ml solution) concentration of PP extract (with inhibitor) were gently poured on the set gels in test tubes to study the growth inhibition of AMPH crystals. To avoid the microbial contamination whole procedure was carried out in aseptic conditions using laminar air flow chamber. After pouring supernatant solution, the test tubes were airtightly capped. The apparent lengths of growing/dissolving crystals in each test tubes were regularly measured for atleast fifteen days and mean length was calculated. All of the experimental procedures were performed in duplicate [17].

E). Data Analysis

All the data was analysed by one way ANOVA using Graphpad software demo version and level of significance was considered 0.05.

III. RESULTS AND DISCUSSION

The single diffusion gel growth technique was used to grow AMPH crystals as it provides the simplified in-vitro

model of the highly complex growth of in-vivo urinary calculi. In this technique, the SMS gel acts as a 'three dimensional crucible' which supports the crystal growth without exerting major forces upon it. The silica hydro-gel was preferred because it remained stable and did not react with aqueous solution and crystals formed. Crystal growth occurs due to reaction between two solutions in a gel medium or achieving super-saturation by slow diffusion in gel medium. Slow and controlled diffusion of reactants in gels can mimic the conditions of urolithiasis in human body [17]. Biocrystallization or biomineralization usually occurs in the slow and steady process in the soft tissues. The main advantage of this technique is that the crystals can be observed practically in all stages of their growth.

It was observed that AMPH crystals of different shape were obtained. At gel liquid interface elongated dendritic type (figure 1) and in the core of gel prismatic and rectangular platelet type (figure 2) crystals were obtained in all the test tubes. Figure 3 shows the photographs of grown crystals in gel medium. The maximum length of AMPH crystals at gel liquid interface was observed 9.6 mm in control group while it was 9.1 mm for 0.75%, 8.0 mm for 1.5%, 5.8 mm for 3.0% and 4.3 mm for 4.5% PP extract group which shows that as the concentration of PP extract in supernatant solution was increased from 0.0% to 4.5%, the mean length of grown crystals was decreased. As shown in figure 4, it was noticed that initially the growth of crystals was increased for first five days in case of without inhibitors while it was increased for first three days in case of PP extract and then start dissolving. Due to comparatively high concentration of reactants at gel liquid interface, a direct reaction may take place which results in elongated dendritic type crystals.

Fig. 1. AMPH crystals at gel liquid interface
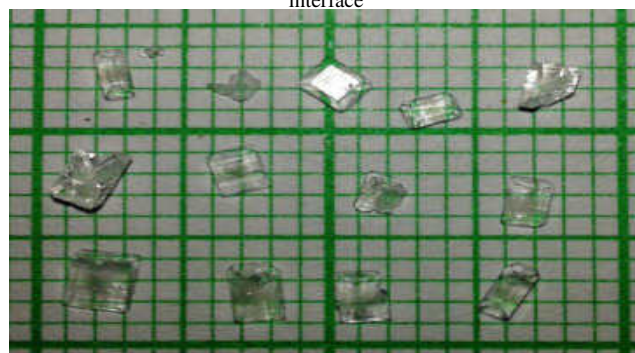
Fig. 2. AMPH Crystals in core of the gel
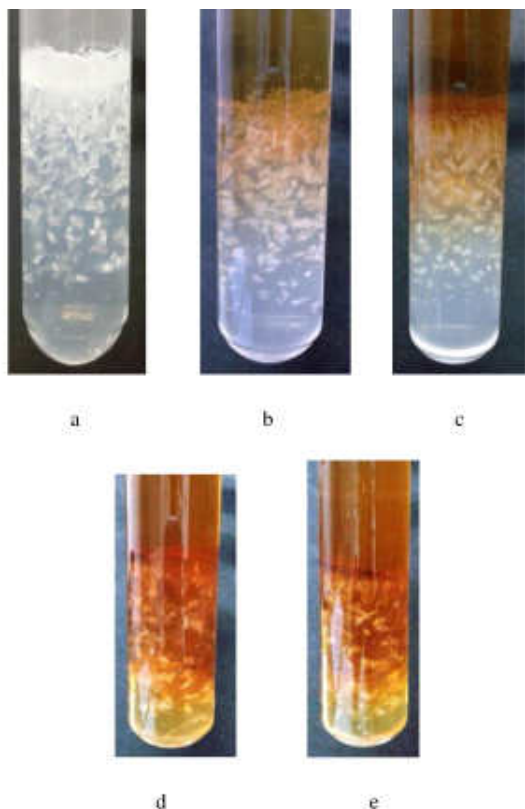
Fig. 3. AMPH crystals in gel media
(a- control, b- 0.75%, c- 1.5%, d- 3.0%, e- 4.5%)
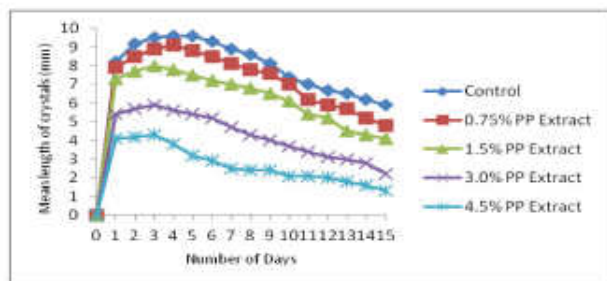
Fig. 4. Growth and dissolution of AMPH crystals at gel liquid interface

IV. CONCOLUSION

It was also found that grown AMPH crystals dissolved to some extent at the gel-liquid interface even in the absence of inhibitor. It may be due to dissolution in acetic acid which is probably formed due to the chemical reaction between ammonium dihydrogen phosphate and magnesium acetate (Chauhan et al. 2009). But it is observed that the dissolution becomes faster in the presence of PP extract. The dissolution of AMPH crystals was increased along the concentration of extract and maximum was observed for 4.5% solution. Conclusively, the lichen Parmelia perlata significantly inhibited the growth of ammonium magnesium phosphate crystals and also stimulated the dissolution of crystals hence can be further explored for in-vivo study and antiurolithiatic potential against other types of stone like oxalate, uric acid, cystine, brushite etc for both in-vitro and in-vivo study.

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Effect of Ganoderma Lucidum on β-Amyloid Level in Rat Brain

Santosh Kumar Verma
Deptt. of Pharmacology
CT Institute of Pharmaceutical Sciences,
Jalandhar, India
Verma2us@gmail.com

Birendra Shrivastava
Deptt. of Pharmacology
Seedling School of Pharmaceutical Sciences,
Jaipur, India

ABSTRACT:-Alzheimer's disease (AD) pathogenesis is to be driven by the production and deposition of the misfolded oligomeric form of β-amyloid peptide (Aβ) within the patient brain resulting from the enzyme amyloid precursor protein (APP), and these amyloid plaques are noxious to nerve cells. For the confirmation of the pathogenesis of the disease and effect of the treatment were evaluated by an immunosorbent that recognize normal as well as misfolded oligomeric form of Amyloid beta within the rat brain preparation in the intra-cerebroventricular induced Streptozotocine (ICV-STZ) rats treated with extracts of G. lucidum showed significant improvement with respect to ICV-STZ control group and sham, sham+aCSF & vehicle treated groups after the treatment.

Key words: Alzheimer's disease, Amyloid beta, G. lucidum

I. INTRODUCTION

AD is a chronic and progressive condition that results from loss of the maintenance of neurons involved in cognitive, emotional, motor and sensory functions of the patient [1]. It results in progressive impairment in memory, judgment, decision making, and orientation to physical surroundings and language. Amyloid beta (Aβ) deposits as amyloid plaques [2], [3] are a one of the prominent cause of progression the disease. Aβ fragments are produced when APP has been cut. It accumulates as microscopic amyloid plaques that are considered as one of the hallmark of brains affected by AD. The pieces first form small clusters called oligomers, possibly toroidal or star-shaped with a central channel [4] that may induce apoptosis by physically piercing the cell membrane [5]. The final stage is plaques, which contain clumps of beta-sheets and other substances and these disrupt brain cells by clogging points of cell-to-cell communication and it activating immune cells that trigger inflammation and devour disabled cells and ultimately killing cells.

Mutation of the amyloid precursor protein (APP), presenilin-1, or presenilin-2 results in the development of early onset autosomal dominant forms of Alzheimer disease (AD) [6]. These mutations lead to an increased Aβ42/Aβ40 ratio that correlates with the onset of disease.

In the present study, estimation of Aβ42/Aβ40 ratio in treatment groups of ICV induced STZ in rats for the evaluation of therapeutic potential of test drugs.

II. MATERIAL AND METHODS

A). Plant Material

Reishi Gano (RG) was brought from DXN, Malaysia, [imported & marketed by Daehsan Trading (India) Pvt. Ltd.] and prepare their different fractionations with solvents as per their polarity.Preparations of different fractions as follows: Petroleum Ether extracts (RGPEt); Chloroform extract (RGCH); Hydro alcoholic extract (RGHA) and Hot Water extracts (RGHW) respectively.

B). Animals Material

The experimental animals are 8-10 month old male wistar rats (220-250gm body weight) obtained from Animal House Facility of S.D. College of Pharmacy, Muzaffarnagar (U.P.) and housed in a separate room of the Animal House in polyacrylic cages (38 × 2 3 × 10 cm) and maintained under standards husbandry conditions (room temperature 22±2°C and relative humidity of 60-65%) with natural dark and light cycle. Animals were kept not more than 4 in each cage; divided into 12 groups having 7 animals in each. The food in the form of dry pallets and water were made available ad libitum. All procedures described were reviewed and approved by the Institutional Animal Ethical Committee (IAEC) and the animal experiments were carried out in accordance with the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) guidelines for use and care of animas.

III. METHOD TO INDUCE ALZHEIMER'S DISEASE

This model for the AD had been based on the oxidative stress and the mitochondrial enzyme dysfunctions, which lead to nerve fiber degeneration in the brain [7], [8]. Male wistar rats weighing 220-250 g were anaesthetized with ketamine (100mg/kg, ip) and xylazine (5 mg/kg, ip). The head was placed in position in the stereotaxic apparatus and a midline saggital incision was made in the scalp. Two holes were drilled through the skull for placement of injection cannulae into the lateral cerebral ventricles using following coordinates: 0.8 mm posterior to bregma; 1.5 mm lateral to saggital suture; 3.6 mm ventral from the surface of the brain. STZ was dissolved in citrate buffer (pH 4.4)] and slowly injected (1 μl/min) using Hamilton microsyringe in a volume of 10 μl into each cerebral ventricle (bilateral ICV) on day 1 and 3 [6].

Animals are divided into 12 different groups (n=7) and receive treatment as per their prescribed schedules according to their group. Group I is called Sham or SH control group and the Group II is called sham+aCSF control group in which the rats were injected ICV on day 1 and 3 with artificial CSF or aCSF instead of STZ. The Group III, i.e. STZ control or negative control group, treated with the vehicle; 1% gum acacia, for 21 days. The sham and vehicle control groups were run parallel to the drug treated groups.

In the next four groups (Group IV-VII), also called STZ test groups, in which rats were treated with RGHW (1000 mg/kg, p.o.), RGHA (1000 mg/kg, p.o.), RGCH (1000 mg/kg, p.o.) and RGPEt (1000 mg/ kg, p.o.) after ICV injection (day 1 and 3) of STZ. Extracts of G. lucidum were suspended in 1% gum acacia and administered. These were administered every day using an Oral Dosing Cannula, also called Feeding Needle (8g x 160mm) starting from day of 1st STZ ICV injection to day 21. On the day of the STZ ICV injections (day 1 and day 3), extracts of G. lucidum were administered before the ICV injection.

Another four groups (Group IX-XII) of the normal test groups of animals (Per Se) or, positive test groups; were treated parallel with RGHW (1000 mg/kg, p.o.), RGHA (1000 mg/kg, p.o.), RGCH (1000 mg/kg, p.o.) and RGPEt (1000 mg/ kg, p.o.) from day 1 to day 21.

A). β-Amyloid (1-40 and 1-42) estimation:

With the help of BetaMark Total Beta Amyloid ELISA kit Catalog No.: SIG-38966-kit from COVANCE, imported and supplied by Sumit Biosciences Pvt Ltd., Mumbai (India). Brain Sample preparation and Total Beta Amyloid ELISA procedure were carried out according to the kit protocol provided with this BetaMark Total Beta Amyloid ELISA kit (SIG-38966-kit). All the necessary chemicals and solutions were provided with this kit.

IV. RESULT AND DISCUSSION

The quantitative measurement of $A\beta_{40}$ and $A\beta_{42}$ levels in brain was performed with Total amyloid beta ELISA kit. The change in luminance was measured immediately with luminescence plate reader. The $A\beta_{40}$ and $A\beta_{42}$ levels in the supernatant were expressed as Pg/m.

The levels of $A\beta_{40}$ and $A\beta_{42}$ significantly in ICV STZ injected rats as compared to those of sham control, sham+aCSF and vehicle treated rats ($P < 0.001$). But the treatment of these animals with G. lucidum extracts, such as RGHW, RGHA, RGCH and RGPEt significantly decreased $A\beta_{42}$ levels as compared with those of ICV STZ injected control rats
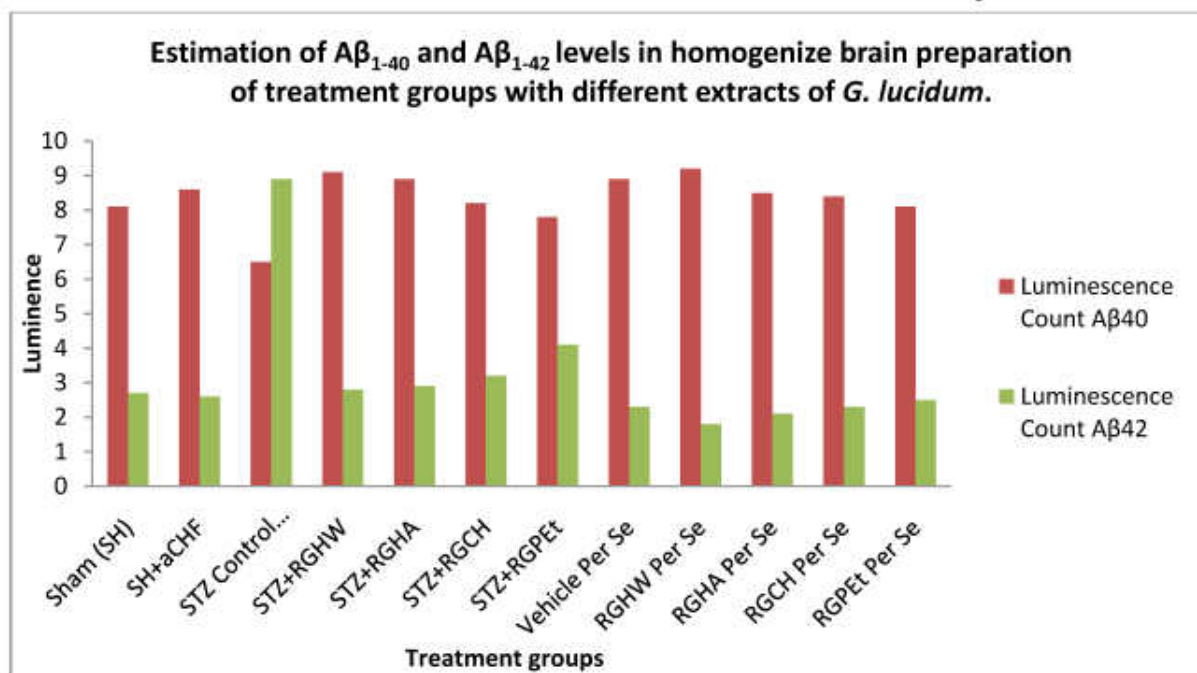
Figure 1: Estimation of $A\beta_{1-40}$ and $A\beta_{1-42}$ levels in homogenize brain preparation of treatment groups with different extracts of G. lucidum.

[STZ control=8.9 vs. STZ+RGHW, STZ+RGHA, STZ+RGCH & STZ+RGPEt=2.8, 2.9. 3.2 & 4.1 respectively; $P < 0.001$].RGHW Per Se, RGHA Per Se, RGCH Per Se & RGPEt Per Se treatments in normal rats having normal $A\beta_{40}$ and $A\beta_{42}$ levels which remained similar to those of sham control, sham+aCSF and vehicle treated groups ($P > 0.05$, Table 6.14, Figure 6.9).

Significant value with ANOVA analysis for the decrease in $A\beta_{42}$ level shown between the ICV

STZ induced extracts treated groups were found to be the STZ+RGHW and STZ+RGHA had been better result than STZ+RGCH and STZ+RGPEt, treatment groups.

Presence of the increased level of $A\beta_{42}$ confirm the pathogenesis of AD; but in treatment groups; ICV STZ control group shown the increased level of $A\beta_{42}$ levels then the other groups and it was found to be significantly decreases in the extract treated ICV STZ groups.

V. CONCLUSION

For the biochemical estimation in the homogenized brain preparation, Aβ level were assayed with the help of BetaMark Total Beta Amyloid ELISA kit. The ICV STZ control group had been shown the increase in the insoluble $A\beta_{42}$ level in the brain, which is significant feature for the pathogenesis for the AD. In other treatment groups, such as treatment with extracts of G. lucidum to ICV STZ induced rat and other control groups, $A\beta_{42}$ were significantly lower with respect of ICV STZ group. It shows the effectiveness of the extract on the pathogenesis of the diseased condition.

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Opuntia Ficus Indica Attenuates 3-Nitropropionic Acid Induced Huntington's Disease in Rats

Manpreet Kaur
Department of Pharmacology
Rayat Institute of Pharmacy, Railmajra
SBS Nagar, Punjab, India
mannblaggan7@gmail.com

Ramica Sharma
Department of Pharmacology
Rayat Institute of Pharmacy, Railmajra
SBS Nagar, Punjab, India

***Abstract*: The present study has been designed to investigate the effect of Methanolic extract of *Opuntia ficus Indica* (MEOFI) in 3-NP-induced Huntington's disease (HD) in rats. HD was induced by administration of 3-NP in rats for 7 days. MEOFI was administered to rats 3 days prior to administration of 3-NP and continued for 7 days. Various behavioral and biochemical parameters were evaluated to explore the neuroprotective effect of MEOFI. Administration of 3-NP (20 mg/kg for 7 days; i.p.) caused a decline in motor function (locomotor and rotarod activity). Pretreatment with MEOFI (100 and 200 mg/kg) dose-dependently improved 3-NP-induced behavioral and biochemical, (P<0.005). Biochemical analysis revealed that systemic 3-NP administration significantly increased lipid peroxidation and nitric oxide and acetylcholiestrease level, prior administration of MEOFI (100 and 200 mg/kg p.o.) dose-dependently restored biochemical alterations induced by chronic 3-NP treatment (P<0.005). Results of study suggest that MEOFI (pretreatment) significantly improved motor coordination and and also protected the brain from oxidative stress induced by 3-NP, that indicated its possible role as neuroprotective in HD and other neurodegenerative disorders.**

Key word; Huntington's disease, 3-NP, Opuntia ficus indica, oxidative stress, motor activity

I.   INTRODUCTION

Huntington's disease (HD) is an inherited neurodegenerative and neuroinflammatory disease caused by abnormal length of repeated section of huntingtin (htt) protein [1, 2, 3]. In HD neurodegenration was characterized by degeneration of the basal ganglia, particularly loss of γ-amino butyric acid (GABAergic) in cerebral cortex [1, 4]. 3-Nitropropionic acid (3-NP) is a mitochondrial toxin that causes striatal neuropathy through the secondary activation of glutamate receptors similar to seen in clinical HD [5, 6]. 3-NP produce by the fungus Arthrinium spp. has been documented to decreased levels of ATP leads to excitotoxicity and increased free radical production leads to neuronal cell death [7, 8]. There is no cure for HD but various synthetic drugs are available that provide only sympatomatic treatment and has various side effects. So, this research has been designed to explore such herbal drugs in the management of HD that possess fewer side effects but more therapeutic efficacy. *Opuntia ficus indica* commonly named as Cactus. It has been reported to possess various constituents like flavonol 3-O-glycosides (quercetin, kaempferol, and isorhamnetin), dihydroflavonols, flavonones, and flavanonol [9, 10, 11]. Clinically, *Opuntia ficus indica* has been reported to possess anti-carcinogenic activity anti-inflammatory, antiulcer, hepatoprotective activity, and antioxidant property [9, 12].

Still no evidences are available which indicate role of *Opuntia ficus indica* on 3-NP induce HD. Thus the present study has been designed to explore the effect of *Opuntia ficus indica*. It may be beneficial to use this plant for 3-NP induces HD.

II.   MATERIAL AND METHOD

A). Animals

The experimental protocol used in the present study was approved carried out as per the guidelines of CPCSEA. Wistar rats weighing about 150–200 g were used for the present study.

B). Plant material

Opuntia ficus indica (cactus) obtained from Cactus botanical garden Punchkula. Plant material was identified and authenticated from National Institute of Science Communication and Information Resources (Ref. NISCARE/RHMD/Consult/- 2011- 12/ 1885/185), New Delhi.

C). Experimental protocol

Six groups were employed in the present study and each group comprised of 6 rats. The MEOFI dissolved in distilled water. 3-NP was dissolved in normal saline. *Group I* (Normal Control): Rats were maintained on standard food and water and no treatment was given**.** *Group II* (3-NP Control): Rats were administered 3-NP (20mg/kg, i.p.) For 7 day *Group III:* (*perse group* I): Rats were treated with MEOFI (100 mg/kg/day, p.o.). *Group IV: (perse group* II): Rats were treated with Rats were treated with MEOFI (200 mg/kg/day, p.o.). *Group V:* (pre-treatment group I): Rats were treated with MEOFI (100mg/kg; p.o) and the treatment was started 3 days before dose of 3-NP (20mg/kg, i.p.) and was continued for 7 days along with 3-NP. *Group VI:* (pre-treatment group II): MEOFI (200mg/kg; p.o) was administered to rats as mentioned in Group V.

1). Behavior assessments:

- *Morris water maze: [7].*
- *Assessment of Locomotor activity:*
- *Rota Rod Activity:*
- *Elevated plus maze:*

Another paradigm to assess memory dysfunction is elevated plus maze, Retention latency was noted again on the 7th day [7]

$$\text{Memory retention \%} = \frac{\text{Transfer latency (6th day} - \text{7th day)}}{\text{(Transfer latency 6th day)}} \times 100$$

3). Biochemical Analysis: On 7th day 24 hrs after 3-NP treatment, for the biochemical analysis, animals were scarified by decapitation immediately after behavioral assessment [8].

- *Preparation of homogenate*
- *Measurement of lipid peroxidation:*
- *Estimation of Acetylcholinesterase (AChE):*
- *Estimation of nitrite:*
- *Estimation of reduced glutathione (GSH):*
- *Protein estimation:*

III. RESULT

The pretreatment with methanolic extract of *Opuntia ficus indica* (MEOFI) (100 mg and 200 mg/kg, p.o.) *per se* to normal rats did not produce any significant effect on behavior parameters biochemical *Behaviour Study.*

A). Effect of MEOFI on locomotor activity in Rats
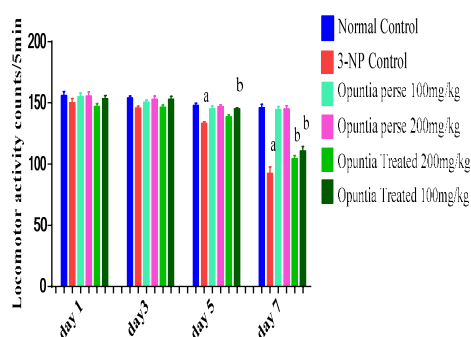
Fig:1. Effect of MEOFI (100mg/kg and 200mg/kg) on locomotor activity in actophotometer apparatus in 3-NP treated rats. Values are mean ±S.E.M. a = p<0.05 vs Normal Control, b= p<0.05 vs 3- NP treated group

B). Effect of MEOFI on muscle grip strength in Rota rod
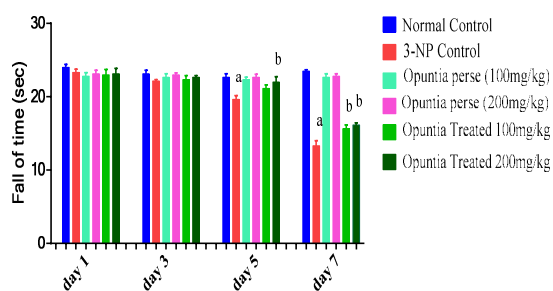
Fig. 2: Effect of MEOFI (100mg/kg and 200mg/kg) on fall off time (sec) in rota-rod apparatus in 3-NP (20 mg/kg, i.p. 7 days) treated rats. Values are mean ±S.E.M. a = P<0.05 vs. Normal control, b= P<0.05 vs. 3-NP treated group.

C). Effect of MEOFI on Morris water maze
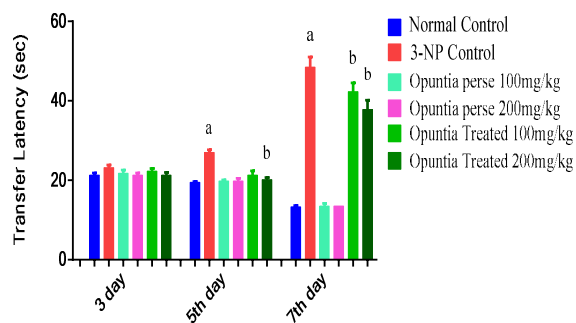
D). BIOCHEMICAL ESTIMATIONS

TABLE 1: Effect of MEOFI on various parameters of 3-NP-induced Rats

Parameters	Normal Control	3-NP Control	*perse*		MEOFI	
					100mg/ kg/p.o.	200 mg/kg /p.o.
Lipid per oxidation (nmoles/mg protein)	6.11±0. 629	12.43±1. 002***	6.02± 0.195 5	6.14 5±0. 283 6	9.728± 0.293*	7.21± 0.362 ***
Nitrate (µmol/mg protein)	0.359± 0.0178	0.578±0. 041***	0.348 ±0.01 77	0.34 ±0.0 77	0.475± 0.011* *	0.440 ±0.01 0***
Reduced glutathione (µmol/mg protein)	1.452± 0.181	0.202.03 49***	1.40± 0.645	1.41 ±0.0 56	0.57±0. 033*	0.945 ±0.01 2***
AchE level (µmol/mg protein/min)	5.411± 0.39	9.656±0. 171***	5.355 ±0.32 1	5.45 1±0. 182	8.47±0. 220**	8.058 ±0.19 57***

Values are expressed as mean ± SEM. 3-NP control was compared with Normal control. MEOFI treated groups were compared with d3-NP control (diseased group).* p<0.05; ** p<0.001; ***p<0.001; ns= non significant

IV. CONCLUSION

The above findings thus suggest that *Opuntia ficus indica* may offer a safer therapeutic approach to the treatment of Huntigton's disease. Also *Opuntia ficus indica* being a neuroprotectant, could be used as an effective adjunct with the drugs used in the management of HD

ACKNOWLEDGEMENT

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Effect of Cyclosporine-A and Verapamil as P-gp Inhibitors on Bioavailability of Candesartan Cilexetil

Gurvirender Singh
Institute of Pharmaceutical
Sciences
Kurukshetra University
Haryana, India

Smita Narwal
Institute of Pharmaceutical
Sciences
Kurukshetra University
Haryana, India

Balram
Institute of Pharmaceutical
Sciences
Kurukshetra University
Haryana, India

Santosh Kumar Verma
CT Institute of Pharmaceutical
Sciences
Jalandhar, Punjab, India

Abstract: The purpose of this activity was to explore the intestinal absorption mechanism of candesartan cilexetil and to attempt to improve the bioavailability of the drug through modulation of its intestinal absorption using two enhancers (Cyclosporine-A and Verapamil). For antihypertensive study, two-kidney, one-clip (2K1C) Goldblatt model is used. Male wistar rats having weight 200-250g were assigned into six groups of 6 animals each. Rats were anesthetized by means of injection of sodium pentobarbital (50 mg/kg i.p). Under antiseptic conditions, the left renal artery was exposed through a retroperitoneal flank. A silver clip was placed around the left renal artery, causing stenosis. After four hours the animal became hypertensive, and when the platue in blood pressure was obtained animal was given the dose after checking the mean arterial blood pressure. It was concluded from pharmacological evaluation that P-gp inhibitors enhanced intestinal permeability and hence, bioavailability of Candesartan Cilexetil.

Keywords: Candesartan Cilexetil, P-gp, Verapamil, hypertention, goldblatt

I.   INTRODUCTION

High blood pressure (HBP) or hypertension means high pressure (tension) in the arteries. Arteries are vessels that carry blood from the pumping heart to all the tissues and organs of the body. Persistent hypertension is one of the risk factors for stroke, myocardial infarction, heart failure and arterial aneurysm, and is a leading cause of chronic kidney failure.[1] Normal blood pressure is below 120/80; blood pressure between 120/80 and 139/89 is called "pre-hypertension", and hypertension is considered to be present when a person's systolic blood pressure is consistently 140 mm Hg or more, and/or their diastolic blood pressure is consistently 90 mm Hg or more[2]. The pioneering work of Goldblatt[3] introduced the first animal model of The direct and indirect effects of the increased circulating ANG II concentrations along with the resultant increases in aldosterone production and the ANG II-dependent increases in the activity of the sympathetic nervous system contribute to the impaired excretory capability of the nonclipped kidney [5][6]. Most of the intestinal efflux activities have been attributed to P-glycoprotein (P-gp). P-glycoprotein (P-gp) is an energy-dependant efflux pump associated with the multidrug resistance in tumor cells,but also expressed in a variety of normal human tissues including liver, brain, kidney and the gastrointestinal tract [7].At the intestinal level, P-gp is located on the apical membrane of the mature intestinal cells and acts as a pump that transports drugs back into the lumen as they are absorbed across the intestinal mucosa[8][9].There is currently considerable interest in intestinal P-gp and the central role it plays in limiting the oral bioavailability of a wide class of drugs. Studies on different In-vitro models have shown that the cardiac glycoside digoxin is a substrate of P-gp in the intestine [10], and these observations have been confirmed in vivo using mice lacking the MDR 1-type P-glycoproteins.

II.   MATERIAL AND METHOD

A). Chemicals

Candesartan Cilexetil was supplied by Jubilant Organosys Ltd. (R & D, batch no. Cst/0706001), Verapamil was gift sample from Lupin Labs. Ltd., (pune, India) and Cyclosporine-A from Lotus International, Mumbai. All the chemicals used were of analytical grade chemicals. Carboxy methyl cellulose was purchased from LOBA CHEMIE Pvt. Ltd. Mumbai

B). Experimental Animals

Male Wistar rats (200-300g) of either sex were purchased from Disease free animal house, Chaudhary Charan Singh Haryana Agriculture University, Hisar. They were housed in polypropylene cages in a controlled room temperature 22±1°C and relative humidity of 60–70%. They were kept under standard conditions of 12/12 h light and dark cycle. The animals were maintained with standard pellet diet and water ad libitum. The animals were acclimatized to laboratory condition for seven days before commencement of experiment. All studies were carried out using 3 parts of small intestine a rat in each group. Ethical clearance was obtained from Institutional Animal Ethical Committee (IAEC).

C). Antihypertensive activity

Animals were randomly assigned into six groups of 6 animals each. Animals in normal control and negative control groups received distilled water. Three formulations were made in carboxy methyl cellulose for the three treated group i.e. CC group given only oral dose of Candesartan Cilexetil 2mg/kg/day, CC + CsA group were given Candesartan Cilexetil 2mg/kg/day along with P-gp inhibitor used that was Cyclosporine-A 5mg/kg/day[11], CC = V group were given Candesartan Cilexetil 2mg/kg/day along with other P-gp inhibitor verapamil 2mg/kg/day [12]. One very intriguing experimental model of hypertension, two-kidney, one-clip (2K1C) Goldblatt model [13] was used in which hypertension is induced by unilateral stenosis of the renal artery [6][14][15].Induction of unilateral renal arterial stenosis and renovascular hypertension occurs. Male wistar

rats having weight 200-250g were taken [16]. Rats were anesthetized by means of injection of sodium pentobarbital 50 mg/kg. Body temperature was maintained at 37° C with a heating module and blanket. A silver clip with an internal diameter of 0.23 mm was placed around the left renal artery, causing stenosis. The renal artery was occluded for the 4 h [17], and when the platue in blood pressure was obtained clip was removed. Mean arterial blood pressure (MABP) was measured by using Biopac instrument.

D). Statistical Analysis

The results are expressed as the mean± SEM for each group. Statistical differences were evaluated using a oneway analysis of variance (ANOVA) followed by Dunnett´s test. Results were considered to be statistically significant at p<0.05.

III. RESULTS

There was a difference in results between the different groups. Normal control group was neither treated nor clipped whereas negative control animals were clipped but only vehicle was administered to them. In sham-operated group animals only surgery was done in order to evaluate any rise in blood pressure due to surgery. Animals treated with candesartan cilexetil (2mg/kg/day) along with verapamil (2mg/kg/day) as P-gp inhibitor showed better results than animal group treated with candesartan cilexetil (2mg/kg/day) along with cyclosporine-A (5mg/kg/day) as P-gp inhibitor, but the later gives better result than candesartan cilexetil alone. Biopac System NIBP 200A instrument was used for blood pressure measurement, to obtain better results four readings were taken every time.
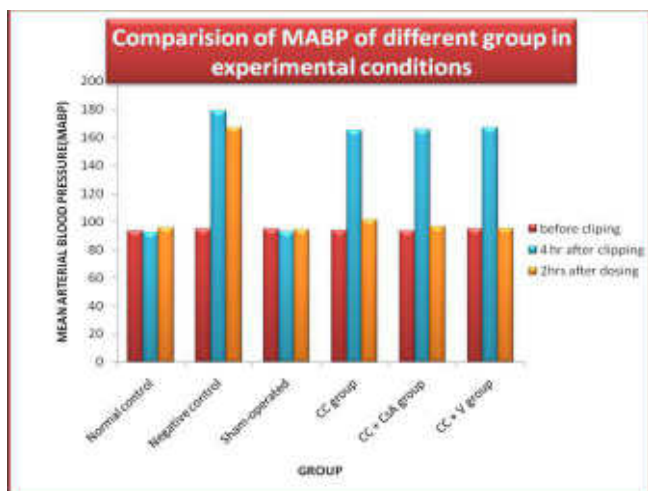
Fig. 1 Comparison of MABP of different group

Table1: Results of animal activity of Candesartan Cilexetil and CC having P-gp inhibitors

Sr. No.	Animal group used.(n=6)	Treatment (mg/kg)	Mean arterial blood pressure before clipping.	Mean arterial blood pressure of clipped rat after 4hr	Mean arterial blood pressure after dosing
1	Normal control	Vehicle	93.2 ± 0.489	92.4 ± 0.748	95.6±0.678
2	Negative control	Vehicle	94.6 ± 0.674	179.2 ± 0.45	167±1.378
3	Sham-operated	Vehicle	94.8 ± 0.583	92.8 ± 0.86	94.2±0.97
4	CC group	CC(2mg)	93.6 ± 0.678	165.2 ± 1.463	101.4±0.24
5	CC + CsA group	CC(2mg) +CsA(5mg)	93.4 ± 0.509	165.6 ± 1.249	96.6±0.98
6	CC + V group	CC(2mg) + Verapamil(2mg)	94.6 ± 0.67	167 ± 1.378	95.4±0.249

IV. CONCLUSION

Present study revealed the better antihypertensive activity of Candesartan Cilexetil if used along with P-gp inhibitors. The occlusion of renal artery upto 4 hour, leads to cause kidney ischemia. Ischemia of the kidneys causes elevation of blood pressure by activation of the renin-angiotensin system. The procedure can be used for acute and chronic hypertension. Acute renal hypertension can be induced in rats, by clamping the left renal artery for 4 h. After reopening of the vessel, accumulated renin is released into circulation. Renin acts on angiotensinogen (renin substrate), an α2- globulin to release the decapeptide angiotensin I. This decapeptide is cleaved by angiotensin converting enzyme (ACE) to yield the active angiotensin II (octapeptide) which is a potent vasoconstrictor leading to hypertension. Angiotensin II undergoes hydrolysis by an aminopeptidase to yield the heptapeptide angiotensin III which is also active. Further cleavage yields to peptides with little activity. The protease renin catalyzes the first and rate-limiting step in the formation of angiotensin II leading to acute hypertension. The test is used to evaluate antihypertensive activities of drug along with P-gp inhibitors. The results of Sham-operated group showed that there was no effect of surgery on the animals used, and the results of use of P-gp inhibitors showed an increase in bioavailability due to inhibition of P-gp's.

V. ACKNOWLEDGEMENT

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Effect of Trigonella Foenum Graecum on Sodium Nitrite Induced Amnesia in Mice

Smita Narwal
Institute of Pharmaceutical Sciences,
Kurukshetra University
Haryana, India

Gurvirender Singh
Institute of Pharmaceutical Sciences,
Kurukshetra University
Haryana, India

Sumit Narwal
Rayat Institute of Pharmacy
S.B.S Nagar, Punjab, India

Santosh Kumar Verma
CT Institute of Pharmaceutical Sciences
Jalandhar, Punjab, India

Abstract: Trigonella foenum graecum plant is commonly used for its medicinal value throughout the world. The pharmacological property of Trigonella foenum graecum plant seeds are also used for various activities like antianxiety, antidiabetic etc. The present study has been designed to explore the effect of Trigonella foenum graecum in sodium nitrite (50 mg/kg) induced memory loss in rats. Sodium nitrite produces amnesia in rats within 5 days which can be assessed by measuring various behavioural parameters like Elevated Plus Maze (EPM) etc. Rats treated with Trigonella foenum graecum improves memory of rats which is indicated by improvement in antiamnesic activity in the behavioural parameter. Sodium nitrite treated group shows the decrease in transfer latency time. Pre treatment with Trigonella foenum graecum significantly improved EPM performance of sodium nitrite treated rats. The result indicates a marked effect in memory enhancement.

Keywords: Trigonella foenum Graecum, amnesia, sodium nitrite-induced amnesia, EPM.

I. INTRODUCTION

Amnesia is characterised by profound loss of memory in the presence of preserved cognitive abilities. Amygdala, hippocmpus and cortex are three mainly involved areas in learning and memory. Damage to hippocampus is found to be mainly involved in amnesia [1]. The various treatments are available for amnesia such as piracetam and many more, but they are associated with serious side effects and provided only symptomatic relief. So, WHO has encouraged studies for the treatment and prevention of amnesic disease based on traditional practice. Many plants have been available that possess antiamnesic activity and acted as memory enhancers such as allium sativum, bacopa Minerva, celastrus peniculatus, nicotiana tobaccum [2]. Literature review revealed that flavanoids, alkaloids, sesquiterpenes, diterpenes, terpenes and terpenoids are basically responsible for antiamnesic activity.

Trigonella foenum graecum Linn. is commonly known as fenugreek and belongs to the family leguminosae. It is one of the most widely used plants in various indigenous systems of medicine for the treatment of different ailments. The information available in the literature on the health benefits and pharmaceutical effects of Trigonella accounts for its known medicinal properties and adds new therapeutic effects in newer indications. Trigonella foenum-graecum with common name Methi in India is used in medicine to tonify kidneys, disperse cold and alleviate pain. The resarch on Trigonella exhibits its health benefits and potential medicinal properties in various indications and has little or no side effects, suggesting its pharmaceutical, therapeutic and nutritional potential. These seeds of herb when taken raw or toasted are a good remedy for hernia and pain in the groin. 2–3 g of raw fenugreek seeds early in the morning with warm water before brushing the teeth has healing effect on joint pains, without any side effects [3]. Other medicinal uses of Trigonella foenum-graecum include its use as anti ulcer [4 and 5], wound healing [6], CNS stimulant [7], immunomodulatory [8], antioxidant [9], antidiabetic [10, 11 and 12], anti-neoplastic [13], anti-inflammatory and anti-pyretic [14] drugs. Traditionally, the seeds of Trigonella foenum graecum are known to possess beneficial effects in memory enhancer, these claims have not been validated by any pharmacological study. Thus, the present study was undertaken to evaluate the anti-amnesic activity of aqueous extract of Trigonella foenum graecum seeds by using sodium nitrite-induced amnesia in rats.

II. MATERIALS AND METHODS

A). Animals

Wistar albino rats, of either sex weighing 150-180 g, were housed in polypropylene cages under standard light/dark cycle, with food and water provided ad libitum. The experiments were performed between 09:00-16:00 hrs. The experimental protocols were approved by the Institutional Animal Ethics Committee and conducted according to the guidelines of Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), New Delhi, India.

B). Procurement of Plant material

The plant material (seeds) was purchased from the Grocery store and was authenticated by Dr. B. D. Vashishta, Department of Botany, Kurukshetra University, Kurukshetra, India.

C). Preparation of Extract

The plant material (seeds) was dried and powdered to form a coarse powder, which was then extracted using the hot extraction method. The plant was extracted in hot water followed by evaporation under vacuum to give the resultant dry aqueous extract of Trigonella foenum graecum (AETFG).The yield of extract was 10%.This extract was then dissolved in distilled water and administered orally to the animals.

D). Phytochemical evaluation

Phytochemical evaluation of aqueous extract of Trigonella foenum graecum (AETFG) seeds was carried out as per standard methods. The presence of saponins was determined by froth test/ foam test; tannins by Lead acetate Test; flavonoids by Alkaline Reagent Test and Shinoda's Test, triterpenoids by salkowski test.

E). Methodology

1). Sodium nitrite induced amnesia:

The animals were divided into seven groups of six animals each. Group1 represented the control group that received the vehicle, 1% gum acacia (5ml/kg, p.o.). Group 2 represented the disease group in which rats were administerd sodium nitrite 50mg/kg i.p. Group three and group four represents per se group and receive AETFG 200mg/kg and 400mg/kg respectively. Group five and group six comprised of treatment group in which rats were treated with AETFG 200mg/kg and 400mg/kg p.o. respectively. The treatment is given for nine days before the inducer is administered. The inducer (SN 50mg/kg i.p.) is administered on 9th day of treatment. Group seven represents as standard group and receive piracetam 400mg/kg i.p.

2). Elevated Plus Maze Test

The training was given for one day to the animals before measuring the transfer latency (TL) time. The animals were left on the open arm and time taken to reach the closed arm (transfer latency time) is noted.

3). Statistical Evaluation

All the results are expressed as mean± standard deviation (S.D.) followed by one way ANOVA along with tukey's multiple comparison test. The $p < 0.05$ was considered to be statically significant. The data of behavioural results was statistically analysed by two-way ANOVA followed by tukey's multiple range test by using graph pad prism version-5.0 software.

III. RESULTS

A). Chemical analysis:

The results of the preliminary Photochemical screening of Trigonella foenum-graecum seeds have been presented in Table 1. It showed the presence of saponins, tannins, flavonoids, and triterpenoids.

TABLE 1. Phytochemical screening of Trigonella foenum-graecum extract

S.NO	TEST	PRESENT (+) /ABSENT (-)
1	Saponins	+
2	Tannins	+
3	Flavonoids	+
4	Triterpenoids	+

B). Effect of AETFG on sodium nitrite induced amnesia by using elevated plus-maze

Transfer latency (TL) on 9th day on elevated plus maze reflected learning behaviour of animals Whereas, TL of 10th day reflected retention of learning behaviour. It has been observed that there was a significant decrease in TL on 10th day i.e. after 24 hr of training on elevated plus-maze (Fig. 1)
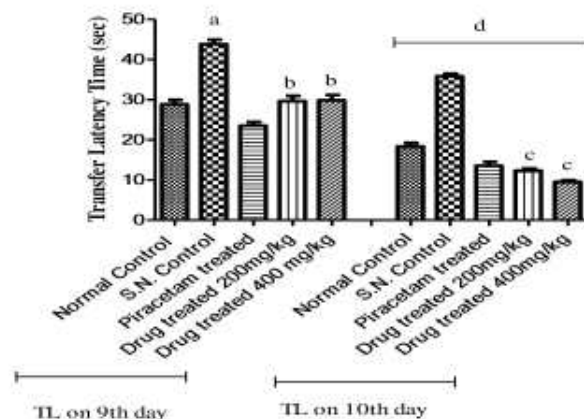
Fig. 1 Effect of aqueous extract of Trigonella foenum graecum (AETFG) on sodium nitrite induced amnesia. All values are represented as mean ± S.E.M. a = $p < 0.001$ vs Normal Control; b = $p < 0.001$ vs sodium nitrite Control; c = $p < 0.001$ vs sodium nitrite control after 24 hr.

IV. DISCUSSION

In the present study, for the first time report that standardized aqueous extract of the seeds of Trigonella foenum-graecum (TFG) showed significant anti-amnesic activities as assessed by behavioural test using Elevated plus maze (EPM) and sodium nitrite-induced amnesia models. Various herbal plant have been found to possess memory enhancing potentials like B. monniera [15] and Ginkgo biloba [16] including Ayurvedic preparations such as Anwala churna (E. officinalis). Hence we too explore the effect of Trigonella foenum graecum as memory enhancer. Transfer latency was disturbed in SN administered rats. In the plus maze test rat show natural aversion to open and high space and therefor spent more time in closed arm than the open arm. Sodium nitrite in the present study caused amnesia as observed by increased transfer latency in elevated plus maze suggested that transfer latency (time in which animal moves from open arm to closed arms) might be shortening transfer latency could be related to memory. Pre-treatment with Trigonella foenum-graecum (200 and 400 mg/kg) dose-dependently reversed SN induced amnesia as observed by increase in transfer latency. Piracetam also revered sodium nitrite-induced amnesia in agreement with earlier reports [17]. Thus it was suggested that our plant may possess memory enhancer property in amnesia which support its traditional use in folk medicine.

V. CONCLUSION

The study thus proved that the aqueous extract of Trigonella foenum-graecum seeds possesses significant anti-amnesic activity. This study though supports the traditional claims; further studies are required to carry out the identification of the proper constituents that are responsible for the anti-amnesic effect. In conclusion, it appears that the

extract of Trigonella foenum-graecum can be developed for use in the treatment of Memory loss.

VI. ACKNOWLEDGEMENT

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Neuroproteomic Study in Swiss Albino Mice Model of Epilepsy

Nisha Gupta
CT Institute of
Pharmaceutical Sciences,
Jalandhar, Punjab

Nidhi B. Agarwal
Jamia Hamdard University,
New Delhi, India

Santosh K Verma
CT Institute of
Pharmaceutical Sciences,
Jalandhar, Punjab

Anil Kumar Sharma
CT Institute of
Pharmaceutical Sciences,
Jalandhar, Punjab

Abstract: Biomarkers are measures of biological processes which would be excellent tools for monitoring epileptogenesis and the dynamics of increased seizure prediction. Kindling is the progressive induction of seizure activity by repeated and appropriately spaced, sub threshold stimuli, up to a stage of spontaneous seizures. For the present study we developed the PTZ (i.p.) induced kindling in mice of Group 1 (n=6) for 4 weeks.Group 2 (n=6) was given the normal saline (0.9% NaCl solution) at the dose of 5ml/kg of body weight. Epileptic mice exhibited significant increase of anxiety-related behavior in the open field and light-dark box, increased locomotor activity in the open field and decreased immobility in the forced swimming and tail suspension tests. However biochemical parameters significantly showed alterations in epileptic mice. The results of 1D gel electrophoresis showed some markers which can be further used for the 2D gel electrophoresis and MALDI analysis for the protein identification.

Keywords: Biomarkers, Epilepsy, PTZ, Gel Electrophoresis

I. INTRODUCTION

Epilepsy is defined as a condition characterized by recurrent (two or more) epileptic seizures, unprovoked by any immediate identified cause (1) In India it is estimated to have 60–80 lakhs of people with epilepsy. Incidence, prevalence and mortality studies provide crucial measures of the frequency and therefore the burden of the disease and allow the planning of services. Gel Electrophoresis (SDS-PAGE) has proven to be a powerful tool for profiling of protein expression. In this, proteins are extracted from cells or tissues and then separated according to their iso-electric points (PIs) in the first dimension and their molecular weights in the second dimension to generate protein profiles (2). Hundreds and thousands of proteins have been resolved on single two-dimensional slab gels. Two Dimensional (2D) Gel Electrophoresis was first described in 1969 and developed by Klose and O'Farrell. The most commonly used technique in proteomics is 2-D gel electrophoresis (2-DE). 2-D Sodium Dodecyl sulphate Polyacrylamide According to a study which was done in 1999, micro-channel based separations are very effective in iso-electric focusing of proteins. Micro-channel based SDS-capillary gel electrophoresis of proteins provides high speed and resolution. Direct comparison of protein expression to identify differentially expressed proteins between the cells from the diseased and normal tissue specimens is eminently possible and has been used to discover bio-markers for epilepsy(4).

II. MATERIALS AND METHODS

For the present experimental study, animals were divided into two groups namely Group 1 (n=6) was given Pentylenetertrazole (PTZ) and Group 2 (n=6) as vehicle treated. The drug was dissolved in normal saline (0.9% solution of NaCl) and was administered intraperitoneally, control rats received only the vehicle i.e. normal saline (0.9% solution of NaCl).The duration of the experiment was 43 days and the dose was selected on the basis of previous reports.A freshly prepared solution of PTZ was prepared in normal saline (0.9% NaCl) and was administered to Group 1 animals between 3:00 pm to 3:30 pm. The vehicle, normal saline (5 mL/kg, i.p.), was administered to (Group 2) control animals. The animals were subjected to various behavioral tests like open field test, forced swimming, tail suspension tests and Morris water maze test for studying locomotor activity and anxiolytic activity on animals due to the PTZ.The brain tissue homogenates were used for biochemical tests and 1 D gel electrophoresis.

III. CONCLUSION

The overall results of FST (3) were found to be a direct indication of hippocampal deficits in PTZ treated group. It is reported that increases in active responses, such as climbing or swimming, and reduction in immobility, are considered as behavioral profiles consistent with an antidepressant-like action. The water maze is usually seen as a hippocampal-dependent memory model. The time spent in target region by the PTZ treated animals is very less as compared to control group. In Morris water Maze test, the time spent on the platform by the PTZ treated animals is very less as compared to control group. Escape tendency and emotions was the factor behind the poor performance of PTZ treated animals. The TST is based on the observation that rodents (almost always mice although gerbils and rats have been used,After initial escape-oriented movements, develop an immobile posture when placed in an inescapable stressful situation. In the case of the TST the stressful situation involves the haemodynamic stress of being hung in an uncontrollable fashion by their tail. This test showed a significant decrease in immobility time in PTZ treated animals when compared to control group.The overall results of the open field test are as expected, when released into the open field, the control animals started moving along the walls, with their initial exploration being limited mostly to the peripheral squares; the inner squares were rarely explored. Therefore, peripheral square entry in control animals was high and

central square entry was low as compared to control. Total protein contents in the brains of PTZ treated group were found to be very high when compared to the control. However biochemical parameters significantly showed alterations in PTZ treated mice. Total protein content was much higher in the PTZ treated mice as compared to control. Results of 1D gel electrophoresis showed some markers which can be further used for the 2D gel electrophoresis and MALDI analysis for the protein identification.

IV. FUTURE PROSPECTS

Much knowledge is needed to understand why seizures happen in some patients or why they do not occur in other individuals with the same genetic mutation(5).Some biomarkers detect disease that manifest in seizures.Development of reliable biomarkers for epilepsy would be a major advance in the management of epilepsy.

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Evaluation of Antioxidant Potential of Hesperidine on Cyclophosphamide Induced Cellular Myocardial Oxidative Damage in Rats

Sunil Kumar
Department of Pharmaceutical Sciences
National Institute of Medical Sciences University,
Jaipur, India.
sunilak2813@gmail.com

Praveen Kumar
Faculty of Pharmacy
Moradabad Educational Trust, Group of Institutions,
Moradabad, Uttar Pradesh, India
praveensha77@gmail.com

Abstract-Our present experimentation was carried out to evaluate the efficacy of hesperidin (HDN) (100mg/kg body weight), administered orally for 7 days on cyclophosphamide (CP) elicited oxidative damage on rat heart. Cardiotoxicity inflicted by single intraperitoneal injection of CP (200mg/kg body weight) was manifested by exalted levels of SOD (superoxide dismutase), CAT (catalase), GPx (glutathione peroxidase) and GST (glutathione-s-transferase) in cardiac tissue. Levels of these enzymes attained normalcy as was observed in HDN protected rats. Thus result of our study is in concordance with the notion that HDN is adept in combating myocardial free radical damage provoked by CP thus proving its protective potential.

Keywords: Oxidative stress, Cardiotoxicity, Cyclophosphamide, Hesperidin, Antioxidants.

I. INTRODUCTION

Like most of the anticancer drugs, CP also causes various toxic effects, the commonest of which is the dose-dependent cardio toxicity that ultimately leads to acute and chronic heart failure [1]. Biotransformation of CP mediates through involvement of cyt p450 mixed function oxidases with the formation of metabolites phosphoramide mustard and acrolein which are highly toxic [2,3,4]. Thus, this is the principal pathway for CP disposition and it is intriguing to note that CP has potential to generate superfluous reactive oxygen species [5,6].

Due to the presence of less developed antioxidant defence mechanism, heart is particularly vulnerable to injury by reactive oxygen species as was explained plausible by previous studies. This facilitated the notion that CP also caused a significant decrease in heart weight / body weight ratio, which indicate loss of myofibrils and cytoplasmic vacuolization in myocytes [7,8] of cardiac tissue. To counteract these reactive turbinators, cell has recruited its own inbuilt antioxidant system. Antioxidants are molecules or compounds that play a role of free radical attenuator. These attach and inactivate the free radicals to retard the destruction performed by them. There are many examples of antioxidants such as SOD, GPx, GSH, sulfhydryl group, CoQ 10 and thioredoxin [9]. In the present investigation the potential of HDN was deeply evaluated in condition of oxidative stress and it was significantly observed that comparable amounts of free radicals were quenched by it.

II. MATERIALS AND METHODS

A. Drugs and chemicals

Cyclophosphamide (Ledoxan) was purchased from Dabur Pharma Limited, New Delhi, India. HDN was purchased from Sigma Aldrich Chemical Company, Bangalore, India. All other chemicals and solvents were of the highest purity and analytical grade.

B. Animals:

The study was conducted after obtaining prior permission according to the university and institutional legislation as regulated by the committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), Ministry of Social Justice and Empowerment, Government of India. Thus experiment was performed under defined guidelines laid down by the committee.

C. Experimental Protocol:

The experimental animals were randomizing into four groups of six rats each as follows:

Group I: Rats were given saline (1ml/kg b.wt.) as vehicle for 7 days, which served as control.
Group II: Rats were given intraperitoneal injection of CP (200mg/kg b.wt.) dissolved in saline, on the first day of the experimental period.
Group III: Rats received only HDN (100mg/kg b.wt.) orally for 7 days.
Group IV: Rats were administered with CP as in group II, and immediately supplemented with HDN intraperitoneally for 7 days. 7 days after the experimental period (i.e., on the 8th day), all the animals were anaesthetized and killed by decapitation. Cardiac tissues were excised and washed in ice-cold physiological saline.

D. Biochemical Estimations

1. Estimation of Antioxidant Enzymes

Superoxide dismutase was assayed following the method of [10]. Absorbance was measured at 480nm in a Shimadzu

UV spectrophotometer. The enzyme activity was expressed as units/min/100 mg protein. One unit of SOD activity is the amount of protein required to give 50% inhibition of epinephrine auto oxidation. The method of [11] was used to assess the activity of CAT. The activity of GST was assayed by the method of [12].The method was used to estimate the activity of GP_X[13].

E. Statistical Analysis

All the grouped data were statistically evaluated with Statistical Package for Social Sciences (SPSS), Version 7.5. Hypothesis testing methods included one way analysis of variance (ANOVA) followed by least significant difference (LSD) test. A 'P' value of less than 0.05 was considered to indicate statistical significance. All the results were expressed as mean + S.D. for six animals in each group.

III. RESULTS AND DISCUSSION

1. Effect of HDN on the level of cardiac tissue antioxidants

CP administered rats (group II) depicted lower levels of antioxidant enzymes (SOD, CAT, GPx and GST) in cardiac tissue when compared to (group I) control rats (Table 1). Administration of HDN in (group IV) CP+HDN treated rats significantly normalized the level of enzymes. Whereas only Hesperidin treated (group III) rats demonstrated non-significant difference with the control (group I) rats.

Table 1: Effect of Cyclophosphamide and Hesperidin on the activities of cardiac enzymic antioxidants

Groups	SOD (Units mg^{-1} protein)	CAT (μ moles H$_2$O$_2$ consumed min^{-1} mg^{-1} protein)	GPx (μ moles min^{-1} mg^{-1} protein)	GST (n moles min^{-1} mg^{-1} protein)
Group I (Control)	15.15 ± 02.16	30.09 ± 0.37	1.81 ± 0.01	0.85 ± 0.01
Group II (CP)	12.44 ± 01.06*[a]	16.83 ± 0.40*[a]	0.75 ± 0.02*[a]	0.44 ± 0.02*[a]
Group III (HDN)	15.23 ± 02.08 [NS]	30.40 ± 0.82 [NS]	1.85 ± 0.06 [NS]	0.83 ± 0.04 [NS]
Group IV (HDN+CP)	14.83 ± 01.02*[b]	26.10 ± 0.38*[b]	1.73 ± 0.01*[b]	0.63 ± 0.11*[b]

Results are expressed as mean +- S.D. for six rats. Comparisons are made between: [a]-group I and group II; [b]-group II and group IV. *Statistically significant (p < 0.05); NS – non significant

Cardio toxicity is cause by extensive range of anticancer agents, one of which is profoundly prescribed drug.Preceding explorations revealed that on increasing the dose of the drug there was a simultaneous augmentation in the toxicity caused by it[14].It is noteworthy from its pharmacokinetic profile that CP after ingestion converts into active metabolites, 4-OH-cyclophosphamide and aldophosphamide. Aldophosphamide, as assured primaly dissociates into phosphoramide mustard and acrolein, which is a toxic by product [15]. However, mechanisms causing deleterious cardiotoxicity by [16] are yet to be fully unveiled.

Cells possess their own inherent defence system. Scrutinized Studies demonstrated that increment in lipid peroxidation induces concomitant decline in the activities of cellular antioxidants. SOD, a prodigious cellular antioxidant, performs the procedure of producing hydrogen peroxide from superoxide radicals and is the only known enzyme that uses free radicals as a Substrate, however, it is itself down regulated by hydrogen peroxide. Previous colorimetric estimations suggested that CP markedly oppressed the activity of SOD [17]. HDN on the other hand elevated the level of this enzyme to normal status [18]. CAT executes function similar to SOD as it catalyzes the conversion of superoxide to hydrogen peroxide (H$_2$O$_2$) as corroborated by previous studies. Inhibition of CAT by CP is normalized by HDN as culminated by documented evidence. GSTs play an important role in the detoxification of toxic compounds however, depending on the properties of the substrate; bioactivation to toxic compounds has also been described by previous researches. CP administration has known to deplete the activity of this antioxidant enzyme via generating free radicals as delineated previously [19]. GPx is involved in the breakdown of hydrogen peroxide into water and oxygen which bespeaks about its antioxidant activity. It is worth taking notice that CP is a potent inhibitor of GPX [20]. Its activity was improved by subsequent administration of HDN. It is important that an enhanced SOD activity be followed up by increased activities of CAT and GSH to prevent accumulation of toxic H$_2$O$_2$. Enough evidence has been garnered for HDN proving to be effective antioxidant in CP mediated oxidative stress [21]. Thus concluding, the cardioprotective effect of hesperidin is probably related to its membrane stabilizing action and scavenging of free radicals generated by CP.

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Effect of Venlafaxine in Chronic Stress Induced Hypercholesterolemic Experimental Rats

Udit Narayan
Truba Institute of Pharmacy
Bhopal, M.P. India
uditnarayan33@gmail.com

Hemant Nagar
Truba Institute of Pharmacy
Bhopal, M.P. India

Nisha Gupta
CT Institute of Pharmaceutical Sciences
Jalandhar, Punjab, India

Santosh Kumar Verma
CT Institute of Pharmaceutical Sciences
Jalandhar, Punjab, India

Abstract: Stress is the physical or psychological stimulus that can produce mental tension or physiological reactions that may lead to illness."For this experimental study we took two drugs: Venlafaxine and Atorvastatin and albino rat were used for experiments. Various physical behavioral study parameters, serum biochemical parameters, glucose levels were determined. We found that during chronic stress various type of mediators released that maintain the homeostasis of our body system but during chronic unpredictable stress release of some mediators increases and some decreases which decrease the stress condition. There are two mediators which are mainly responsible for decreases stress related disorder and stress condition i.e. - glucocorticoids and nor epinephrine. Venlafaxine works by blocking the transporter "reuptake" proteins for key neurotransmitters affecting mood, thereby leaving more active neurotransmitters in the synapse. Atorvastatin showed comparative effect of serum lipid profile with venlafaxine.

Key words:- Stress, neurotransmitters, Venlafaxine.

I. INTRODUCTION

A. History of stress

The term stress originates from the indo–european root 'str', which has been historically associated with exertion of pressure. The modern synonym 'homeostasis', which means steady state, was coined by the American physiologist walter Cannon in the beginning of the 20th century, whereas the word 'stress' was first used with its current meaning and popularized by the Hungarian Canadian experimentalist Hans selye a few decades later. Both Cannon and selye employed Hooke's law of elasticity to heuristically and creatively extrapolate physical concepts into biology.

B. Definition of stress

The stress is generally considered as the functional adaptation of the organism in order to cope with a changing and challenging environment.[4] "A physical or psychological stimulus that can produce mental tension or physiological reactions that may lead to illness."

C. Type of stress

Chronic stress is a stressor that is ongoing for a long period of time. When chronic stress is experienced, our body is in a state of continuous physiological arousal. Normally, our body activates our fight-or-flight-response, and when the perceived stress is over our body returns to a state of homeostasis. When chronic stress is perceived, however, the body is in a continuous state of fight-or-flight response and never reaches a state of homeostasis. The physiological effects of chronic stress can negatively affect memory and learning.[10]

Acute stress is the reaction to an immediate threat, commonly known as the fight or flight response. The threat can be any situation that is experienced, even subconsciously or falsely, real or imaginary as a danger.

II. MATERIALS AND METHODS

A. Drug profile of Atorvastatin

1. Chemical Structure
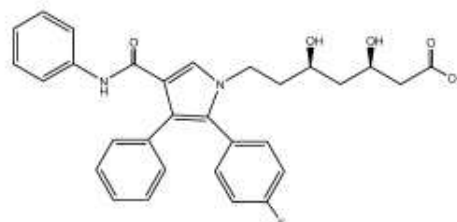
Chemical formula - C6H68CaF2NJ4O10
Mol. Wt. 1155.36

Atorvastatin Calcium is calcium salt of (βR,8R)-2-(4-fluorophenyl)-α,δ-dihydroxy-5-(1-methylethyl)-3-phenyl-4-[(phenylamino)carbonyl]-1H-pyrrole-1-heptanoic acid trihydrate.Atorvastatin Calcium contains not less than 98.0 per cent and not more than 102.0 per cent of C66H68 CaF2N4O10, calculated on the anhydrous basis.

B. Mechanisms of the action of statins

Dyslipidemia and hypercholesterolemia are controled by the liver. Hepatocytes take up from the circulation ~ 50% of LDL cholesterol. An increase in the activity of LDL receptor in hepatocytes could be an efficient method to decrease plasma LDL cholesterol level.

C. Inhibition of HMG CoA reductase

Statins target hepatocytes and inhibit HMG-CoA reductase, the enzyme that converts HMG-CoA into mevalonic acid, a cholesterol precursor. The statins do more than just compete with the normal substrate in the enzymes active site. They alter the conformation of the enzyme when they bind to its active site. This prevents HMG-CoA reductase from attaining a functional structure. The change in conformation at the active site makes these drugs very effective and specific.

D. Venlafaxine Hydrochloride

1. Chemical structure

Chemical formula - $C_{17}H_{27}NO_2, HCl$
Mol. Wt. - 313.9
1-[(1RS)-2-(Dimethylamino)-1-(4-ethoxyphenyl) ethyl] cyclohexanol hydrochloride.
Content - 99.0 per cent to 101.0 per cent (dried substance).

2. Grouping of animal and experimental procedure for chronic stress -

For the experiment the 36 healthy white albino rats of either sex which have body weight between 150-200 gms were taken from the animal house. Then they were grouped in six ways and each group contains 6 rats.Group 1. Albino rats of body weight 150-200 gm were taken and give vehicle only.Group 2. Albino rats of body weight 150-200 gm were taken and give vehicle + chronic stress.Group 3. Albino rats of body weight 150-200 gm were taken and give vehicle + chronic stress + high feed diet.Group 4. Albino rats of body weight 150-200 gm were taken and give vehicle + chronic stress + venlafaxine (20mg/kg/po). Group 5. Albino rats of body weight 150-200 gm were taken and give vehicle + chronic stress + venlafaxine (20 mg/ kg/ po) + high feed diet.Group 6. Albino rats of body weight 150-200 gm were taken and give vehicle + chronic stress + atorvastatin (10 mg/ kg/ po) + high feed diet. Physical behavioral study parameter studied are Elevated plus maze model for anxity activity and Locomotive activity. Serum biochemical parameters studied are TG (Triglycerides), TC (Total Cholesterols), HDL, LDL, VLDL and glucose levels.

III. OBSERVATION AND RESULTS:

A. Evaluation of serum cholesterol parameter

Table. 1 Effect of venlafaxine on chronic stress induced hypercholestremia

Grou p no.	Experimental Condition with animal	TC Mean±SEM	TG Mean ± SEM	HDL Mean ± SEM	LDL Mean ± SEM	VLDL Mean ± SEM
Group 1	Control animal	119.2±2.72	103.08±2.57	48±1.71	50.54±4.19	20.655±.478
Group 2	Stress	162.55±5.78 a***	138.67±3.19 a***	39.28±1.58 a**	96.18±5.86 a***	27.734±.6383 a***
Group 3	Stress + high feed diet	180.47±4.05 a***	147.30±2.60 a***	37.37±.54 a***	114.01±4.389 a***	29.087±.8807 a***
Group 4	Stress + venlafaxine	147.65±2.00 a**,c**	133.75±1.61 a***,c*	41.20±1.22 a*	76.25±3.88 a*,c**	26.861±.2398 a***
Group 5	Stress + venlafaxine + high feed diet	157.77±6.24 a***,c*	142±1.476 a***	39.29±.54 a**	89.94±7.01 a**,c*	28.524±.2893 a***
Group 6	Stress + atorvastatin + high feed diet	139.95±2.79 a*, b*,c***	130.72±1.68 a***,c**	41.44±1.36 a*	72.36±3.01 b*,c***	26.144±.3376 a***,c*
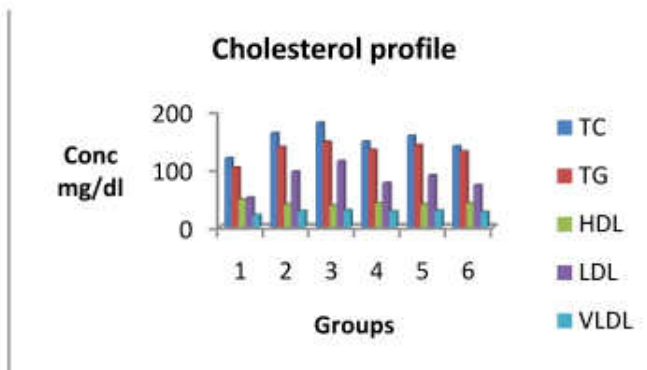
Graph. 1- Effect of venlafaxine on chronic stress induced hypercholestrem

B. Evaluation of locomoter activity

TABLE. 2- Effect of venlafaxine on locomoter activity by Actophotometer

Group no.	Experimental Condition with animal	No of crossing Mean ± SEM
Group 1	Control animal	196.66 ± 8.41
Group 2	Stress	116.33±9.49, a*
Group 3	Stress + high feed diet	125±18.14
Group 4	Stress + venlafaxine	216.66±29.07, b**,c*
Group 5	Stress + venlafaxine + high feed diet	144.33±5.45
Group 6	Stress + atorvastatin + high feed diet	193.33±10.83, c*
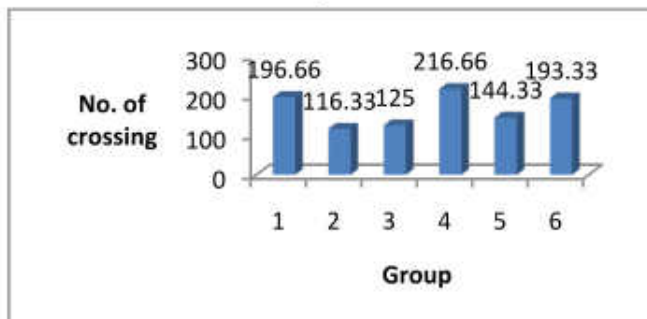
Graph. 2- Effect of venlafaxine on chronic stress induced hypercholestremia

C. Evaluation of behavioral activity

TABLE. 3- Effect of venlafaxine on behavioral activity by Elevated Plus Maze Model

Group no.	Experimental Condition with animal	No of entries in open arm Mean ± SEM	Time duration in open arm Mean ± SEM
Group 1	Control animal	4.66±1.20	19.33 ±8.253
Group 2	Stress	0±0, a*	0 ±0
Group 3	Stress + high feed diet	1.33±0.88	2.66 ±1.76
Group 4	Stress + venlafaxine	3.66±0.88	11.33 ±3.52

| Group 5 | Stress + venlafaxine + high feed diet | 2.33±0.33 | 14.0 ±8.08 |
| Group 6 | Stress + atorvastatin + high feed diet | 1.33±0.88 | 7.0 ±2.08 |

The data were analyzed by one way ANOVA followed by Tukey multiple comparisons Test.
Each values represents the mean ± SEM; n=6, *p<0.05, **p<0.01, ***p<0.001
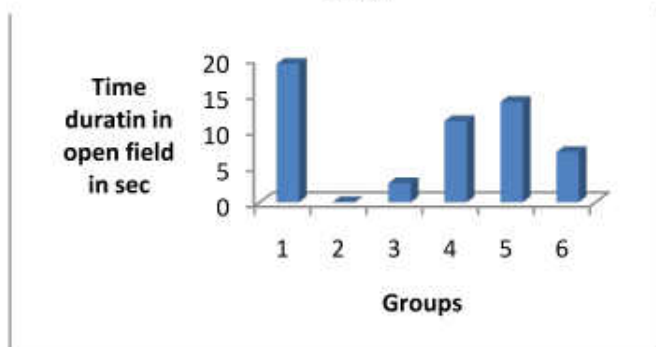
Graph. 3- Effect of venlafaxine on behavioral activity by Elevated Plus Maze Model

D. Evaluation of glucose profile

TABLE. 4- Effect venlafaxine on blood glucose level glucometer

Group no.	Experimental Condition	Glucose (mg/dl), Mean ± SEM
Group 1	Control animal	78.66 ± 2.33
Group 2	Stress	100.33 ± 1.20, a***
Group 3	Stress + high feed diet	100 ±4.39, a***
Group 4	Stress + venlafaxine	75±1.15, b***,c***
Group 5	Stress + venlafaxine + high feed diet	92±2.08, a**,d***
Group 6	Stress + atorvastatin + high feed diet	98±1.00, a***,d***

The data were analyzed by one way ANOVA followed by Tukey multiple comparisons Test.
Each values represents the mean ± SEM; n=6, *p<0.05, **p<0.01, ***p<0.001
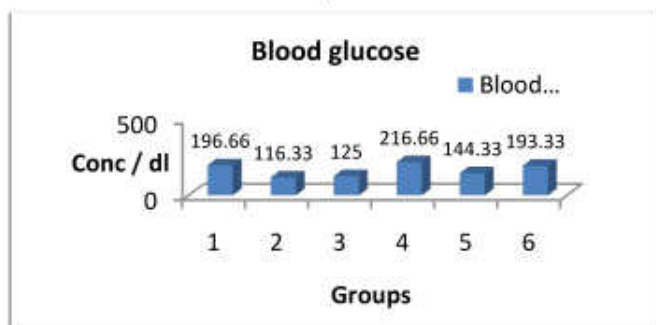
Graph. 4- Effect venlafaxine on blood glucose level glucometer

IV. CONCLUSION

Synthetic remedies have been investigated for centuries for a wide variety of ailments. Venlafaxine has received special attention for its beneficial effect, but until recently there has been little scientific support for its theraruptic and pharmacological properties. In the present study venlafaxine was selected to screen for its hypolipidemic activity in chronic stress induced hyperlipidemia in rats. Atorvastatin has choosen for comperative data of cholesterol with venlafaxine.

The present study was designed to investigate the hypolipidemic activity of venlafaxine in chronic stress induced hyperlipidemia. In this study firstly I have to choose this drug because it having antistress activity after that study was divided in to six groups. Then I gave the vehicle for first group, stress for 2nd group, stress and high feed diet for 3rd group, stress and venlafaxine for 4th group, stress and venlafaxine and high feed diet for 5th group, stress and atorvastatin and high feed diet for 6th group. After the end of experimental period of 15 day blood was withdrawn from retro orbit eye plexus of rat under ether anaesthesia as per CPCSEA guideline and then centrifuged at 2000 rpm for 30 min so at to get serum. After obtaining blood serum various biochemical Serum parameter as total cholesterol, triglycerides, HDL, LDL and VLDL was estimate by using span diagnostic kit. In this study we finally conclude that venlafaxine at the dose of 20mg/kg have significant hypolipidemic activity. But in stress and high feed diet group of venlafaxine has less significant than stress and venlafaxine treated group and venlafaxine treat stress induced hyperlipidemia. In comparision of venlafaxine have less hypolipidemic activity than atorvastatin.

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Anti-Inflammatory Activity of Alcoholic Extract of Ipomoea Carnea JACQ

Rajnish Kumar Singh
Dept. of Pharmacy
Moradabad Educational Trust
Group of Institution,
Moradabad, Uttar Pradesh,
India.
rajnishsingh4u@gmail.com

Praveen Kumar
Dept. of Pharmacy
Moradabad Educational
Trust
Group of Institution,
Moradabad, Uttar Pradesh,
India.

Vaibhav Rathod
Dept. of Pharmacy
Moradabad Educational
Trust
Group of Institution,
Moradabad, Uttar Pradesh,
India.

Rajan Kaushik
Dept. of Pharmacy
Moradabad Educational
Trust
Group of Institution,
Moradabad, Uttar
Pradesh, India.

Abstract: A wide range of parts of the medicinal plant is used for extract as raw drugs and they possess varied medicinal properties. The aim of present study was to assess the anti-inflammatory activity of alcoholic extracts of Ipomoea carnea leaves. Inflammatory diseases including different types of rheumatic diseases are very common throughout the world. Therefore, the search for a better tolerated anti-inflammatory agent appears to be a necessity. Ipomoea carnea is used for the treatment of aphrodisiac, purgative, cathartic and skin disease in India. Anti-inflammatory activity was screened by carrageenan (0.1%) induced rat paw edema method. The mature green leaves of Ipomoea carnea were collected and authenticated. For screening of anti-inflammatory activity, the extracts were administered orally at a dose of 250 mg/kg and 500 mg/kg body weight. Animals were divided into six groups of 6 animals each. Group 1 served as control and group 2 as reference standard (Etoricoxib 6 mg/kg), group 3 and 4 animals were treated with 250 mg/kg and 500 mg/kg alcoholic extract respectively. Paw volume was significantly (p<0.01) reduced in test treated groups (500 mg/kg body weight) as compared to control group. Present study revealed that the plant Ipomoea carnea leaves possesses a significant anti-inflammatory activity as evidences in Carrageenan induced paw edema method.

Key words- Inflammatory disease, Ipomoea carnea leaves, Alcoholic extract, Etoricoxib, Paw edema method, Carrageenan.

I. INTRODUCTION

Ipomoea carnea (Convolvulaceae) commonly called as Beshram, Behaya, Morning glory, Behayo. Ipomoea carnea which is glory species grows to a height of 6m on terrestrial land, but shorter in the aquatic habitats. Ipomoea carnea is widely distributed throughout the India, West Pakistan and Srilanka [1]. The leaf is simple, alternate, exstipulate and petiolate. Petiole is cylindrical, attains 4.0-7.5cm length and 2.5-3.0mm diameter[2]. Its ash is used for the treatment of skin disease. The milky juice of this plant is used for the treatment of leucoderma. It is used for the treatment of polluted tanks[3]. Inflammatory diseases including different types of rheumatic diseases are very common throughout the world. Therefore, the search for a better tolerated anti-inflammatory agent appears to be a necessity. The leaves of Ipomoea carnea said to have central nervous system depressant activity and also possess sedative-hypnotic and muscle relaxant properties[4]. Carrageenan is a sulphated mucopolysaccharide extracted from the seaweeds Chondrus spp. and Gigartina spp,

commonly known as Irish moss or carrageen moss. It has been used in the rat for inflammation models: foot pad inflammation or paw edema model.

II. MATERIAL AND METHODS

A. Plant material:

The plant Ipomoea carnea is widely found throughout India. The plant herbarium specimen was identified and authenticated by Mr. P. G. Diwakar, Joint Director, Botanical Survey of India, Western circle-7, Koregaon Road, Pune -1 on dated 11/01/2011, Voucher No. RASICA4. The leaves were dried in shade at room temperature. The dried leaves were coarsely powdered, stored in airtight container until used and packed in soxhlet apparatus. Extraction of leaves of Ipomoea carnea was carried out by using soxhlet apparatus. Polar solvent petroleum ether, chloroform, ethanol and water were used according to the polarity.

B. Experimental animals:

Healthy albino Wistar rats of age between 10-15 weeks of either sex were used after approval of the institutional ethics committee. The animals were maintained at a temperature controlled, well ventilated animal room for a period of 7 days prior to the experimental period. They were kept on standard pellet diet and water ad libitum. Surgical procedures on animals were done under strict aseptic conditions, under light ether anesthesia.

C. Acute toxicity study:

Alcoholic extracts of Ipomoea carnea leaves were studied for acute toxicity at doses of 5mg/kg, 50mg/kg, 300mg/kg, 500mg/kg and 2000mg/kg. As per OECD 420 guideline dose of 2000mg/kg showed the toxic symptoms, so according to OECD guideline 420, it is considered as a LD_{50} cutoff value. Doses selected for pharmacological studies by fixed dose methods are 250mg/kg and 500mg/kg[6]

D. Evaluation of anti-inflammatory activity:

i. Carrageenan-induced paw edema in rats:

Albino wistar rats of either sex weighing 100-150g were divided in to four groups. Each group consisted of 6 rats. The

animals were starved overnight. Group I served as control and received 0.2 ml of 2% gum acacia. Group II served as standard and received Etoricoxib intraperitoneal (6mg/kg body weight)[7]. Group III received the Alcoholic extract at the dose of 250 mg/kg body weight orally. Group IV received the Alcoholic extract at the dose of 500 mg/kg body weight orally. After one hour of administration of the test formulation and the drug, a sub-plantar injection of 0.1 ml of 1% w/v suspension of Carrageenan into the plantar side of the left hind paws. The paw was marked with ink at the level of the lateral malleoulus and immersed in mercury up to this mark. The paw volume was measured plethysmographically before the injection and after the injection for 0h, 1h, 2h and 3h interval gap. Each observation was repeated thrice and average of these observations was considered. The average foot swelling in test as well as standard groups was compared with that of the control group and the % edema was calculated by using the formula:

$$\% \text{ Edema} = (C_t - C_o/ C_o) \times 100$$

Where, C_t = Average paw volume of treated group.

C_o = Average paw volume of control group.

Statistical analysis: The data is expressed as mean±SEM and subjected to students 't' test and the level of significance was set at $p<0.001$.

III. RESULT

The result of Anti-inflammatory activity of Ipomoea carnea on carrageenan-induced inflammation is shown in Table 1. Paw volume was significantly ($p<0.001$) reduced in test treated groups (250 mg/kg body weight and 500 mg/kg body weight) as compared to control group. The inhibition of paw edema was found to be 67% at the dose of 250mg/kg and 70% at 500mg/kg. The Alcoholic extract of Ipomoea carnea exhibited significant anti- inflammatory activity against carrageenan-induced rat paw edema. The Alcoholic extracts of Ipomoea carnea leaves with a dose of 500mg/ kg showed the maximum anti-inflammatory activity. Etoricoxib as a reference standard inhibited the edema formation due to carrageenan to an extent of 71 % at the dose of 6 mg/kg i.p. Etoricoxib and Alcoholic extract of Ipomoea carnea exhibited significant anti-inflammatory activity against carrageenan-induced rat paw edema. The edema formation was greatly inhibited between 2-3 hours after sub-planter injection of carrageenan in all treated groups. (Table 1; Figure 1).

Table.1 Anti-inflammatory activity of Alcoholic extract of Ipomoea carnea on carrageenan induced rat hind paw edema.

Treatment	Dose(mg/kg)	Mean PAW VOLUME(ml) AT				%Inhibition of edema after 3hr
		0h	1h	2h	3h	
Control	0.2ml	1.06± 0.04	1.34 ± 0.06	1.66 ± 0.06	2.07 ± 0.04	-
Etoricoxib	6mg/kg	0.94± 0.02	0.99± 0.06	0.91± 0.02	0.65** ± 0.02	71
Alcoholic extract	250mg/kg	0.88± 0.03	0.96± 0.06	0.94± 0.06	0.67** ± 0.02	67
Alcoholic extract	500mg/kg	0.85± 0.04	0.97 ±0.06	0.87± 0.03	0.65** ± 0.06	70

Values are mean ☐ SEM (n=6).

**Values are statistically significant at $p<0.001$ comparing each extract or drug treatment value with saline (control) values.

Figure.1 Anti-inflammatory activity of Alcoholic extract of Ipomoea carnea on carrageenan induced rat hind paw edema.
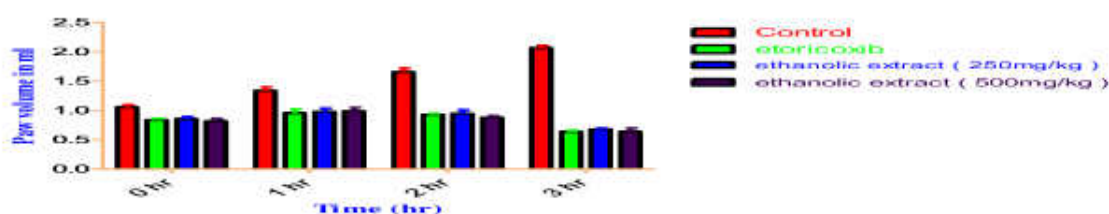
IV. DISCUSSION

Edema represents the early phase of inflammation in carrageenan induced paw edema and is the simple stand

most widely used acute inflammatory model for studying anti-inflammatory agents. The enzymes included cyclooxygenase-1 (COX-1), cyclooxygenase-2 (COX-2), phospholipase A (2) (PLA (2), 5-lipoxygenase (5-LO) and 12-lipoxygenase (12-LO) of which leaves of Ipomoea carnea along with all of the other plant extracts showed inhibitory activities against at least one of the enzymes in various percentages depending upon the concentrations. The Alcoholic extract of Ipomoea carnea (500mg/kg) exhibited significant anti- inflammatory activity at 3rd hour against carrageenan-induced rat paw edema.

V. CONCLUSION

The Alcoholic extract of Ipomoea carnea leaves possesses anti-inflammatory property with the dose dependent effect carried out on experimental model. The significant anti-inflammatory effect of Alcoholic extract at 500mg/kg was seen as compared to Etoricoxib (6mg/kg). In present study Ipomoea carnea was taken to evaluate in vivo anti-inflammatory activity. Present study revealed that the plant Ipomoea carnea possesses a significant anti-inflammatory activity in carrageenan induced paw edema method.

VI. ACKNOWLEDGEMENT

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Pathophysiology and Management of Urolithiasis

Savita Kumari
Department of Pharmacology
CT Institute of Pharmaceutical
Sciences,
Jalandhar, India

Seema Rani
Department of Pharmacology
CT Institute of Pharmaceutical
Sciences,
Jalandhar, India

Santosh Kumar Verma
Department of Pharmacology
CT Institute of
Pharmaceutical Sciences,
Jalandhar, India

A.K.Sharma
Department of
Pharmacognosy
CT Institute of
Pharmaceutical Sciences,
Jalandhar, India

Abstract : Urolithiasis or Kidney stones are jagged mineral deposits that form in the kidney and drop into the collecting system. Symptoms of stone include severe pain and blood in the urine. The kidney's filter the salts and minerals in the blood and reabsorb water produce the byproduct- urine results supersaturation, crystallization which present the stone formation of various types and sizes. Various risk factors promote the formation of stone for example hyper calciuriea , hyperuricosuria, hyperoxaluriea etc. Kidney stone is a growing problem now days for its treatment there are various allopathic, herbal and homeopathic medicines available in the market. If stone are unable to pass out or dissolve, then they are treated by interventional procedures like extracorporeal shock lithotripsy (EWSL), Percutaneous Nephrolithotomy (PNL), Ureteroscopic Stone (URS).

Key words: Urolithiasis, crystallization, hyper calciuriea, allopathic and herbal treatment.

I. INTRODUCTION

Urolithiasis derived from greek word **ouron** (urine) and **lithos** (stone) [1]. It is complex process in which calculi formation i.e. (acceration of hard solid and metallic mineral) in the urinary system primarily in the kidney the ureter and may also form in or migrate into the lower urinary system bladder or urethra [2]. Many factors affect the growth of urinary calculi i.e.hypercalciuriea, low urine volume, hyperoxaluriea, hyperuricosuria, [3]. It is estimated that there are many type of stones formation in the kidney but the major common types are calcium oxalate its incidences 33% and Struvite stone 15 %, uric acid 8%, pure calcium phosphate 6%, cystine 3% and incidences of other 1% [1]. The most common symptoms of stone are painful urological disorder known as renal colic in which strong gripping pain in the back below the ribs and also accompanied pain in your side thighs [4], nausea, vomiting, fever, chills and bloody foul smelling urine [1].

Kidneys reabsorb water and contribute to concentration of different solute that might crystallize and precipitate [5]. Stone larger then 5mm fail to pass and should be treated by some interventional procedures such as ESWL, URS, and PNL, unfortunately the propensity for stone recurrence is not altered and stone reoccurrence is still 50 % (6).The safest and cheapest medicinal treatment is use various medicinal plant [4], which has property of breaking the stone. Several proprietary composite herbal drugs have introduce for dissolving kidney stone [7]. Homeopathic and allopathic treatment also available for stone. There are various in vitro and in vivo models for preclinical evaluation of several drugs before entering the market.

A. Types of Urolithiasis

- Bases of etiology
- Bases of composotion

Mostly calcium oxalate, uric acid stone, Struvite stones, and cystine stones are developed in body [8].

B. Pathogenesis

Kidney stone are classified according to their chemical compositions [1]. It is a multistep process in which urinary concentration of certain salts with respect to stone increases and that concentration exceed then thermodynamically solubility of that salts; urine become supersaturated % [6]. In state of super saturation nuclei of salt crystal formed in a process called nucleation. Super saturations depend on urine pH. Acidic pH promote the formation of calcium oxalate, uric acid stone [9] and cystine stone [4] while Struvite stone formed in alkaline pH. There are many substances in the body known as promoter and inhibitors which affect on stone forming process. Promoters promote the crystallization of urinary salts while inhibitors inhibit the crystal growth and nucleation [10]. Therefore, the stone formation is due to imbalance between these promoters and inhibitor [11].

In renal impairment, renal tubular reabsorption of calcium results in elevated level of urinary calcium hyperparathyroidism cause resorptive hypercalciuriea as elevated level of parathyroid hormone stimulate the uptake of calcium from gut, increased renal synthesis of $1,25(OH)_2$ vitamin D which in turn enhance intestinal calcium [9]. Hyperoxalurea induce activation of rennin angiotensin system (RAS) which play a major role in renal disease progression. RAS activate the NADPH Oxidase in renal cell result in production of ROS and reduction in cellular antioxidant capacities due to down regulated expression of antioxidant enzyme (superoxide dismutase, catalase, glutathione peroxidase and glucose 6 phosphate dehydrogenase) as wel as radical scavengers (vitamin, ascorbic acid reduced,

glutathione) leads to development of oxidative stress followed by renal cell injury and inflammation due to lipid per oxidation. Loss of membranes integrity subsequently facilitates retention of calcium oxalate crystal and growth of stones in renal tubules [11]

Table I:PLANTS USED IN RENAL TREATMENT[12,13,14,15,16]

Formulations for urolithiasis		
DRUG	DOSE	COMPANY
Ashmari	2 tabs t.i.d for 3 months	DHANWANTRI
Calcury tablets	2 tabs 3-4 times a day	CHARAK
Cystone tablet	1tab 3 times a daily till stone pass out 1 tab daily for 6 month for urinary infection 1tab 3 times daily until infection is cleared 1tab 3 times daily for burning micturition	HIMALAYA
Patharina tablets	2 tabs b.i.d	BAIDYANATH
Rencal capsule	1 caps 3 times a day	VITALCARE
Stonex capsule	2 caps thrice daily	BALVEDICS

.

Table II : Several formulations are available in the market recommended by the Physician in condition of Urolithiasis[17]

S. no	Plant	Extract	Mechanism
1.	Acalypha indica linn.	Ethanolic extract herb	It brought enzymatic and non enzymatic antioxidant to its normal level.in liver and kidney.
2.	Benincasa hispida seed	Ethanolic extract seed	Reduce the synthesis of oxalate and urinary excretion and kidney retention level of oxalate, protein, calcium
3.	Cansiera Rheedii	Ethanolic extract leaves	Prevent crystal deposition
4.	Crataeva manga lour,	Ethanolic extract bark	Reduce elevated level of serum creatinine, oxalate, calcium, with marked increase in final body weight and urine volume also reduce elevated level urine uric acid
5.	Daucus carrota linn	Hydro-alcoholic extract seed	Reduce elevated Serum and urinary calcium, oxalate phosphorus creatinine, uric acid and increase reduce urinary magnesium level, increase urine volume, reducing the tendency for crystallization, reduce microcrystal deposition

Table III : ALLOPATHIC TREATMENT[18,19]

Stone	Drug	Mechanism
Caoxalate stone	Thiazide	1. Reduction in hypercalciuriea mediated by enhanced reabsorption of calcium in distal convoluted tubule. 2. Restore the normal serum 1,25 dihydroxy vitamin D by reducing hyperparathyroidism
Uric acid stone	Allopurinol	1. It decreases uric acid synthesis by inhibiting xanthine Oxidase enzyme resulting lowering urinary uric acid.
Struvite stone	1. Acetohydroxamic acid 2. Antibiotic	A urease inhibitor, reduce urinary saturation of Struvite

C. SURGICAL TREATMENT

Stones larger then 5mm or stones that fail to pass through are treated by some intervention procedure:

1.   EWSL

2.   USR

3.   PNL

1. Extracorporeal Shock Lithiotripsy (ESWL)

 ESWL is noninvasive procedure (6)which uses shock waves that are created outside the body to travel through skin and body tissue until the shock waves hit the dense stone break down the small piece [4].

2. Ureteroscopic Stone Removal (USR)

Ureteroscopic procedure used for mid and lower ureter stone and carried out under spinal or general anesthesia [4] with the help a small fiber optic instrument known as ureteroscope passing through urethra and bladder into ureter. then the surgeon locate the stone and remove it with a cage like device or shatter it with a special instrument that produce a form of shock wave [1].

3. Percutaneous Nephrolithotomy (PCNL)

PCNL is used to remove stones of medium to larger size or in a location that does not allow effective use of ESWL. The term Percutaneous mean that the procedure done through the skin In this procedure, the surgeon makes a tiny incision [1] and [4] of 1cm [20] in the back and creates a tunnel directly into the kidney. Using an instrument called a nephroscope, with this locates and removes stones.

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Track 4

Technical Session: 1

Chemistry/EVS

Planning for Sustainable- The Green Energy

Pankaj Vikas Thakur
CT Institute of Engineering
Management and Technology
Shahpur, Jalandhar
pankajvikasthakur@yahoo.com

Rajeev Kumar
CT Institute of Engineering
Management and Technology
Shahpur, Jalandhar

Tarundeep Singh Mann
CT Institute of Engineering
Management and Technology
Shahpur, Jalandhar

Abstract:- Today's fast growing life has make the human beings to use the natural resources up to the exhaustible level , which results in pushing the nature toward the urge of unsustainability. Day by day we are compromising with the nature for our luxurious comforts and there is the upmost need of conserving our Natural Resources. Energy should be conserved since we are consuming disproportionate amount of energy and that day is not far when all our Non-Renewable resources will expire forcing us to rely just on Renewable Sources. The electricity that we use comes from nuclear power, coal power plants, Oil that we use to run our vehicles are fossil fuels that were created million of years ago from decaying plants. When burned they emit carbon-dioxide which is harmful to humans and the environment. Apart from these it also helps us to save money, mitigates the numerous adverse environmental and social impacts associated with energy production and consumption. These include air pollution, acid rain and global warming, oil spills and water pollution, loss of wilderness areas, construction of new power plants, foreign energy dependence and the risk of international conflict over energy supplies. Energy conservation extends the lifetime of equipment and reduces the maintenance cost by operating fewer hours and at less than maximum capacity.

I. INTRODUCTION

The resources are the substances which we human being use for our survival, comfort and prosperity. There are three types of resources in the world: renewable, non-renewable, and perpetual. Perpetual resources are not affected by human use of them. Examples are sunlight and wind. Renewable resources are those that are replenished through biogeochemical and physical cycles. By contrast, non-renewable resources do not replenish themselves, or, as in the case of fossil fuels, do so only at a very slow rate. Renewable resources are seldom perfectly renewable. If their levels are heavily decreased, they may not be able to completely replenish themselves. . Renewable resources can be lost through pollution. Though water renews itself, if it is polluted, it is no longer useful for human use. Urban sprawl, cultivation, irrigation, grazing, deforestation, fishing, hunting, and habitat destruction can all be causes of the destruction of a renewable resource. The energy resources from which we gain energy are classified broadly into two groups namely: Renewable and Non-Renewable (Fossil Fuels)

In this Paper the Key focus is on use of Green Energy. Green energy refers to the all those energy sources which can liberate us from the immense pollution. These energy sources neither emit harmful gases nor chemicals during the process of energy generation. The green energy sources are commonly known as renewable energy sources. In net shell the Green Energy can frame the sustainability of our planet "The Green Earth"

II. TYPES OF RENEWABLE RESOURCES OF ENERGY

The global battle against climate change has encouraged both developed and developing nations to reduce carbon dioxide emission. Signatories of the Kyoto Protocol lead the world to emission reduction activities, one of which is conducting research and development on renewable energy. Here are six types of renewable energy sources that are being considered to power the globe in the nearest future.

A. Hydroelectric Power

Hydropower is the largest source of renewable energy. Its generating capacity amounts to 77,000 megawatts. Water coming from rivers and waterfalls are released through turbines to produce energy. Although the technology is non-pollutant, it can possibly harm marine life as it may alter the quality of water. Other than that, hydropower is also highly expensive and is likely to take a long time to install.

B. Biomass

The International Energy Agency reports that 11% of the world's renewable energy is derived from biomass. The technology produces 7,000 megawatts of renewable electricity. Biomass is taken from industrial processing of forestry and wood products, agriculture, construction and solid waste. These biodegradable materials are converted to gas by burning it in a gas turbine. In the United States, mill operations are the main source of biomass energy. It

is the best alternative to coal as it produces less sulfur dioxide.

C. Geothermal Energy

Geothermal energy resources are one of the most cost-effective and reliable. In the United States alone, it generates up to 2,800 megawatts of energy everyyear which is roughly 2% of the total energy consumption in the country. Geothermal energy is produced from naturally occurring steam under the Earth's surface. Steam is extracted to power a turbine which in turn powers an electric generator. The problem with geothermal energy is the difficulty to find viable land sites. However, the same technology is employed on a smaller scale to power building heaters.

D. Wind Energy

Wind energy **produces** 2,500 megawatts of energy that comprises 1% of the total electricity consumption in the United States. The wind rotates the blade that is attached to a main shaft where a generator is installed. Energy capacity is determined by the size of turbine. Small wind turbines are generally used to power households, farms and ranches in the country. The downside to this technology is the noise that it produces and its relatively expensive installation cost.

E. Photovoltaic Cells

Photovoltaic cell is one among the different types of renewable energy resources that does not require high maintenance. It basically produces energy by using microchip-like materials that absorbs sunlight. This frees the electrons from their atoms and allows them to generate electricity. PV cells are generally reliable and produce less to none pollution.

F. Solar Thermal Systems

Solar thermal systems, as the name implies, also derive energy from sunlight. The system uses solar collectors to absorb solar radiation that will then be used to heat water or air that will generate steam used to operate a turbine. The turbine will then power a generator.

G. Tidal Energy

The energy of the tides which is transformed into useful electricity and other power sources is known as tidal energy or tidal power. The term tide means rise and fall of ocean and sea level due to gravitational strength from moon and rotation of earth. This is a renewable energy source which is under development and not many people know about it. Tidal energy or Tidal power is more efficient and reliable way of generating electricity as compared to wind mills and solar energy systems. Federal and state government encourages citizens to install solar energy at home or in the workplace by awarding income tax credits. The same is being done for the other renewable energy sources.

III. NON RENEWABLE RESOURCES

The sources of energy, which have accumulated in nature over a period of hundreds of millions years, such that they cannot be replaced when exhausted, are called non-renewable resources. The non-renewable sources of energy are fossil fuels, such as, coal, petroleum and natural gas. They are also known as "Conventional Sources of energy"

IV. PROS AND CONS OF USING RENEWABLE SOURCES OF ENERGY

A. Pros

The sun, wind, geothermal, ocean energy are available in the abundant quantity and free to use. Renewable resources have low carbon emissions, therefore they are considered as green and eco-friendly. Renewable resources help in stimulating the economy and creating job opportunities. You don't have to rely on any third country for the supply of renewable sources as in case of non-renewable resources. Renewable resources can cost less than consuming the local electrical supply. In the long run, the prices of electricity are expected to soar since they are based on the prices of crude oil, so renewable sources can cut our electricity bills. Various tax incentives in the form of tax waivers, credit deductions are available for individuals and businesses who want to go green.

B. Cons

It is not easy to set up a plant as the initial costs are quite steep. Solar energy can be used during the day time and not during night or rainy season. Geothermal energy which can be used to generate electricity has side effects too. It can bring toxic chemicals beneath the earth surface onto the top and can create environmental changes. Hydroelectric provide pure form of energy but building dams across the river which is quite expensive can affect natural flow and affect wildlife. To use wind energy, you have to rely on strong winds therefore you have to choose suitable site to operate them. Also, they can affect bird population as they are quite high.

V. PROS AND CONS OF USING NONRENEWABLE SOURCES OF ENERGY

A. Pros

Non-renewable resources are cheap and easy to use. You can easily fill up your car tank and power your motor vehicle. You can use small amount of nuclear energy to produce large amount of power. Non-renewable resources have little or no competition at all. eg: if you are driving a battery driven car your battery gets discharged then you won't be able to charge it in the middle if the road rather it is easy to find a gas pumping station. They are considered as cheap when converting from one type of energy to another.

B. Cons

Non-renewable resources will expire some day and we have to us our endangered resources to create more non-renewable sources of energy. The speed at which such resources are being utilized can have serious environmental changes. Non-renewable sources release toxic gases in the air when burnt which are the major cause for global warming. Since these sources are going to expire soon, prices of these sources are soaring day by day.

VI. WHY SHOULD WE CONSERVE ENERGY?

Energy needs to be conserved to protect our environment from drastic changes, to save the depleting resources for our future generations. The rate at which the energy is being produced and consumed can damage our world in many ways. In other words, it helps us to save the environment. We can reduce those impacts by consuming less energy. The cost of energy is rising every year. It is important for us to realize how energy is useful to us and how can we avoid it getting wasted. To start saving energy is not a big thing at all. We can start saving the energy from our home itself, just by turning off the lights during day hours, washing clothes in cold water or using public transport instead of using our own vehicle and later can implement f these things on much wider scale at society level, then at city level then district level and finally at country level. You might notice a small change in your monthly bills by implementing these changes as they would be getting decreased more and more. With so many alternatives and so many techniques about there, if millions of people like us start doing these things, it will help us to save much more money and also help the environment.

A. Principles of Conservation

To achieve the general conservation goals, we have defined ten principles that have guided the actions of: Interinstitutional cooperation, A participatory approach, An interdisciplinary approach, Networking and international cooperation, Communication through the media, Identification of a flagship species, Formal and informal education, Economic sustainability and ecotourism, Administrative sustainability, Research and conceptual sustainability for conservation. These principles have been effective for establishing the long-term initiative, as well as involving multiple actors, disciplines, and scales.

B. Need for public awareness

The United Nations conference on environment and development held in Rio de Janeiro in 1992, popularly known as "Earth Summit" has firstly highlighted the key issue of global environmental concern and attracted the attention of general people towards deteriorating environment. Any government cannot achieve sustainable development until the public has a participatory role in it. Public participation is possible only when public is aware of ecological and environmental issues. These is a Chinese proverb "If you plan for one year, plant rice, if you plan for 10 years, plant tree and if plan for 100 years, educate people". If we want to manage our planet earth, we have to make all the persons environmentally educated. Individuals can involve themselves in many ways in the process of improving the environment, some are listed below:-One should not use unnecessarily and exhaustively the natural resources such as underground water, minerals etc, One should not harness too much energy such from burning of fossil fuel. One should not cut the trees and use timber for aesthetic pleasure such as in decorating our houses. One should preserve forest cover area. One should formulate and obey the moral codes meant for achieving a better environment.

C. Role of Individual

As an individual we should give a thought for the conservation of natural resources. As per need, we have to find alternate methods for different resources. We have to be an active participation for the conservation by heart. We should formulate some Moral Codes for the conservation of Natural Resources and creating awareness programs. Emphasis on 4-R approach i.e. Recycle, Refuse, Reduce, Reuse. It gives proportionality between rate of production and rate of consumption.

VII. CONCLUSIONS

In the end study concludes that we should form certain objectives and moral codes to handle environmental degradation. Imparting Knowledge: We should impart knowledge regarding the problems individual can face because of environmental degradation. Spreading Awareness: We should aware the individual as well as different social groups working for the Environment protection regarding the consequences of environmental degradation. Developing Skills: We should develop the skills in the individuals to find out the problems linked with environment and then the ways to solve those problems Developing Attitude: To develop a positive attitude that it's our responsibility to protect our planet Earth in every individual as well as the social groups working for Environment protection. Active participation: We should frame the active involvement of each and every individual to solve this environmental degradation problem. So overall we conclude that Clean and Green are the two factors which will decide the sustainability of our planet "The Green Earth".

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PAHs Concentration in Roadside Soil at Jalandhar-A Developing City of Northern India

Vaneet Kumar
CT Group of Institutions
Jalandhar, Punjab
vaneet2106@gmail.com

N. C. Kothiyal
Dept. of Chemistry
NIT Jalandhar, Punjab
(India)

Saruchi
Dept. of Chemistry
NIT Jalandhar, Punjab
(India)

P V Thakur
CT Group of
Institutions Jalandhar,
Punjab

Abstract: The objective of this study was to ascertain contamination levels in roadside soils, distribution behavior and human exposure with Polycyclic Aromatic Hydrocarbons (PAHs) during 2013-14 in Jalandhar, Punjab, India. PAHs concentration was measured at 20 different locations (at 1, 2 and 3 meters) from roadside soil. Recovery range was found 20 % and 80 % with lower value corresponds to the lower molecular weight PAHs compound. Identification and quantification of PAHs was done by GC-FID equipment. Five ringed PAHs were in highest concentration in all seasons.
Keywords:- Polycyclic Aromatic Hydrocarbons, Gas Chromatography, Pollutants, Concentration, Season

I.   INTRODUCTION

There is minuscule kenned about the possible exposure of people living near roadside area in the developing city environment with diminutive pollutants (PAHs). It has been observed that roadside areas may result in paramount human exposure to PAHs.   Polycyclic Aromatic Hydrocarbons (PAHs) are a group of five hundred compounds containing two or more fused aromatic rings system. Incomplete combustion of petroleum hydrocarbons in automobiles (urban/sub urban sources) is responsible for surface road side soils contamination with PAHs. Degradation rate of PAHs adsorbed into sediments or soil is very slow and depends upon several factors. Slow degradation of such pollutants pose a potential risk to human being coming in contact with contaminated soil [1]. Some studies have reported the major inception of PAHs in road dust as exhaust gases from automobile [3]. Soils in industrial area customarily consist of high concentration of PAHs, sometimes 10 to 100 times higher as compared to less populated and undeveloped areas [2]. PAHs sources in the environment include automobile exhaust, lubricating oils, atmospheric depositions, power plants, domestic heating systems, petrol and diesel engines and sundry industrial activities. Concentrations of PAHs in soil were postulated to be influenced by traffic density, road condition, traffic demeanor, metrological condition and rate of deposition. Concentration of PAHs in roadside soil was found to vary according to distance from the source of inception [4-6]. Once such PAHs seep into the soil, they got accumulated in horizons affluent in organic matter, where they are liable to be retained for many years due to their sedulous assiduousness, hydrophobicity and slow degradation rate [7].

The objective of present study was to determine concentration level, ratio of high carcinogenic and low carcinogenic PAHs and their distribution comportment (16 potential carcinogenic PAHs identified EPA) during summer, winter, autumn and pluvial season in the roadside soil.

II.   MATERIALS AND METHODS

A.   Calibration Procedure

More than one internal standards that are kindred in analytical comportment to the compounds of interest was culled. The quantification of the internal standard was immune to method or matrix interference. The following deuterated PAH compounds were habituated to pre-spike the sample extracts: Napthalene d8; Acenapthene d10; Fluorene d10;, Phenanthrene d10; Benzo(a)anthracene d12; Chrysene d12 and Perylene d12 [8-11].

B.   Sampling sites

Punjab is one of the prosperous and expeditious developing states of India. Jalandhar, one of the major expanding city located at the centre of Punjab between Beas and Sutlej rivers. Twenty sampling locations (both public and commercial places) were culled on the substructure of high traffic density, urban populations and geographical dispersion.

C.   Sampling period

The samples were taken for a span of one year during autumn, winter, pluvial and summer seasons during year 2013-14. A total of 120 samples were accumulated from ten major locations (J1 to J10).

D.   Sampling technique

From each sampling location, three soil samples were accumulated from 1, 2, and 3 meter distance from different directions of the road (left and right side). Samples were amassed by scooping 6 cm below the surface layer [8-11].

E. Extraction of PAHs and Analytical quality control

About 20 gm of pre dried soil samples were heated at 40^0C to abstract any trace of moisture afore extraction. Dried soil samples were transferred in soxhlet apparatus and extracted utilizing acetone and dichloromethane (1:1) as solvents at the rate of 3 cycles per hour for 8 hour. Soxhlet extraction [using DCM-acetone (1+1)] over an 8 hour period recuperated 95 % of the PAHs. Presented data are redressed accordingly with the mean of triplicate analyses. Replicated analyses give an error between ± 10% and ± 20% for PAHs in soils [8-11].

III. RESULTS AND DISCUSSION

The results of average concentration of PAHs determined in one twenty soil samples during one year at different distances from roadside soil have been shown in figure 1.The ten sampling location were divided into high / average population and traffic density areas, and categorized as site 1 / site 2 (Table 1). In the present study 16 PAHs (EPA identified) were tenacious namely Nap, Napthalene; Ace Nap, Acenapthene; Ace Naph, Acenapthylene; Flu Fluorene; Phen, Phenanthrene; Anth, Anthracene; Flan, Fluoranthene; Pyr, Pyrene; B(a)A, Benzo(a) Anthracene; Chry, Chrysene; B(b)F, Benzo(b) Fluoranthene; B(k)F, Benzo(k) Fluoranthene; B(a)P, Benzo(a)Pyrene; IP, Indeno(123cd) Pyrene; Dib(ah)A, Di Benzo(ah) Anthracene and B(ghi)P, Benzo (ghi) Pyrelene.
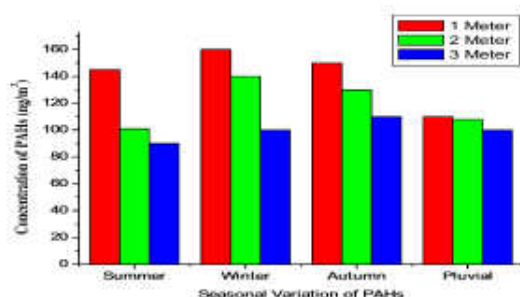
Figure 1: Behavior of PAH during all seasons

A. Behavior of PAHs at places of high population and traffic density intercepts

Type and concentration of PAHs at sundry intercepts were found to differ from place to place. Average concentration of 16 PAHs at a distance of 1 to 3 meter (□X 1M,□X 2M,□X 3M) were resolute. This shows variation of average

concentration with distance during four seasons. The results shown designated that the average concentration of PAHs decreases with distance from roadside soil in most cases from 1 to 3 meter during four seasons. The observed deportment was perhaps due to close proximity of intercepts from roadside in the form of buildings, plants and shops in the area of high population and traffic density. The observed value was perhaps highest in roadside soil among metro or expeditious developing city within India or other cities of the world. Pyr and IP were two individual PAH (among 16 PAHs) found in highest concentration.

During winter due to high sultriness and dense fog in the day time, less photochemical degradation of these PAHs is responsible for low concentration of PAHs.

B. Toxic equivalency factor

TEF evaluation is the most popular method used to identify the toxicity of PAHs. Toxicity equivalency concentrations (TEQs) are calculated as the product of summing up the values obtained by TEF values and concentrations of PAHs, as follows:

$TEQ = \Sigma (Ci \times TEFi)$

Where, TEQ: toxic equipollent concentration

Ci: concentration of PAHi.

Toxic parity factor of B(a)P and Dib(ah)A have been found in higher side as compare to the other PAHs. Thus B(a)P and Dib(ah)A was two most toxic PAHs .

IV. CONCLUSION

PAHs concentration was higher during summer and autumn as compared to pluvial and winter seasons. Toxic equivalency factor of B(a)P and Dib(ah)A was maximum as compared to other PAHs.

It was observed from the results that high carcinogenic PAHs (4 to 6 rings) were in higher concentration (around 85%) than low carcinogenic PAHs (2 to 3 ring, around 15%) at most intercepts. It was additionally concluded from this study that developing cities were exhibiting equal or even higher concentration of carcinogenic PAHs as compared to the metropolitan cities, which is a perilous sign towards human exposure. This study suggests that the pollution of PAHs in developing cities like Jalandhar (India) should accentuate on controlling the traffic exhaust specially diesel exhaust. The study could be of considerable paramountcy for the planners while considering environmental remedial measures.

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Pesticides as a Major Cause of Cancer

Ekta Khosla
Dept. of Chemistry, Hans Raj Mahila Maha Vidyalaya,
Jalandhar (India)
ekta1999@gmail.com

Tanureeet Kaur Arora
Medical graduate from Dr. B.R. Ambedkar Medical
College, Bangalore (India)

Abstract: In this study we have tried to evaluate the speculative correlation between increased production of pesticides and cancer cases in India. Apart from chemical fertilizers, pesticides played an important role in the "Green Revolution" during the 1960s and 1970s. Indian exports of agrochemicals have shown an impressive growth over the last five years. India is one of the most dynamic generic pesticide manufacturers in the world with more than 300 technical grade pesticides being manufactured indigenously by 125 producers consisting of large and medium scale enterprises and more than 500 pesticide formulators spread over the country. In the present paper an attempt has been made to correlate the increasing number of cancer cases with increased pesticide production in the last decade. The significant correlation has been found between pesticide production and increased rate of cancer cases in India by linear regression analysis methods.

I.   INTRODUCTION

Chemical Industry is an important element of the Indian economy. Its size is predictable at around US$ 35 billion approx., which is equivalent to about 3% of India's GDP. The total investment in Indian Chemical Sector is US$ 60 billion and total employment generated is about 1 million. [1] In terms of volume, it is 12th largest in the world and 3rd largest in Asia. Presently, per capita consumption of products of chemical industry in India is about 1/10th of the world average. Over the last decade, the Indian Chemical industry has evolved from being a basic chemical producer to becoming an innovative industry. With investments in R&D, the industry is registering significant growth in the knowledge sector comprising of specialty chemicals, fine chemicals and pharmaceuticals.

Pesticides are of three major categories viz. herbicides, insecticides and fungicides. The pesticide sector of Indian chemical industry is a de regularized system. No doubt the country is large and self sufficient in production of pesticides. The Pesticide industry is governed by the Provisions of Insecticides Act 1968, which is administered by the Department of Agriculture and Cooperation, Ministry of Agriculture. The Central insecticide board and registration committee are the agencies under which distribution, manufacture, import, export, ban and usage of pesticides are controlled. The Act is enforced by the State government and the departments of chemicals play the role of facilitator for the growth of Industry [2].

The use of pesticides is ought to for country like India where due to warm climatic condition 20-30% of food grain worth Rs.50, 000 crore is eaten up by the pests. The act of sufficient food security allows the farmers to use pesticides to control the growth of pests, insects, fungi and enhance the production of full fed, highly populated country like India. In a written reply of RTI from department of chemicals and petrochemicals stated that "Department of Agriculture and Cooperation is responsible for ban the use of toxic and stable pesticides." After this, a Bill was passed in Indian Legislative Assembly as Pesticide Management bill in 2008, to control the use of pesticides judiciously [3]. The bill is effectively responsible for controlling use of bio-magnifying chemicals. The reports published by NRCP (ICMR) Bangalore on Time trends of Cancer incidence in India. The data source of this report was (PBRC) [4] of major cities like Bangalore, Mumbai, Delhi and Bhopal. The Indian Council of Medical Research (ICMR) and National Cancer registry Program (NCRP). Established in year 1982 with main objective of generating reliable data of magnitude and pattern of cancer in India. The reports of ICMR suggests that the incidence of cancer has changed from urban registry to rural registry in last decade. After deciding the population growth rate for 2001-2011, it has been postulated that in year 2009-2010, 2010-2011, 2011-2012, the estimated cancer cases are 462,408; 497,081 and 504,301, respectively for Indian males and 517,378; 530,999 and 600,404 for Indian females. The total cancer cases are expected to increase from 979,786 in year 2010 to 1,148,758 cases in 2020. In the present paper we have used linear regression method to correlate the increase in pesticide production with rise in cases of cancer in counrty.

II.   MATERIALS AND METHODS

The pesticide production date was procurred from 36th report of Standing Committee on chemicals and fertilizers (2012-13). This data was submitted as a report to Ministry of chemicals and fertilizers (Department of Chemicals and petrochemicals) as a note on production and availability of pesticides in August 2013. The data of cancer cases in India was collected from PCBR's Bangalore , Mumbai , Chennai , Delhi and Bhopal. The latest Registry of NRCP, 2008 were also used to assess the future load of cancer cases in India. The statistical analysis regarding correlation was carried out

by SPSS 17 software available in Department of Computer Sciences of Hans Raj Mahila Maha Vidyalaya, Jalandhar.

III.   RESULTS AND DISCUSSION

The information regarding production of major pesticides in India for the last three years has been procured. The pesticide like D.D.T. is being produced in large amounts even after ban in 1972 by environment protection agency after recognizing it as a probable carcinogen [5]. India opposed the production of D.D.T. in Stockholm convention in Geneva while parallel economies like China banned its use and production in 2007. Such pesticides have been recognized as persistent organic pollutants (POP) due to their long lasting effects on the environment. POPs are chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of living organisms and are toxic to human beings and wildlife. Along with D.D.T. other chemicals being synthesized as pesticides include Malathion, Parathion, Dimethoate, D.D.V.P., Quinalphos, Monocrotophos, Phosamidon, Phorate, Ethion etc. The average production of major pesticides in India has been shown in Table 1. The conventional production of pesticides is being carried out without many changes in formulation because research and development units are not working properly in countries like India even after tax rebate on research. In order to promote chemical industry, there is a need to encourage R&D by creation of R&D hubs with state-of-art testing with internationally recognized accreditation, extension of income tax exemption under Section 35 of Income Tax Act on the investment in initial setting up of R&D facilities as well as extension of customs duty exemption on import of R&D equipment for the chemical sector on lines of agrochemical and pharmaceutical sector. Only few states of India are contributing mainly towards R&D and the state wise Pi chart regarding R&D contribution has been shown in Figure 1

Table1. Production of major pesticides in India (2009-10, 2010-11, 2011-12) in Million tons

Pesticide	2009-10	2010-11	2011-12
D.D.T	3.61	3.09	3.62
Malathion	0.62	0.64	0.7
Parathion	0	0	0
Dimethioate	0.96	1.12	0.09
D.D.V.P.	3.12	3.13	4.1
Quinalphos	0	1.01	0.99
Monocrotophos	5.74	8.6	8.6
Phosphamidon	1	0.03	0.06
Phorate	2	2.63	2.33
Ethion	0.43	0.65	0
Endosulphan	2.8	1.73	0.02
Fanvalerate	0.53	0.08	0.05
Cypermetherin	6.23	4.95	8.8
Anilphos	0	0	0
Acephate	10.83	12.84	14.6
Chlorpyrophos	2.9	3.35	1.9
Phosalone	0	0	0
Metasystox	0	0	0
Fenthion	0	0	0
Triazophos	1	1.58	0.7
Lindane	0	0	0
Temephos	0	0	0
Deltametherin	0.02	0	0.32
Alphamethrin	0	0.51	0.32
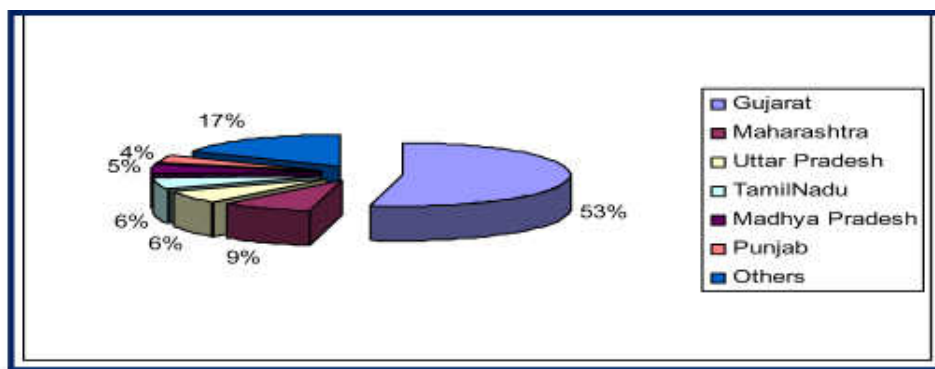
Fig.1 State wise participation in R&D of pesticides in India

The Indian Chemical Industry is required to prepare itself to meet our obligations under these different international conventions. There is now overwhelming evidence that some of these chemicals do pose potential risk to humans and other life forms and unwanted side effects to the environment [6-8]. No segment of the population is completely protected against exposure to pesticides and the potentially serious health effects, though a disproportionate burden is shouldered by the people of developing countries and by high risk groups in each country [9].

According to cancer projection study by Takiar et.al in 2010 [4], the number of cancer cases have been projected from 2010-2020 and we have considered the projected cases for other than tobacco reason. The linear regression analysis for 2009-2010, 2010-2011 and 2011-2012 suggests that there are chemical, biological and environmental reasons responsible for cancer. The pesticide production may be correlated to increasing risk of cancer cases in India. The pesticide residues in diet interact with DNA of normal cells resulting into series of multistep processes responsible for uncontrolled cell proliferation or tumors. In last three financial years the net pesticide production in India is 41.79, 45.94 and 47.21 million tons respectively. The percentage increase in production of pesticide is 0.1 and the increase in cancer incidence in India is also of the same range. The linear regression suggests that the percentage increase in cancer cases in Indian males 9.05% and 16.4% in Indian Females in the last three years. The percentage increase of cancer cases is related to increase in pesticide production significantly and the regression coefficient is higher and is greater than 0.9 for both male and female. The plot has been represented as a histogram in Figure 2.
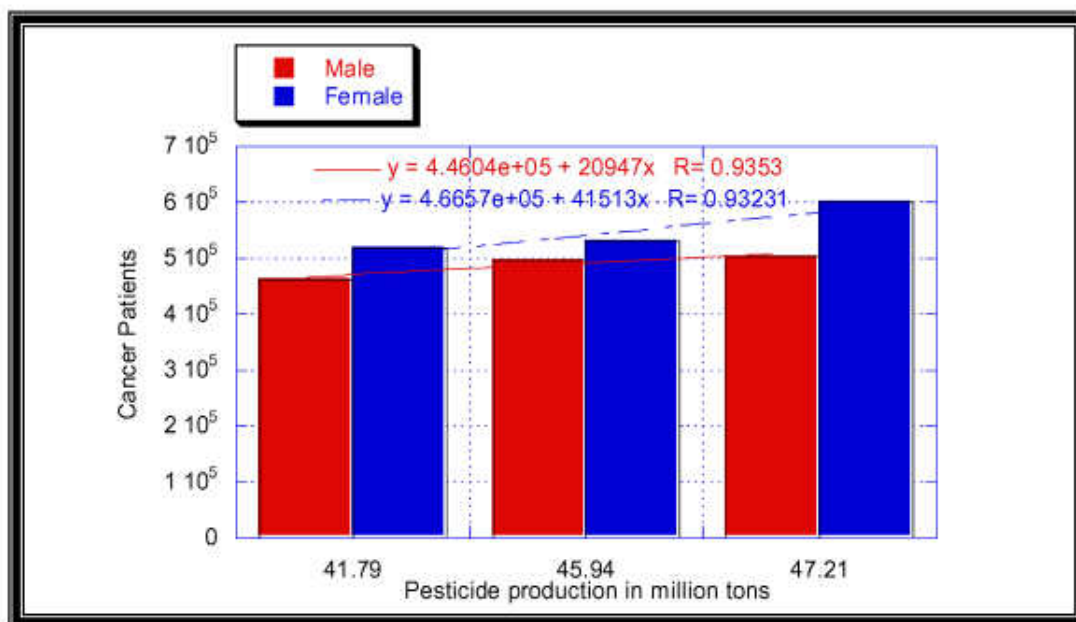
Figure 2. Linear Regression results of correlation of Pesticide production and cancer cases
(2009-10=41.79MT, 2010-11=45.94MT and 2011-12=47.21MT)

Cancer incidence will continue to grow in the country in the future as a result of increase in life expectancy, increase in the proportion of elderly population, size of population and due to absence of any mass screening programmes in the country. Rising longevity, alterations in lifestyles, urbanization, globalization and progressive control of communicable diseases has led to emergence of cancer and other non communicable diseases as an important health problem. In India, the life expectancy at birth has steadily risen from 45years in 1971 to 63.4 years in 2002, indicating a shift in demographic profile (SRS, 2002-2006). It is estimated that life expectancy of Indian population will increase from 68years to 71years by 2011-2015 to 2021- 2025 (MOH and FW, 2011). The population of India on 1st March 2011 was 1,210.2 million as per the provisional population totals of (Census of India, 2011) compared to a total of 1028.7 million in 2001. The major environmental risk factors for cancer are carcinogen and co-carcinogen exposure. Dsouza et.al (2013) suggested state wise projected cancer cases [10] as shown in Table 2.

Table 2. State wise projection of cancer cases in India except Punjab

Year: Country/states	2011		2016		2021		2026	
	Males	Females	Males	Females	Males	Females	Males	Females
India	589866	603560	684918	702151	799957	811688	934268	935715
Haryana	12474	11925	14445	13975	17076	16382	20441	19278
Delhi	8551	7658	10999	9598	14169	11931	18062	14730
Rajasthan	29502	31161	34623	36640	40655	42709	47813	49751
Uttar Pradesh	89484	85032	102751	99830	118373	116264	136900	135436
Bihar	44146	42209	51454	49903	59537	58205	68690	67600
Assam	13277	13230	15680	15731	18660	18590	22174	21848
West Bengal	47109	47019	55584	55055	65607	64046	77044	74058
Orissa	21460	22470	24445	25870	28097	29692	32476	34047
Madhya Pradesh	31537	32405	36663	37792	42982	43822	50710	50896
Gujarat	29301	31375	35164	36840	42249	42891	50544	49705
Maharashtra	59609	61900	68360	70539	79773	80356	93919	91966
Andhra Pradesh	43872	48161	50868	55905	59296	64274	68980	73450
Karnataka	31340	33769	36603	39252	42818	45335	49935	52047
Kerala	21735	25520	24616	28682	28175	32168	32225	35894
Tamil Nadu	42097	44148	47780	50470	50468	57253	61483	64323
NE excl Assam	6509	6395	7812	7688	9369	9181	11174	10907

VI. CONCLUSION

Pesticides are often considered a quick, easy, and inexpensive solution for controlling weeds and insect pests in urban landscapes. However, pesticide use comes at a significant cost. Pesticides have contaminated almost every part of our environment. Pesticide residues are found in soil and air, and in surface and ground water across the nation, and urban pesticide uses contribute to the problem. Pesticide contamination poses significant risks to the environment and non-target organisms ranging from beneficial soil microorganisms, to insects, plants, fish, and birds. Contrary to common misconceptions, even herbicides can cause harm to the environment. In the present study along with the environmental risks the correlation has been found with significant values indicating increase of pesticide production is indirectly related to increase in cancer cases in India. We recommend the limited use of chemical fertilizers along with training of farmers for adequate dosage of pesticides. The research should me more emphasized on research of bio pesticides for healthy nation.

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The Adsorption of Methylene Blue Dye from Surface Water onto Aquifer Material During Batch Experiments

Shrinishtha Mishra
Dept. of Civil Engineering, Indian Institute of
Technology Roorkee-
Roorkee 247667, India
shrinishthashri@gmail.com

Pradeep Kumar
Dept. of Civil Engineering, Indian Institute of
Technology Roorkee-
Roorkee 247667, India
indumpradeepk@gmail.com

Abstract:The removal of Methylene Blue (MB) dye from the surface water during river bank filtration (RBF) was studied at 298 K in terms of its adsorption behavior. Aquifer material from the Srinagar RBF site, India was used as a representative of river bank media for the experiments. The textural properties of the aquifer material including surface area, mean pore area and total pore volume were examined from the low-temperature adsorption of nitrogen at 77 K. The conditions for maximum adsorption of the MB dye on aquifer material were optimized. The removal efficiency of dye was obtained above 90% at initial concentration of 2 mg/L. From the kinetic study, the adsorption data followed the second-order kinetic model (R^2=0.999).Equilibrium data were fitted to Langmuir, Freundlich, isotherms and the equilibrium data were best described by the Langmuir isotherm model(R^2=0.99).So RBF is very effective in removing the dyes.
Keywords:Adsorption, Isotherms, Kinetics, River bank filtration, methylene blue dye,

I. INTRODUCTION

Removal of hazardous compounds from industrial effluents is one of the growing needs of the present time. Many industries, mostly textile industry, propagate colored effluents containing dyes and pigments. It has been estimated that 10–15% of the dye is lost in the dye effluent [1]. The discharge of dyes in the environment is a matter of concern for both toxicological and esthetical reasons, causing serious water pollution problems to aquatic life due to the reduced light penetration. The presence of even very small amounts of dyes in water less than 1ppm for some dyes is highly visible and undesirable[2].

River bank filtration (RBF) is a natural process to purify the polluted river/lake water. The quality of surface water improves when it flows through bank of the river/lake and adjacent aquifer material. The processes responsible for changes in quality are sorption, filtration, acid-base reaction, oxidation, reduction, hydrolysis, bio-chemical reactions, mixing with background groundwater etc. Reference [3]reportedthree anthraquinone blue disperse dyes associated with textile discharges in the Savannah River (USA). Reference [5] reported 15 dye compounds in the river Yamaska water, in suspended solids, and in sediments downstream of textile mills in Quebec, Canada. The identified dyes included C.I. Disperse Red 60, C.I. Disperse Blue 26, and C.I. Disperse Blue 79.Hillary

Methylene blue (MB), which is classified as a basic dye has wider application including coloring paper, dyeing cottons, wools, temporary hair colorant coating for paper stock [5]. Though methylene blue is not strongly hazardous but on inhalation, it can show various harmful effects. It can give rise to short periods of rapid or difficult breathing while ingestion through the mouth produces a burning sensation and may cause nausea, and gastric, vomiting.Although several studies have focused on the removal/attenuation of turbidity, inorganic and organic compounds and pathogens during RBF, [6] [7] [8], however, no study has been done on the removal/attenuation of dyes during RBF.

The objective of this study to determine the effectiveness of the RBF to remove the MB dye. Since biodegradability of MB is less so mainly adsorption was studied. Batch studies were conducted to determine the adsorption kinetics and adsorption isotherm. Aquifer from the Srinagar river bank filtration site, India was used as a representative river bank media for the experiments.

II. MATERIALS AND METHODOLOGY

A. Adsorbate

The MB was used in this study purchased from S D Fine-ChemLimited. The molecular weight of MB is 319.8 with three groups of water. The molecular formula is $C_{16}H_{18}ClN_3S$. The structure of MB is shown as below:
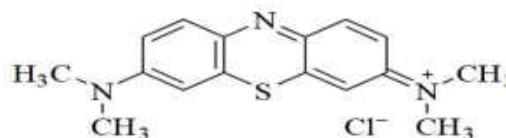
The dye solution shows an intense absorption peak in at 664 nm. Octanol/Water Partition Coefficient of the dye(log K_{ow}) is 5.85. Solubility of the dye in water is 43,600 mg/L at 25ºC. The compound consisting of dark green crystals or crystalline powder, having a bronze-like luster.

B. Characterization of Aquifer material

Aquifer material was collected from Alakananda river bank, Srinagar India (30.22°N 78.78°E). It was transported to geotechnical laboratory, IIT Roorkee for grain size analysis. The grain size analysis of oven dried aquifer material was carried out as per the Indian Soil Classification 1498 (1970).

1) Point of Zero Charge

Determination of pHzpc was done to investigate how the surface charge of adsorbent material depended on pH. For the determination of pHzpc of aquifer material, 0.01 M NaCl was prepared, and its initial pH was adjusted between 2.0 to 12.0 by using NaOH/HCl in each batch system. Then 50 mL of 0.01 M NaCl was taken in 250mL. Erylenmeyer flasks and 0.20 g of adsorbent was added to each solution. These flasks were kept for 48 h in incubator, and the final pH of the solutions was measured by using a pH meter. Graphs was plotted between "pHfinal vs. pHinitial". The point of intersection on the curves of pHfinal vs. pHinitial was recorded as pHzpc of the aquifer material.

C. Synthetic solution preparation

A stock solution of 100 mg/L was prepared by dissolving 10 mg of dye in 100 ml distilled water. Each solution of dye concentration 0.5ppm, 1ppm, 1.5 ppm, 2ppm, 2.5ppm, 3ppm, 5ppm was scanned in the range of 200–700 nm Maximum adsorption was found at wavelength 664nm.

D. Batch adsorption test

The adsorption studies were conducted with 1.5 g of adsorbent and 100 of MB solution at desired concentration, pH on an Orbital shaking incubator with a constant speed of 200 rpm and constant temperature of 25^0C. The solution was centrifuged at 3000 rpm for 10 min and the concentration of MB in the supernatants was examined with a HACH UV/VIS spectrophotometer at the wavelength of 664 nm at which the maximum absorbency occurred. Then the amounts of MB adsorbed per unit mass of adsorbent were calculated from the differences between the initial and final MB concentrations in solution by the following equation:

$$q_{eq} = \frac{(C_0 - C_{eq})V}{W} \quad (1)$$

where q_{eq} (mg/g) is the amount of MB adsorbed in adsorbent, C_0 and C_t (mg/L), initial and final concentration of MB solution, V (L), the volume of MB solution used, W (g), the weight of the adsorbent.

III. RESULTS AND DISCUSSION

A. Grain size analysis of aquifer material

Average grain size (d_{50}) of the aquifer was 0.13 mm with 82.5 percent sand and 17.5 percent fines. The uniformity coefficient was 3.75. The grain size finer than 1mm were used for the batch experiments.The BET surface area of this aquifer material was found to be 2.1724 m^2/g byusing the nitrogen adsorption method whereas the average cross sectional area was determined to be 0.162 nm² and the total pore volume was estimated to be 0.0011 m²/g.

Adsorption of cations is favored at pH>pHzpc, while the adsorption of anions is favored at pH<pHzpc [9].pHzpc value for the aquifer material is 8.8 (Fig. 1). So adsorption is favored.
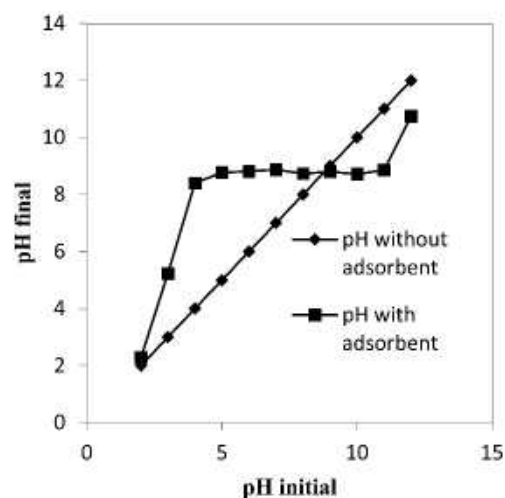
.Fig. 1. pHzpc curve

B. Kinetics of batch sorption process

The objective of adsorption kinetic study is to investigate the possible mechanisms for the sorption process and to determine the time required to attain equilibrium. Fig. 2shows the effect of the adsorption time on the adsorption capacities of MB by the aquifer material. It is clear that the adsorption capacities of aquifer material increased rapidly with the increase of the adsorption time from 0 to 40 min and more than 90% of the equilibrium adsorption capacities of aquifer material occurred within 40 min and gradually increased from 40 to 120 min until equilibrium. Therefore, under our experimental conditions, the

equilibrium times for the adsorption of MB on aquifer material all 120 min.

To investigate the potential rate-controlling steps involved in the adsorption of MB onto aquifer material, both pseudo first- order and pseudo-second-order kinetic models were used to fit the experimental data.
The pseudo-first-order rate expression of Lagergren model is generally expressed as follows:

$$\frac{dq_e}{dx} = k_1 (q_e - q_t) \quad (2)$$

After integration with the initial condition qt=0 at t=0, Eq.can be obtained:

$$\ln(q_e - q_t) = \ln q_e - k_1 t \quad (3)$$

The pseudo-second-order rate equation is given as

$$\frac{t}{q_t} = \frac{1}{k_2 q_e^2} + \frac{t}{q_e} \quad (4)$$

Where q_e and q_t are the amounts of adsorption dye (mg/g) at equilibrium and at time t (min), k_1 (min^{-1}) and k_2 (g mg^{-1} min^{-1}) are the adsorption rate constant of pseudo-first-order and pseudo second-orderadsorption rates, respectively[10]. The linear plots of log (q_e−q_t) versus t and (t/q_t) versus t are drawn for the pseudo-first order (Fig. 3) and the pseudo-second-order models, (Fig. 4) respectively and are listed in (Table 2).
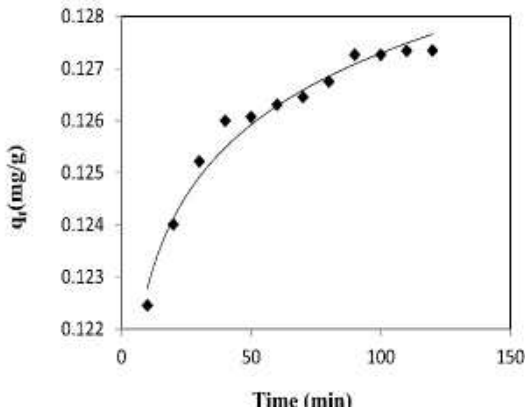
Fig. 2. Kinetics of MB uptake by the aquifer
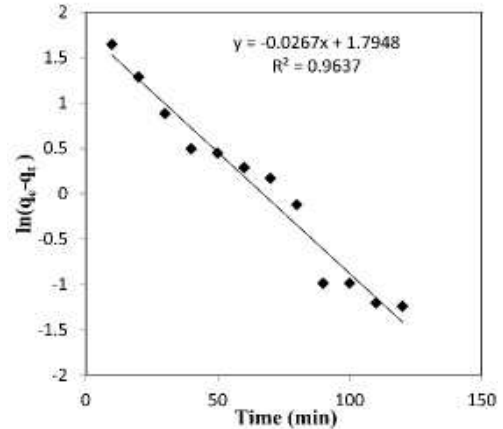
Fig. 3. Pseudo first order KineticsMB concentration: 2mg/L, pH: 8.91
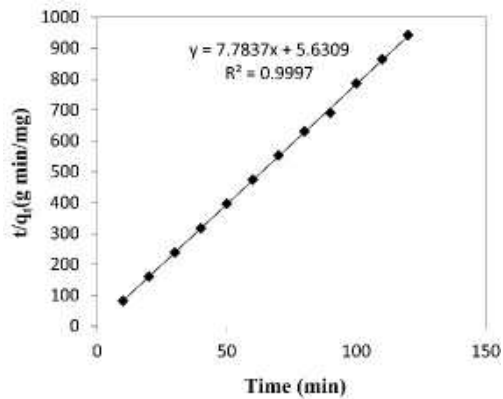
Fig. 4. Pseudo second order Kinetics

1) Effect of MB concentration

The effect of MB concentration on its uptake by aquifer material was studied at constant temperature 25^0C using 1.5g of the sorbent. The resultsobtained showed that the increase in MB dye concentrationresulted in an increase in the MB dye uptake. (Fig. 5)
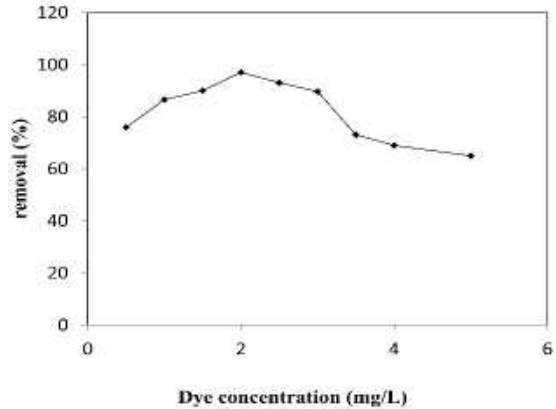
Fig. 5. % removal of due to the effect of the change of the initial conc. of the dye, adsorbent dose of 1.5 g at pH= 8.95

2) Effect of sorbent concentration

Examination of the effect of aquifer material on the removal of MB dye from aqueous solution showed that the concentration of MB dye were further decreased with the additional amounts of aquifer material in the suspension from 0.2 to 2.5 g in 100 ml. The reason for such behavior is attributed to the larger number of binding sites on the adsorbent available to the dye. According to the data of this work, at initial MB concentration of 2mg/L, the maximum amount of MB removal is 80% is achieved when using 1.5 g of aquifer material (Fig. 6).
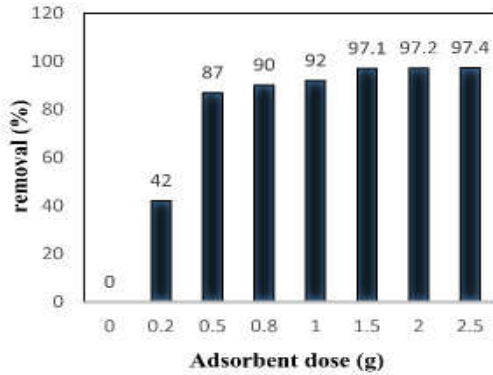
Fig. 6. Representation of % removal due to the different amount of adsorbent pH: 8.99, Dye conc. 2mg/L.

C. Adsorption isotherms

The equilibrium adsorption data were generally interpreted using Langmuir and Freundlich models which are represented by the following equations, respectively:

$$\frac{C_e}{q_e} = \frac{1}{bq_m} + \frac{C_e}{q_m} \qquad (5)$$

$$q_e = k_f C_e^{\frac{1}{n}} \qquad (6)$$

Where q_m (mg/g) and b (L/mg) are Langmuir isotherm coefficients (Fig.7). The value of q_m represents the maximum adsorption capacity. K_f (mg/g) and n are Freundlich constants (Fig.8). Two adsorption isotherms were constructed by plotting the Ce/q versus C_e, log q versus log C_e, respectively [11].
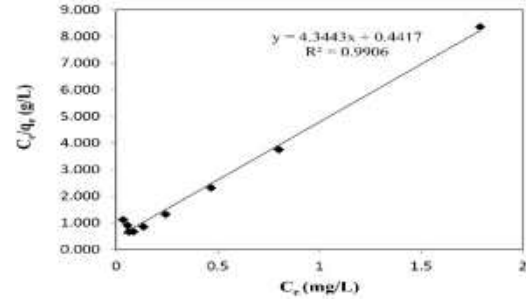
Fig. 7. Isotherm for MB adsorption onto aquifer material (temperature at 25^0 C, pH 8.89)
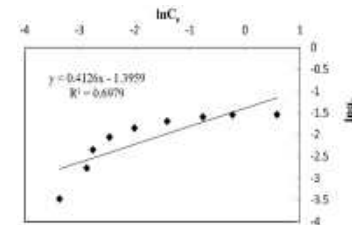
Fig. 8. Frendulich isotherm for adsorption onto aquifer material (temperature at 25^0C, pH 8.89)

Isotherm models						
Langmuir isotherm				Freundlich isotherm		
q	K_L	$R^2 K_F$	1/n	R^2		
0.232	9.85	0.99		0.247	0.412	0.697

Table 1. Isotherm constants for MB adsorption onto aquifer material

The adsorption equilibrium data were analyzed by the isotherm equations mentioned above, and corresponding parameters calculated were tabulated in Table 1. The values of R^2 obtained fromLangmuir isotherm equation were higher than those from Freundlich isotherm equations. Furthermore, the values of experimental adsorption capacity (q_e) were close to those of theoretical adsorption capacity (q_m) calculated from Langmuir isotherm equation. This information suggested Langmuir isotherm model could well describe the adsorption equilibrium process, indicating monolayer coverage of MB on the composite adsorbents.

$q_e$exp(mg/g)	0.127
Lagergren-first-order	
q_e cal (mg/g)	5.65
k_1 (1/min)	0.026
R^2	0.963
Pseudo-second-order	
$q_e$cal (mg/g)	0.128
k_2 (g/mg min)	10.84
R^2	0.999

Table 2. Parameters of kinetic models for the adsorption of MB on aquifer material.

CONCLUSIONS

From lab-scale results, RBF shows promise as a significant barrier for Dye transport.The removal of MB dye from aquifer material was studied in batch-experiments. The batch-suspension tests showed that the MB uptake increases with increasing adsorbent concentration and that equilibrium was attained within 2 h. The kinetics data followed the second order kinetics model indicating the chemisorptions nature of the process. Equilibrium data were fitted to Langmuir and Freundlichisothermsand the equilibrium data were best described by the Langmuir isotherm model.The maximum % removal of MB obtained was 97.2% at dye concentration of 2 mg/Lusing adsorbent dose with 1.5 g at pH 8.91 and temperature 25^0C.

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Adsorption of Different Petroleum Fraction Saline Emulsion from GT-CL-POLY (AA-IP-AAM) Interpenetrating Polymer Network Hydrogel

Saruchi
Dept. of Chemistry
NIT Jalandhar, Punjab
(India)

B S Kaith
Dept. of Chemistry
NIT Jalandhar, Punjab
(India)

Rajeev Jindal
Dept. of chemistry
NIT Jalandhar, Punjab
(India)

Vaneet Kumar
CT Group of
Institutions Jalandhar,
Punjab

Abstract: The adsorption of crude oil from different petroleum fraction saline emulsions were carried out using synthesized interpenetrating polymer network hydrogel. Gum tragacanth, poly(acrylic acid) and poly(acrylamide) IPN was synthesized using ascorbic acid-potassium persulphate as an initiator and glutaraldehyde as cross-linker. The prepared hydrogel was characterized using XRD technique.
Keywords: IPN, Poly(acrylic acid), poly(acrylamide) and petroleum emulsions

I. INTRODUCTION

Attention of researchers all over the world has also been focused on the design and development of multipolymer devices because of their better performance compared to that of individual components. Since homopolymer and copolymer hydrogels alone cannot meet out the divergent demands both in properties and performances, therefore, an IPN system is better approach. Interpenetrating polymer networks (IPNs) comprised of two or more than two polymer networks that are formed in the presence of one another have been found to be the versatile materials for biomedical applications. Many IPNs are prepared from water soluble polymers through cross-linking using chemical or enzymatic initiators. Different properties of IPN-system like porocity, elasticity and response to external stimuli can be tuned with respect to types of cross-linking agents and their proportions[5-6].
Present study deals with the synthesis of novel interpenetrating polymer network (IPN) for the removal of saline from different petroleum fraction saline emulsions.

II. EXPERIMENTAL

A. Material and Methods

Gum tragacanth, ascorbic acid and potassium persulphate, glutaraldehyde and acrylic acid were purchased from Merck. Petrol, diesel and petroleum ether (Indane oil) used as received.

B. Synthesis of IPN Gt-cl-poly(AA-ip-AAm)

Interpenetrating polymeric network (IPN) hydrogel based on Gum tragacanth, poly(acrylic acid) (PAA) and poly(acrylamide) (PAAm), was synthesized using ascorbic acid-potassium persulphate as an initiator and glutaraldehyde as a cross-linker. Gt-cl-poly(AA) was suspended in the deionized water. Known concentration of acrylamide was added with continuous stirring and was kept overnight. To the reaction mixture ascorbic acid-potasium persulphate was added slowly with continuous stirring followed by drop by drop addition of glutaraldehyde under preoptimized reaction conditions. Homopolymer was removed with aqueous extraction. Synthesized IPN was dried at 50^0C till constant weight was obtained. Concentration of acrylamide was optimized with respect to percentage swelling and was calculated using Eq. 1 [7].

$$P_s = W_s\text{-}W_d/W_d \, \text{x}100 \qquad (1)$$

Where, W_s and W_d are weight of swollen and dry polymer, respectively.

C. Swelling behavior of the hydrogel

Various reaction parameters like reaction time, temperature, amount of solvent, pH, molar ratio of ascorbic acid and potassium persulphate, concentration of monomers and cross-linker were optimized with respect to percentage swelling (P_s). The sample (0.5g) was immersed in distilled water and after every 2h interval weight gain of the swollen sample was noted down. On attaining the swelling equilibrium, swollen sample was separated from the water through filtering. The percentage swelling of the hydrogel was calculated as per the Eq. 1

2.4 X-ray diffraction (XRD) studies

This technique was used to understand weather the polymers retain their crystalline structure or they get deformed during polymerization process. The structural analysis has been extended to "dried gels" and hydrogels were obtained through rehydrating the dried samples. The X-ray diffraction profiles of the hydrogels have been interpreted into three components: free water, crystalline aggregates and swollen amorphous hydrogel. X-ray imaging techniques based on phase-contrast have been used to study the use of these hydrogel in biomedical application due to their ability to provide information about the X-ray refraction properties of the samples. Coherence length of all the samples was calculated using Eq. 2. [3-4].

$$L = 0.9\lambda / \beta \tfrac{1}{2} \times \cos\theta \qquad (2)$$

where, λ=wavelength, θ=diffraction angle, L=coherence length and $\beta\tfrac{1}{2}$=full width half maximum.

Selective absorption of saline from different petroleum fraction-saline emulsions,Initially different petroleum fraction-saline emulsions were prepared using 1% NaCl saline and petroleum fraction (1:1, V/V) in a beaker. To the mixture 10% tween-20 was added as an emulsifier and emulsion was prepared through continuous stirring in an automatic shaking machine (Dolphin DAR64X) for about 30 min. Saline uptake studies have been carried-out by immersing different weights of the candidate polymer in 1:1 ratio of petrol-saline, diesel-saline and petroleum ether-saline emulsions (100 ml). Volume of each sample was taken after a definite time interval up to 60 h. Percentage saline removal from different petroleum fractions-saline emulsions was calculated using Eq. 3 [1].

Percentage saline removal (Psr) = 50-volume of saline removed/50 x100 (3)

III. RESULT AND DISCUSSION
A. Synthesis of Gtc-cl-poly(AA-ip-AAm) (IPN)
B. Optimization of acrylamide

The fluid uptake capacity of the cross-linked candidate polymer was found to increase with increase in acrylamide concentration and optimum concentration for maximum fluid uptake (Ps = 225.5%) was found at 0.35×10^{-3} molL^{-1}. Further increase in acrylamide concentration resulted in decreased fluid uptake capacity which was due to increased cross-linking density with more compactness and lesser fluid intake capacity.

C. X-ray diffraction (XRD)

XRD studies of Gum tragacanth and Gt-cl-poly(AA-ip-AAm) were carried-out to find-out the effect of graft copolymerization and cross-linking of different poly(monomer) chains within the matrix (IPN) on amorphous and crystalline behavior of the candidate polymers.

1) Gum tragacanth

Gum tragacanth showed maximum peak intensity at 26.63^0 on 2θ-scale corresponding to the coherence length of 0.0816Å. XRD results revealed that Gum tragacanth was almost amorphous in nature with minimum coherence length (Fig. 1a).

2) Gt-cl-poly(AA-ip-AAm)

In case of Gt-cl-poly(AA-ip-AAm) maximum intensity peak was observed at 20.88^0 on 2θ-scale with coherence length 0.088 Å (Fig. 1b). Higher coherence length indicated increase in anisotropy with the alignment of different polysaccharide chains, poly(AA)chains and poly(AAm) chains alongwith cross-linking and interaction in comparison to backbone.
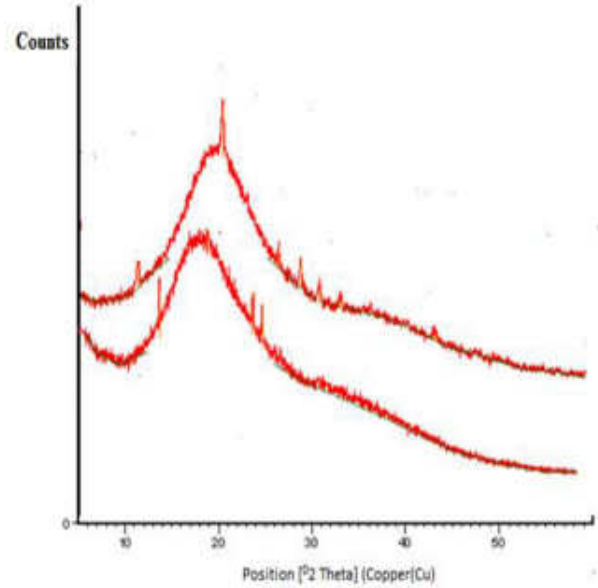
Figs. 1a,b: XRDs Patterns of (a) Gum tragacanth and (b) Gt-cl-poly(AA-ip-AAm)

D. Selective Absorption Of Saline From Different Petroleum Fraction-Saline Emulsions

Saline uptake studies were carried out using different dosage of synthesized hydrogels at different time intervals. It was found that initially increase in time intervals %age saline volume decreased at faster rate and with further increase in time interval rate of saline removal from petroleum fraction-saline emulsion became slow till equilibrium was attained. It was due to the fact that after the long time duration (52 h), pore network of the synthesized hydrogels got saturated with the solvent molecules restricting further entry into the matrix. The %age saline volume decrease in saline-petrol emulsions was (23%, Fig. 2a), saline-diesel emulsions was 23.6% (Fig. 2b) and saline-petroleum ether emulsions was found to be 19.4% (Fig. 2c) in Gt-cl-poly(AA-ip-AAm) [1,2].
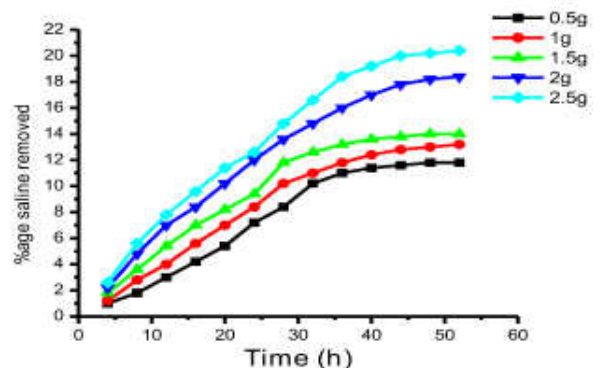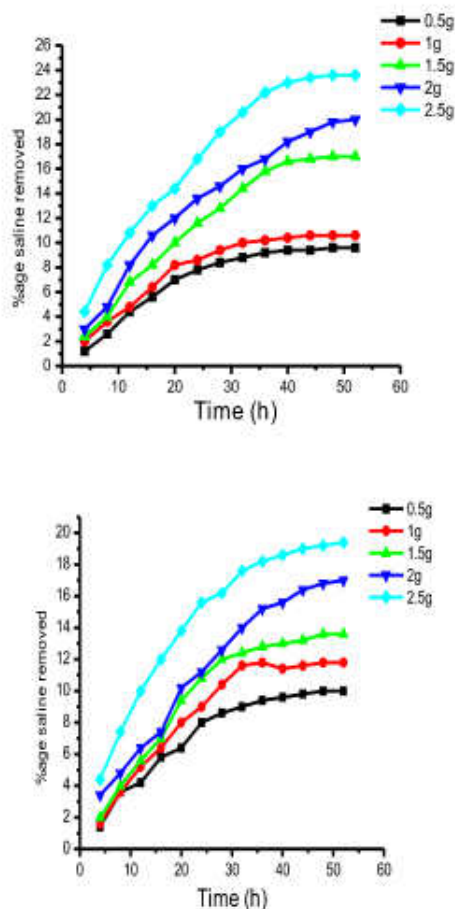
Figs. 2a-c: Percentage saline removal from (a) petrol; (b) diesel and (c) petroleum ether-saline fraction by Gt_C-cl-poly(AA-ip-AAm)

IV. CONCLUSION

A novel interpenetrating polymer network hydrogel was synthesized. Synthesized IPN was biodegradable in nature and do not have any adverse impact on the environment. Foregone discussion revealed that synthesized IPN wasveryefficient for theremoval of saline from different petroleum fraction and also do not have any adverse impact on environment. Thus the method used for the removal of petroleum fraction from different petroleum-saline emulsions is important from technological point of view.

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An Eco-Epidemic Predator-Prey Model with Disease in Prey

Kulbhushan Agnihotri
Department of Applied Sciences & Humanities
Shaheed Bhagat Singh State Technical Campus
Ferozepur , India
agnihotri69@gmail.com

Nishant Juneja
Department of Mathematics
Dev Samaj College For Women
Ferozepur , India
nishu_2107@rediffmail.com

Abstract-In the present paper, an eco-epidemic model with predator-prey system in which only the prey population is infected with some disease is proposed and analyzed. Consequently the prey population is divided into two categories i.e. the susceptible prey and infected prey. It is assumed that the predator consumes the infected prey only. Recovery of the infected prey species is also incorporated. Predator functional response is assumed to be Holling type II. All the feasible equilibrium points of the system are obtained. The conditions for existence as well as for local and global stability of the equilibrium points have been carried out.

Keywords- Prey, Predator, stability, equilibrium points

I. INTRODUCTION

Many researchers have worked and some are working on infectious diseases caused by pathogens. In their seminal paper, Anderson and May [1] proposed an eco-epidemiological model to deal with infectious diseases in predator-prey systems. It is observed that not only the disease in the system affects the dynamics of the prey- predator population, but the prey-predator interactions also affect the dynamics of disease [2-3]. Hethocote et al. [4], Chattopadhyay and Bairagi [5] and Xiao and Chen [6] considered the case where only the predator species is infected with some disease. Bhattacharyya and Mukhopadhyay [7] and Auger et al. [8] consider the spread of disease in prey species.

In the present paper, a predator-prey model is proposed and analyzed in which only the prey population is invaded by a disease. The disease is spreading from infected prey to susceptible prey. It is assumed that the predator species eats only the infected prey because the infected species are easily cacheable. Recovery of the prey species is also incorporated, consequently a SIS model is considered.

II. MATHEMATICAL MODEL

An eco-epidemiological model consisting of three species, namely, the susceptible prey, the infected prey and the predator population with recovery in prey species is considered in the present work. Mass action incidence rate is taken for the dynamics of direct transmission of disease in prey. It is assumed that the disease spread among the prey population only and it is not genetically inherited. Also it is assumed that the predator population eats only the infected prey with Holling type-II functional response.

Under above assumptions, following mathematical model is formed.

$$\frac{dS}{dt} = r - \beta SI - d_1 S + \gamma I$$

$$\frac{dI}{dt} = \beta SI - \frac{PI}{1+I} - d_2 I - \gamma I \qquad (1)$$

$$\frac{dP}{dt} = P\left(-d_3 + \frac{cI}{1+I}\right)$$

where 'r' is the constant recruitment rate into the prey population, d_1, d_2 and d_3 are the natural death rates of the susceptible prey, infected prey and the predator population respectively, 'γ' is the recovery rate of infected prey, 'β' is the incidence rate of disease in prey and 'c' is the conversion efficiency of predator.

III. UNIFORM BOUNDEDNESS

Theorem-1:- All the solutions of the system (1) will be in the region $\quad R = \left\{ S, I, P \right\} \in R_+^3 : 0 \le S + I + P \le \frac{r}{\lambda} \quad$ as

$t \to \infty$ for all positive initial values $(S(0), I(0), P(0)) \in R_+^3$ where $\lambda = \min(d_1, d_2, d_3)$.

Proof: - Let us consider the following function:

$$W(t) = S(t) + I(t) + P(t)$$

$$\frac{dW(t)}{dt} \le r - \lambda W, \text{ where } \lambda = \min(d_1, d_2, d_3)$$

By comparison theorem [9], $W(t) \le \frac{r}{\lambda}$ as $t \to \infty$. Hence the proof.

IV. EQUILIBRIUM POINTS

The system (1) has following equilibrium points.

(i) $\hat{E}(\hat{S}, 0, 0)$, where $\hat{S} = \frac{r}{d_1}$, which always exist.

(ii) $E'(S', I', 0)$,

where $S' = \frac{d_2 + \gamma}{\beta}$, $I' = \frac{r\beta - d_1(d_2 + \gamma)}{d_2 \beta}$, exist if $r\beta - d_1(d_2 + \gamma) > 0$.

(iii) $E^*(S^*, I^*, P^*)$

where $S^* = \frac{r(c - d_3) + \gamma d_3}{d_1(c - d_3) + \beta d_3}$,

$I^* = \frac{d_3}{c - d_3}$,

$P^* = \frac{c}{c - d_3} \left[\frac{r\beta - d_1 d_2 - d_1 \gamma \quad c - d_3 \quad -d_2 d_3 \beta}{d_1(c - d_3) + \beta d_3} \right]$

which exist if $c > d_3$, $r\beta - d_1 d_2 - d_1 \gamma > \frac{d_2 d_3 \beta}{c - d_3}$

i.e. $c - d_3$, $r > \frac{d_2 d_3 \beta + d_1(d_2 + \gamma) \quad c - d_3}{\beta \quad c - d_3} = \hat{r}(\text{say})$

The basic reproduction number [10] R_0 (for susceptible prey species) is defined as the expected number of infected prey produced by a single infected prey when introduced in a fully susceptible prey population and it is given by

$$R_0 = \frac{\beta \hat{S}}{d_2 + \gamma}$$

VI. STABILITY ANALYSIS

Theorem-2:- The equilibrium point $\hat{E}(\hat{S}, 0, 0)$ is globally stable if $R_0 < 1$.

Proof: - From variational matrix, it is known that all the Eigen values for the equilibrium point $\hat{E}(\hat{S}, 0, 0)$ have negative real parts provided

$$\beta r < d_1(d_2 + \gamma) \text{ i.e. } R_0 < 1.$$

Therefore $\hat{E}(\hat{S}, 0, 0)$ is locally stable provided $R_0 < 1$.

Also when $\hat{E}(\hat{S}, 0, 0)$ is locally stable, then all other equilibrium points namely E' and E^* will not exist. Therefore when $\hat{E}(\hat{S}, 0, 0)$ is locally stable then it is also globally stable. Hence the proof.

Theorem-3:- The boundary equilibrium point $E'(S', I', 0)$ (if exists) is locally as well as globally stable if $c < d_3$.

Proof: - From the variational matrix, the characteristic equation for $E'(S', I', 0)$ is given by

$$\left(\xi + d_3 - \frac{cI'}{1 + I'} \right) \xi^2 + (\beta I' + d_1)\xi + d_2 \beta I' = 0.$$

The second factor in the above equation will give only negative Eigen values. So all the Eigen values have negative real parts provided

$$\frac{cI'}{1 + I'} - d_3 < 0$$

i.e. $d_3 > c$

Also it is observed that when equilibrium point $E'(S', I', 0)$ exists then $\hat{E}(\hat{S}, 0, 0)$ is not locally stable and when $E'(S', I', 0)$ is locally stable then $E^*(S^*, I^*, P^*)$ does not exist. So when $E'(S', I', 0)$ locally stable then it is globally stable as all other equilibrium points either do not exist or not locally stable. Hence the proof.

Theorem-4:- The Interior equilibrium point $E^*(S^*, I^*, P^*)$ is locally as well as globally stable if $a_1, a_2 > 0$ and $a_1 a_2 - a_3 > 0$, where

$$a_1 = \beta I^* + d_1 - \frac{P^* I^*}{(1 + I^*)^2},$$

$$a_2 = I^* \left(\beta^2 S^* + \frac{P^* c}{(1 + I^*)^3} \right) - \frac{P^* (\beta I^* + d_1)}{(1 + I^*)^2} - \beta \gamma$$

and $a_3 = \dfrac{P^* I^* c(\beta I^* + d_1)}{(1 + I^*)^3}$.

Proof: - From the variational matrix, the characteristic equation for E^* is given by

$$\xi^3 + a_1 \xi^2 + a_2 \xi + a_3 = 0$$

The local stability of $E^*(S^*, I^*, P^*)$ will be found by Routh- Hurwitz criterion.

So when the equilibrium point $E^*(S^*, I^*, P^*)$ exist and is locally stable, then all other equilibrium points $\hat{E}(\hat{S}, 0, 0)$ and $E'(S', I', 0)$ are not locally stable. Hence the equilibrium point $E^*(S^*, I^*, P^*)$ is globally stable.

VII. CONCLUSION

In this paper, a three species eco-epidemiological model with disease in prey species is proposed and analyzed. SIS model for the prey species is considered. Functional response for predator species is taken to be Holling type-II. Conditions for the existence and local as well as global stability of all the equilibrium points are obtained. It is observed that all the equilibrium points are globally stable, whenever they are locally stable. The effect of recovery of the prey species on the dynamics of predator-prey system is also investigated and it is found that recovery of prey species will reduce the basic reproduction number R_0 and enhance the stability of disease free equilibrium point. Also if the recovery of infected prey species is sufficiently so high that $R_0 < 1$, then disease free point $\hat{E}(\hat{S}, 0, 0)$ will become globally stable. It is further concluded that if conversion efficiency of predator is sufficiently low that $d_3 > c$, then $E'(S', I', 0)$ will become globally stable and predator species will become extinct from the system.

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Green Computing: The Need of the Hour

Parminder Kaur
Department of Computer Science & Engineering
Guru Nanak Dev University
Amritsar-143005, India
parminderkaur@yahoo.com

Hardeep Singh
Department of Computer Science & Engineering
Guru Nanak Dev University
Amritsar-143005, India
hardeep_gndu@rediffmail.com

Abstract—Modern IT systems rely upon a complicated mix of people, networks, and hardware; as such, a green computing initiative must cover all of these areas as well. A solution may also need to address end user satisfaction, management restructuring, regulatory compliance, and return on investment (ROI). There are also considerable fiscal motivations for companies to take control of their own power consumption via power management tools. Green Information and Communication Technology (ICT) and its services present opportunities to deliver low carbon footprints and mitigate carbon emissions because of the unique ability to make energy consumption. This paper reviews various available Green Computing technologies. Government perspective as well as Industry perspective to encourage Green Computing is also discussed.

Keywords—Green Computing, Green Information Technology, Solar Computing, Carbon-free Computing, Energy-efficient Computing, Green Technology

I. INTRODUCTION

Green computing, the study and practice of efficient and eco-friendly computing resources, is now under the attention of not only environmental organizations, but also businesses from other industries. In recent years, companies in the computer industry have come to realize that going green is in their best interest, both in terms of public relations and reduced costs. The Green Computing Initiative (GCI), stewards of the industry standards EFGCD – Eco – Friendly Green Computing Definition defines Eco- Friendly Green Computing as the study and practice of the design, development, implementation, utilization and disposal of IT infrastructure efficiently and effectively with low or zero impact on the environment whilst reducing operating costs [1-3, 19]. Currently the ICT industry is responsible for 3% of the world's energy consumption. With the rate of consumption increasingly by 20% a year, 2030 will be the year when the world's energy consumption will double because of the ICT industry. Organizations use the Green Computing Lifecycle (Figure 1) when designing and implementing green computing technologies. The stages in the Life Cycle include Specification, Design, Implementation & Usage, Recycling & Disposal and Analysis. The Five core green computing technologies advocated by GCI are Green Data Centre, Virtualization, Cloud Computing, Power Optimization and Grid Computing. Company like VIA Technology, a Taiwanese company, offer green PC's that are affordable, non- toxic and ultra-low wattage. It takes responsibility for their out-dated products by offering a PC recycling service [5-8]. The main objectives of practicing Green Computing are:

- To gain an understanding why the green computing is instrumental for the environment.

- How to design energy-efficient hardware, software and systems?

- To make use of IT to make physical infrastructure efficient w.r.t. Homes, offices, buildings as well as transportation?

- How to reduce the use of hazardous materials?

- How to promote recyclability or biodegradability of defunct products and factory waste?
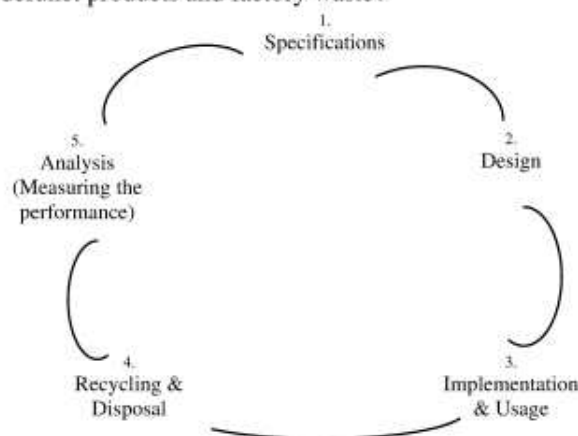
Fig. 1: Green Computing Process [Sara & Imtiaz, 2012]

II. LITERATURE REVIEW

When it comes to PC disposal, there is a need to know everything involved in green computing. Basically, the whole green aspect came about quite a few years back when the news that the environment was not a renewable resource really hit home and people started realizing that they had to do their part to protect the environment [4]. Many governments worldwide have initiated energy-management programs, such as Energy Star, an international standard for energy-efficient electronic equipment that was created by the United States Environmental Protection Agency in 1992 and has now been adopted by several other countries. Energy Star reduces the amount of energy consumed by a product by automatically switching it into —sleep mode when not in use or reducing the amount of power used by a product when in-standby mode.

Surprisingly, standby-leaking, the electricity consumed by appliances when they are switched off, can represent as much as 12 % of a typical household's electricity consumption. Basically, the efficient use of computers and computing is what green computing is all about. The triple bottom line is what is important when it comes to anything green and the same goes for green computing. This considers social responsibility, economic viability and the impact on the environment. Many businesses simply focus on a bottom line, rather than a green triple bottom line, of economic viability when it comes to computers. The idea is to make the whole process surrounding computers more friendly to the environment, economy, and society. This means manufacturers create computers in a way that reflects the triple bottom line positively. Once computers are sold businesses or people use them in a green way by reducing power usage and disposing of them properly or recycling them. The idea is to make computers from beginning to end a green product. The solution to green computing is to create an efficient system that implements these factors in an environmentally friendly way. A good example would be IT managers purchasing hardware that has been EPEAT (www.epeat.net) approved meaning that maintenance is reduced, the hardware's life is extended, and makes recycling the computer easy once it is no longer necessary. Mobile phones are better than computers – an alternative for green computing. What do you use your computer for? Surfing Internet, chat, gaming, social networking, downloading, desktop computing including documents, spreadsheets or presentation making or just watching your photos and videos, everything can be performed by mobile phones, rather sometimes more than the traditional phones. They have faster processors, more RAM, faster wireless Internet connectivity and larger memories. Mobile Phones consume very low power. VIA Technologies (www.via.com) that manufacture motherboard chipsets, CPUs, and other computer hardware, introduced its initiative for green computing. If everyone takes into account green computing then our world of computers will have as little a negative impact on our physical world as possible and that is what green computing is all about.

III. GREEN COMPUTING TECHNOLOGIES: SOME INITIATIVES

With this green vision in mind, companies have been focusing on power efficiency throughout the design and manufacturing process of their products. Its environmentally friendly products are manufactured using a range of clean-computing strategies, and the company is striving to educate markets on the benefits of green computing for the sake of the environment, as well as productivity and overall user experience.

A. Carbon –free Computing

One of the VIA Technologies idea, is to reduce the "carbon footprint" of users-the amount of greenhouse gases produced, measured in units of carbon dioxide (CO_2). Greenhouse gases naturally blanket the Earth and are responsible for its more or less stable temperature. An increase in the concentration of the main greenhouse gases-carbon dioxide, methane, nitrous oxide, and fluorocarbons-is believed to be responsible for Earth's increasing temperature, which could lead to severe floods and droughts, rising sea levels, and other environmental effects, affecting both life and the world's economy.

B. Solar Computing

Amid the international race toward alternative-energy sources, VIA is setting its eyes on the sun, and the company's Solar Computing initiative is a significant part of its green-computing projects. Solar cells fit VIA's power-efficient silicon, platform, and system technologies. It enables the company to develop fully solar-powered devices that are non-polluting, silent, and highly reliable. Solar cells require very little maintenance throughout their lifetime, and once initial installation costs are covered, they provide energy at virtually no cost. Worldwide production of solar cells has increased rapidly over the last few years; and as more governments begin to recognize the benefits of solar power, and the development of photovoltaic technologies goes on, costs are expected to continue to decline.

C. Lead-Free and RoHS Computing

In February 2003, the European Union adopted the Restriction of Hazardous Substances Directive (RoHS). The legislation restricts the use of six hazardous materials in the manufacture of various types of electronic and electrical equipment. The directive is closely linked with the Waste Electrical and Electronic Equipment Directive (WEEE), which sets collection, recycling, and recovery targets for electrical goods and is part of a legislative initiative that aims to reduce the huge amounts of toxic e-waste. Driven by these directives, VIA implemented a set of internal regulations in order to develop products that are compliant with these accepted policies, including the use of non-hazardous materials in its production of chipsets, processors, and companion chips. VIA's lead-free manufacturing technologies do not require a lead bead, and the solder balls now consist of a tin, silver, and copper composite.

D. Energy Efficient Computing

A central goal of VIA's green-computing initiative is the development of energy-efficient platforms for low-power, small-form-factor (SFF) computing devices. In 2005, the company introduced the VIA C7-M and VIA C7 processors that have a maximum power consumption of 20W at 2.0GHz and an average power consumption of 1W. These energy-efficient processors produce over four times less carbon during their operation and can be efficiently embedded in solar-powered devices.

VIA isn't the only company to address environmental concerns: Intel, the world's largest semiconductor maker, revealed eco-friendly products at a recent conference in London. The company uses virtualization software, a technique that enables Intel to combine several physical

systems into a virtual machine that runs on a single, powerful base system, thus significantly reducing power consumption. Earlier this year, Intel joined Google, Microsoft, and other companies in the launch of the Climate Savers Computing Initiative that commits businesses to meet the Environmental Protection Agency's Energy Star guidelines for energy-efficient devices.

IV. REGULATIONS AND INDUSTRY INITIATIVES

The Organization for Economic Co-operation and Development (OECD) has published a survey of over 90 government and industry initiatives on "Green ICTs", i.e. information and communication technologies, the environment and climate change. The report concludes that initiatives tend to concentrate on the greening ICTs themselves rather than on their actual implementation to tackle global warming and environmental degradation. In general, only 20% of initiatives have measurable targets, with government programs tending to include targets more frequently than business associations [5].

A. Government Perspective

Many governmental agencies have continued to implement standards and regulations that encourage green computing.

In 1992, the U.S. Environmental Protection Agency launched Energy Star, a voluntary labelling program that is designed to promote and recognize energy-efficiency in monitors, climate control equipment, and other technologies. This resulted in the widespread adoption of sleep mode among consumer electronics. Concurrently, the Swedish organization TCO Development launched the TCO Certification program to promote low magnetic and electrical emissions from CRT-based computer displays; this program was later expanded to include criteria on energy consumption, ergonomics, and the use of hazardous materials in construction [9].

The Energy Star program was revised in October 2006 to include stricter efficiency requirements for computer equipment, along with a tiered ranking system for approved products [10-11]. By 2008, 26 US states established state-wide recycling programs for obsolete computers and consumer electronics equipment [12]. The statutes either impose an "advance recovery fee" for each unit sold at retail or require the manufacturers to reclaim the equipment at disposal. In 2010, the American Recovery and Reinvestment Act (ARRA) was signed into legislation by President Obama. The bill allocated over $90 billion to be invested in green initiatives (renewable energy, smart grids, energy efficiency, etc.) In January 2010, the U.S. Energy Department granted $47 million of the ARRA money towards projects that aim to improve the energy efficiency of data centres. The projects provided research to optimize data centre hardware and software, improve power supply chain, and data centre cooling technologies [13].

B. Industry Perspective

Green Computing from Industry perspective is as follows:

- Climate Savers Computing Initiative (CSCI) provides a catalogue of green products from its member organizations, and information for reducing PC power consumption. It was started on 2007-06-12. The name stems from the World Wildlife Fund's Climate Savers program, which was launched in 1999.[11] The WWF is also a member of the Computing Initiative [14-15].

- The Green Electronics Council offers the Electronic Product Environmental Assessment Tool (EPEAT) to assist in the purchase of "greener" computing systems. The Council evaluates computing equipment on 51 criteria - 23 required and 28 optional - that measure a product's efficiency and sustainability attributes. Products are rated Gold, Silver, or Bronze; depending on how many optional criteria they meet [16-17].

- The Green Grid is a global consortium dedicated to advancing energy efficiency in data centres and business computing ecosystems. It was founded in February 2007 by several key companies in the industry – AMD, APC, Dell, HP, IBM, Intel, Microsoft, Rackable Systems, SprayCool (purchased in 2010 by Parker), Sun Microsystems and VMware. The Green Grid has since grown to hundreds of members, including end-users and government organizations, all focused on improving data center infrastructure efficiency (DCIE).

- The Green500 list rates supercomputers by energy efficiency (megaflops/watt, encouraging a focus on efficiency rather than absolute performance.

- Green Comm Challenge is an organization that promotes the development of energy conservation technology and practices in the field of Information and Communications Technology (ICT).

- The Transaction Processing Performance Council (TPC) Energy specification augments existing TPC benchmarks by allowing optional publications of energy metrics alongside performance results [17-18].

- The Advanced Configuration and Power Interface (ACPI), an open industry standard, allows an operating system to directly control the power-saving aspects of its underlying hardware. This allows a system to automatically turn off components such as monitors and hard drives after set periods of inactivity. In addition, a system may hibernate, when most components (including the CPU and the system RAM) are turned off. ACPI is a successor to an earlier Intel-Microsoft standard called Advanced Power Management, which allows a computer's BIOS to control power management functions.

- The dominant desktop operating system, Microsoft Windows, has included limited PC power management features since Windows 95. These initially provided for stand-by (suspend-to-RAM) and a monitor low power state. Further iterations of Windows added hibernate (suspend-to-disk) and support for the ACPI standard.

Windows 2000 was the first NT-based operating system to include power management.

- Google is creating a better web that's better for the environment by using resources efficiently and supporting renewable power. They have committed over $1 billion to renewable energy projects. Google Products like Google maps, Google+, YouTube, Gmail, Google Earth, Google Cloud Platform and Finance help us live a better life while also being good to the environment.

V. CONCLUSIONS

The field of "green technology" encompasses a broad range of subjects — from new energy-generation techniques to the study of advanced materials to be used in our daily life. As individuals and organizations around the world look to reduce their impact on the environment, a growing concern is the reduction of one's Carbon Footprint which is a measure of the impact human activities have on the environment in terms of the amount of greenhouse gases produced, measured in units of carbon dioxide (CO_2). It has taken upon itself the goal to provide society's needs in ways that do not damage or deplete natural resources. Mainly this means creating fully recyclable products, reducing pollution, proposing alternative technologies in various fields, and creating a centre of economic activity around technologies that benefit the environment. Green IT programs are demonstrating fundamental economic as well as environmental sense, it is understandable why organizations are exploring green computing options with such intense interest across the IT industry. As more and more companies include some form of reporting on their goals and achievements in the area of CSR, there is a growing awareness among business leaders that greening their IT practices offers the-double-win of reducing costs while demonstrating a positive environmental commitment.

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Track 4

Technical Session: 2

Physics

Systematics of Band Moment of Inertia of Yrast SD Bands of Even-Even Nuclei in A=150 Mass Region

Neha Sharma
CT Institute of Engineering
Management and Technology,
Shahpur, Jalandhar-144020
Email- nsharma.nitj@gmail.com

H.M. Mittal
Dr B.R. Ambedkar National Institute
of Technology, Jalandhar-144011

Pankaj Vikas Thakur
CT Institute of Engineering
Management and Technology,
Shahpur, Jalandhar-144020

Abstract - A four parameter formula has been applied to all the yrast superdeformed (SD) bands of even-even nuclei in the A=150 mass region to obtain band moment of inertia J_0. In even-even nuclei, total three yrast SD bands bands have been fitted. The measured Q_t- values and hence the axes ratios have been used to calculate the rigid body J_0 values and compare with the fitted values of J_0. It is interesting to look at the yrast SD band ^{152}Dy(1), the doubly magic SD nucleus and the first one to be discovered that the J_0 values are quite larger than that extracted from Q_t measurement.

Keywords: Nuclear Structure, band moment of inertia, superdeformed bands

I. INTRODUCTION

The superdeformed (SD) shapes whose existence was predicted first by V.M. Strutinsky [1] have been observed experimentally by Twin et al. [2]. They are manifestation of strong deformed shell effects which remain in close analogy to the well known spherical shell closures. The phenomenon of high spin deformation represents one of the most remarkable discoveries in nuclear physics made during the last decade of 20th century. A large number of SD bands have been observed in the mass region A=60, 80, 130, 150, 190 [3, 4]. Also Ideguchi et al. [5, 6] observed SD bands in A=40 mass region. The cascades of SD bands are known to be connected by electric quadruple (E2) transitions. There is no linking transition to normal levels so spin assignments of most of these bands carry a minimum uncertainty $\approx$ 1-2 $\hbar$. Recently a link has been observed in A=190 mass region [7]. It may be pointed out that a lack of knowledge of the spins has led to an emphasis on the study of dynamical moment of inertia of SD bands and the systematics of the kinetic moment of inertia have not been examined in a detailed manner.

Since the SD bands are good rotors, so it was found that moment of inertia of SD bands comes quite close the rigid body value in most of the cases [8, 9]. On the other hand, studies of pairing correlations in rapidly rotating nuclei [10] show that pairing fluctuations [11] lead to important renormalization of nuclear motion after the pairing collapse, that is, at rotational frequencies where the normal phase has been realized.

In this paper, we extract the band moment of inertia J_0 of all the known yrast SD bands in A=150 mass region

corresponding to 2:1 deformation and present their systematics. In this paper, we use a simple 4-parameter formula based on the prescription of Bohr and Mottelson [12, 13] to obtain the band moment of inertia.

II. FORMALISM

Bohr and Mottelson [12, 13] pointed out that the rotational energy of K = 0 bands in even-even nuclei can be expanded in a power series of I(I + 1):

$$E(I) = A(I(I+1)) + B(I(I+1))^2 + C(I(I+1))^3 + D(I(I+1))^4 \tag{1}$$

The expansion for K≠0 band can take a form similar to equation (1), but includes a term for the bandhead energy and I(I+1) has to be replaced by $I(I+1)-K^2$. The energy may also be written in different form as [14],

$$E(I)= \frac{1}{2J_0}\left((I(I+1)) - \frac{\sigma}{2}(I(I+1))^2 + \sigma^2(I(I+1))^3 - 3\sigma^3(I(I+1))^4 \right) \tag{2}$$

where the softness parameter $\sigma = 1/2S(J_0)^3$ [15] is a small parameter of the expansion with S and J_0 as stiffness constant and moment of inertia respectively. On rearranging the equation (1), we obtain

$$E(I) = A\{(I(I+1)) + (B/A)(I(I+1))^2 + (C/A)(I(I+1))^3 + (D/A)(I(I+1))^4\} \tag{3}$$

A comparison of equations (2) and (3) suggests that

$$A = \frac{1}{2J_0}, B/A = \frac{\sigma}{2}, C/A = \sigma^2 \text{ and } D/A = -3\sigma^3 \tag{4}$$

For SD bands, where the band quantum number K is not known, the equation (1) can be written as

$$E(I) = E_0 + A(I(I+1)-I_0(I_0+1)) + B((I(I+1))^2 - (I_0(I_0+1))^2) + C((I(I+1))^3 - (I_0(I_0+1))^3) + D((I(I+1))4 - (I_0(I_0+1))^4) \tag{5}$$

where E_0 is the bandhead energy and I_0 is the bandhead spin. Since the bandhead energy and spin are generally not known for the SD bands, one may chose to fit the E2 transitions,

$$E_\gamma(I) = E(I)-E(I-2) \tag{6}$$

Using equations (5) and (6), we obtain

E_γ (I $\rightarrow$ I−2) = A(I(I+1)−(I−2)(I−1)) + B((I(I+1))2−((I−2)(I−1))2) + C((I(I+1))3 − ((I−2)(I−1))3) + D((I(I+1))4 − ((I−2)(I−1))4)

(7)

The parameters A,B,C and D may now be determined by fitting the E2 transitions for the SD cascades. One may then obtain the nuclear softness parameter (s) by using the relations in (4).

III. RESULT AND DISCUSSIONS

First of all, we classify the bands into yrast SD bands of even-even nuclei in A=150 mass region by using the feeding intensities from the experiments and reported in ref. [3, 4]. We have calculated the band moment of inertia J_0 by fitting the E2 gamma ray energies of all the yrast SD bands of even-even nuclei in A=150 mass region [3, 4] by using a 4-parameter formula [12, 13]. In these bands, some kind of spin assignments is available. The fits are very good because the SD bands are very good rotors. The root mean square deviation has been calculated and shown in the results for each band. For a prolate ellipsoid, the transition quadrupole moment (Q_t) can be related to the major-to-minor axis ratio, x, by [16]

$$Q_t = \frac{2}{5} ZR^2 \frac{x^2-1}{x^{\frac{2}{3}}} \times 10^{-2} eb \quad .$$

(8)

So, the axes ratio can be estimated from Q_t in this way. For a prolate ellipsoid which gives rigid rotation, it is possible to estimate the rigid body moment of inertia as [17]

$$J_{prolate} = \{ \frac{A^{\frac{5}{3}}}{72} \frac{1+x^2}{2x^{\frac{2}{3}}} \} \hbar^2/MeV.$$

(9)

Higher order shape degrees of freedom and effect of triaxiality or necking have been ignored here.

We compared the fitted values of J_0 of yrast SD bands of even-even nuclei in A=150 mass region with the rigid rotor values of moment of inertia obtained from the measured- Q_t values. Those SD bands in which the Q_t measurements are not available, we have compared the fitted J_0 values with those obtained from the corresponding prolate shape of the SD nuclei. It is to be noted that all the SD nuclei of A=150 mass region correspond to the 2:1 shape of the nuclei. In a significant finding, we noted that fitted values of J_0 of yrast SD bands of even-even nuclei i.e. [148]Gd(1) and [152]Dy(1) are larger than that of the measured Qt-values [see Table 1]. These bands are termed as "super-rigid" SD bands.

Table 1. Table of band moment of inertia J_0($\hbar^2$/MeV) and softness parameter (σ) with RMSD (keV) for yrast SD bands of even-even nuclei having 2:1 deformation.

Nuclei	J_0(4-parameter)	σ×10⁻⁵	J_0(Qt)	J_0(2:1)	J_0(1:1)	RMSD
[108]Cd(1)	31.7	39.5	46.9	53.6	34.0	2.91
[148]Gd(1)	81.7	1.3	80.4	90.6	57.5	1.3
[150]Gd(1)	68.3	16.9	86.7	92.6	58.8	4.1
[152]Dy(1)	92.6	1.9	88.2	94.7	60.1	0.74

IV. CONCLUSION

The 4-parameter formula has been used to obtain the band moment of inertia J_0 for the yrast SD bands of even-even nuclei in A=150 mass region. In a significant finding, we found that the value of J_0 of yrast SD bands of even-even nuclei i.e. [148]Gd(1) and [152]Dy(1) is larger than the rigid rotor value obtained from the measured Q_t-values. We termed these bands as super rigid rotor bands.

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Where and Why are Chalcogenides used? – A Review

Anjali Kaushal
Department of Physics
D.A.V. College
Jalandhar, India
anjali13kaushal@gmail.com

Sharanjit Sandhu
Department of Physics
D.A.V. College
Jalandhar, India
sharanjitkaursandhu@yahoo.com

Abstract— This paper represents a review of the various applications of the chalcogenide glasses based on different physical properties of these glasses.

Keywords— Chalcogenide Glasses

I. INTRODUCTION

Chalcogenide glasses are based on the chalcogen elements S, Se, and Te. These glasses are formed by the addition of other elements such as Ge, As, Sb, Ga, etc to one or group of chalcogenides. They are low-phonon-energy materials and are generally transparent from the visible up to the infrared. Chalcogenide glasses can also be doped by rare earth elements, such as Er, Nd, Pr, etc., and hence numerous applications of active optical devices have been proposed. By doing slight change in the compositions, preparation techniques and conditions, we can change their properties as we require. Chalcogenide-glass fibers transmit in the IR, there are numerous potential applications in the civil, medical, and military areas. Passive applications utilize chalcogenide fibers as a light conduit from one location to another point without changing the optical properties, other than those due to scattering, absorption, and reflection.

II. DISCUSSION AND CONCLUSION

A. Phase Change Memory

Chalcogenide based phase change materials are currently becoming established as the basis for the next generation of non-volatile memory.

1) Optical Phase Change

Today's CD-RW and DVD-RW optical discs take advantage of the phase change nature of chalcogenide materials. The active layer of the CD-RW consists of a AIST. When the layer is heated to above its crystallization temperature and slowly cooled it becomes crystalline, if it is heated a bit higher to the melting temperature it becomes amorphous when quenched at a sufficiently fast rate, typically 10^9 C/sec. Writing and reading the phase change layer is achieved via the same laser as the reading process but during reading its power is reduced to a level which prevents the phase change layer reaching its glass transition temperature. The reading laser is reflected from the surface of the disk and the reflected signal varies in intensity depending on the phase of the film below. Amorphous marks offer low reflectivity and higher intrinsic absorption in comparison with the crystalline state.

2) Electrical Phase Change

Electrical phase change data storage uses the same principles as optical storage but rather than optical heating, it is possible to heat electrically such that both the crystallisation and melting temperatures can be achieved within the film. The high density of charge carrier traps in a chalcogenide's amorphous state means that it has a high intrinsic electrical resistivity, whereas in the crystalline form, resistance is several orders of magnitude lower. These two well defined resistance states allow data to be written, stored and erased [1]

B. In manufacturing optical devices

The chalcogenide vitreous semiconductors exhibits excellent optical properties like transmittance in the infrared region (in the wavelength regions 3-5 µm and 8-14), continuous shift in the optical absorption edge and the variation in refractive index under the influence of light. These properties also have a very strong correlation with the corresponding chemical composition of chalcogenide, which explains the significant interest in these amorphous materials for the manufacture of filters, anti reflection coatings and in general, a wide variety of optical devices.

C. Used as core materials for optical fibres

Due to their high refractive index (ranging between 2.0 and 3.5) and optical band gap lying in the sub-band gap region, chalcogenide glasses are used as core materials for optical fibres which is further used for transmission, especially when short length and flexibility is required.

D. For measuring temperature

AsS fibers with a Teflon cladding are being studied for its use to measure temperature increase of up to 200°C on the surface layer of ceramic plates during grinding Ueda et al. [2].

E. For thermal imaging

Chalcogenide fibers have also been used for thermal imaging [3]. Saito et al. [4] recorded the image of an electric iron at 773K through a 1,000 fiber bundle, and Nishi et al. [5] fabricated a flexible fiber bundle containing 8400 Teflon-coated fibers and recorded the thermal image of an operating integrated circuit in the 3–5.4 µm region.

F. For Analyses of polycrystalline diamond

High-quality single-mode and multimode chalcogenide fibers have been used to demonstrate 100nm resolution for both topographic and spectroscopic analyses of polycrystalline diamond [6].

G. Use in laser power handling and transmission

To transmit longer wavelengths, new fibre materials are required, of which chalcogenide glass fibers are one of several options. One application of growing interest is the use of chalcogenide fibers to deliver laser power delivery for medical purposes.

With their high glass-transition temperature, GaLaS glasses offer the potential for greater power handling capacity. Lasers with emission wavelengths around 2.9 microns are widely used in surgery. This wavelength corresponds to the strongest absorption band of water and thus bio-tissues, allowing a host of medical applications [7].

H. Detecting chemicals in mixtures

Chalcogenide fibers are well-suited for chemical-sensing applications, since most molecular species vibrate in the infrared region. Chalcogenide fibers can be used in fiber-optic chemical-sensor systems for detecting chemicals in mixtures.[8-10]

I. Monitoring the quality of engine oil

A fiber-optic dipstick probe could monitor the quality of engine oil and, consequently, save large amounts of money in preventing unnecessary oil changes in the military and civil sector.

J. Detect contaminants in soil and marine diesel fuel in sea

A fiber optic-based reflectance probe has been used to detect contaminants in soil [11]. Detection limits of 130 ppm of marine diesel fuel in sea sand have been demonstrated

using a 20-meter length of cable.

K. Tissue evaluation and early detection of cancer

A chalcogenide-fiber ATR probe has been used to show the spectral differences between various tissues and organs in biomedical samples. IR spectra in the region of 2–10 μm for various organs/tissues from a dead chicken, as well as from the liver of an anaesthetized sheep, have been recorded. Chalcogenide fibers can be utilized to generate a biomedical database for medical diagnostics, such as tissue evaluation and early detection of cancer.

L. Military applications

The arsenic sulfide fibers transmit in the 2–5 μm region and can be used for transmission of laser power in this region for military applications, such as in infrared countermeasures and laser threat warning systems [12]

M. In LIDAR systems, sensors, welding and cutting

The radiative properties of some chalcogenide compounds enable them to be used in LIDAR systems, radiation at 2.75 μm coincides with a strong water absorption in tissue and is used for medical applications, the 3.6 μm transition could be useful for H_2S, NO, and SO^2 (remote) sensing and the 4.5 μm transition could find use in CO and O_3 gas sensors when tuned to 4.7 μm. Highpower CO and CO_2 lasers using chalcogenide as laser power transmitter operating at 5.4 and 10.6 μm, respectively, are available and are used for industrial welding and cutting [13].

N. In fabricating diffraction and transmission grating

Diffraction gratings have been fabricated in chalcogenide glasses using the photoinduced effects that they exhibit. Both photodarkening [14] and the metal-photodissolution effect [15] (especially of silver) have been used to fabricate transmissive gratings, especially for use at IR wavelengths These gratings can be used as efficient beam combiners, couplers and have significant applications in monochromators, laser-tuning devices, shapers, opticalfiber couplers, etc.

O. In fabricating Bragg reflectors

First- and second-order Bragg reflectors at telecommunication wavelengths (1.5 μm) have been fabricated in single-mode monolayer (As_2S_3) and multilayer (As–S–Se/As–S)

chalcogenide glass planar waveguides with near-band gap illumination using an interferometric technique [16]. Reflectivities as high as 90% near 1.55 μm, and refractive-index modulations up to 3×10^{-4} were achieved. The volume photodarkening effect is the principal mechanism involved in the formation of the Bragg gratings. The stability and high efficiency of these gratings make them potentially useful as wavelength-selection elements, and add-drop filters for WDM networks [16].

P. For optical fibre amplifier

Optical amplification at 1.083 μm in neodymium-doped chalcogenide fibers was observed [17] in a glass composition of Ge–As–Ga–Sb–S. A maximum internal gain of 6.8 dB was achieved for a pump power of 180mW. The first amplified spontaneous emission in a chalcogenide glass fiber has also been reported [17]. Laser action in a rare-earth-doped GaLaS chalcogenide glass has been demonstrated, showing that this class of glasses is suitable for active applications, such as amplifiers and lasers [18].

Q. As photoelectrochemical energy conversion electrode

Ternary chalcogenid materials, such as Cd_4GeSe_6, were synthesized in which new covalent chemical bonds appeared. Due to these covalent bonds these materials show higher resistance against corrosion. This novel property in itself makes novel applications, such as photoelectrochemical energy conversion electrode.[19]

R. For photonic crystal applications

Due to high refrective index of chalcogenide glasses, these are used for photonic crystal applications.for example, A high

refractive index Te-enriched bulk chalcogenide glass $Ge_{20}As_{20}Se_{14}Te_{46}$ ($n \approx 3.3$) has been patterned for this application. The high photosensitivity of this narrow-gap semiconductor glass to the femto second irradiation is ascribed to a free electron absorption typical of metals, which is caused by laser-induced heating of the glass.

S. As optical writing, photolithography

Infrared (IR) transmitting chalcogenide glasses are known for their photosensitivity to band-gap radiation, which produces several types of photo-induced changes in structure and properties. This photosensitivity is useful in applications such as optical writing, photolithography, etc. [20]..

T. For fabrication of quantum dot

Semiconductor quantum dots (QDs) are fabricated using wide-bandgap chalogenide glasses. For example, CdSe-based quantum dot (QD) emitters have applications in a range of fields, including QD light-emitting diodes, waveguides, solar concentrators and as optical down converting filters for GaN-based UV light emitting diodes.[21]

U. As nano materials

Chalcogenide materials are used in making carbon nano tube composite. CNTs–$AgAsS_2$ glass composite possess highly increased ionic conductivity, from $\sigma_{25°C} = 4.38 \pm 0.0438 \times 10^{-6}$ to $\sigma_{25°C} = 6.57 \pm 0.0657 \times 10^{-6}$ S.cm^{-1} and decreased refractive index from n=2.652 to 2.631 at the wavelength λ=1.55 mm [22].

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Theoretical Study of the Physical Parameters of the Quaternary $TE_{10}GE_{10}SE_{80-X}SN_X$ (X = 0, 4, 8, 12, 16) Chalcogenide Glass System

Surbhi Sharma
Dept. of Applied Sciences, CT
Institute of Engineering, Management
and Technology, Shahpur, India

Amit Sarin
Dept. of Physics, Amritsar College of
Engineering and Technology,
Amritsar, India

Navjeet Sharma
Dept. of Physics, DAV College,
Jalandhar, India

Abstract: By changing energy band gap and lattice parameter glasses can be made fit for some electrical, optical applications. In contrast with ternary glass systems, fabrication of lattice matched layers is easy in quaternary glass systems. In this paper an attempt has been made to theoretically study some physical parameters i.e. co-ordination number, floppy modes, bond energy, electro negativity, heat of atomization, cohesive energy and glass transition temperature of quaternary glass system $Te_{10}Ge_{10}Se_{80-x}Sn_x$ (x = 0, 4, 8, 12, 16). Chemically ordered Network model has been applied to study bond energy. Tichy - Ticha and Lankhorst approaches has been used to find glass transition temperature. In our present study Tg seems to be increasing in theoretical calculations while average single bond energy is decreasing with the increase in the content of Sn.

Keywords: Quaternary chalcogenide glasses, heat of atomisation, cohesive energy, mean bond energy, Glass transition temperature.

I. INTRODUCTION

Chalcogenide glasses C.G have attracted interest of many researchers due to their unique properties like reversible phase transformation, high transparencies in low and middle IR region, relatively good thermo-mechanical and optical properties. The potential of C.G is now exploited in various electrical and optical applications [1-3] but still due to lack of complete knowledge about their properties the scope of their applications in various fields is yet undiscovered. In contrast with crystals, C.Gs are covalently bonded materials with the lack of long range ordering. The absence of long range ordering allows the modification of optical properties of C.Gs by changing their compositions. Due to lack of translational symmetry, C.G atoms shows strong tendency to link themselves with other atoms to form chain like structure. C.Gs are found to be more rigid than organic polymers and more flexible than oxides due to which glass transition temperature and its other properties lies between these materials.

Selenium (Se) alloys are found to exhibit the unique property of reversible phase transformation which makes them useful for optical memory, switching, rectifiers etc. [4]. But Se also have some disadvantages like low sensitivity, short life time, aging etc. [5],[6],[7]. To improve its properties, it is alloyed with elements of 3rd, 4th, 5th group of periodic table. So, it is desirable to introduce two or more number of components to remove these drawbacks. The second element thus added will act as bond modifiers which strengthen the average bond by cross linking with Se and thereby increase the glass transition temperature. Ge-Se and Te-Se glass system has found to have wide glass forming ability. Third element added helps in achieving network flexibility. But fabrication of ternary compounds is relatively difficult, so in this paper an attempt has been made to study physical parameters viz. average co-ordination number, heat of atomization, cohesive energy, mean bond energy, energy gap and glass transition temperature of quaternary chalcogenide glass system $Te_{10}Ge_{10}Se_{80-x}Sn_x$ (x = 0, 4, 8, 12, 16).

II. THEORETICAL METHODOLOGY

The concept of co-ordination number is a useful parameter in describing the geometrical arrangement of atoms in a crystal. Co-ordination number characterizes the electronic properties of glasses. In multi-component glasses, co-ordination number helps in determining the degree of cross-linking in covalently bonded glasses. In glasses co-ordination number characterizes the strength of bonding. In the present study average co-ordination number has been calculated by standard results [8-9].

$$<r> = \frac{ar_{Te} + br_{Ge} + cr_{Se} + dr_{Sn}}{a+b+c+d} \qquad (1)$$

where a, b, c, d are the concentration in (%) of Te, Ge, Se, Sn respectively and $r_{Te} = 2$, $r_{Ge} = 4$, $r_{Se} = 2$, $r_{Sn} = 4$ are their co-ordination number.

Determination of co-ordination number $<r>$ helps in calculating number of constraints in atomic species N_T, which in turn is the sum of both angular constraints N_B (Bond Bending) and radial constraints Ns (Bond stretching). J.C Phillips proposed a mechanical constraint theory which is based on the glass formation tendencies of material structure [8-9]. These constraints are based upon the breaking of weaker inter atomic long range chains resulting into short range order which provides flexibility to the system required for the glass formation.

Bond Bending per atom is given by:

$$N_B = 2<r> - 3 \qquad (2)$$

Bond stretching per atom Ns is given by

$$N_S = <r>/2 \tag{3}$$

Total number of constraints is given by

$$N_T = N_B + N_S \tag{4}$$

The mechanical constraint theory maintains the balance between number of floppy states and number of stressed states. According to Philips and Thorpe approach glass formation ability of the system maximizes when the number of constraints are equal to the number of degrees of freedoms which occurs when $<r> = 2.4$. At this state number of floppy modes are equal to stressed state and this state is referred to as rigid percolation threshold or (RPT). For $<r> > 2.4$ the system is said to be over stressed and for $<r> < 2.4$ the system is said to be under co-ordinated, polymeric or "floppy" state.

The effective co-ordination number $<r_{eff}>$ is also related with the total number of constraints $<r_{eff}>=2(<r>+3)/5$ $\tag{5}$

Number of floppy modes can also be calculated by using co-ordination number. Number of floppy modes helps in determining the degree of cross linking. Number of floppy modes f can be calculated by using the relation

$$f = 2 - \frac{5}{6}<r> \tag{6}$$

Liang Zhenhua proposed the correlation between the glass formation ability and number of lone pairs for C.G glasses. Lone pair electrons help in bridging the chalcogen atoms which influences the glass formation ability. [10]

$$L = V - <r> \tag{7}$$

Thus more the number of valance lone electrons more is the possibility of formation of amorphous structure hence more is the glass formation ability. Moreover lone pair electrons also provide the flexibility to the structure. Zenhua proposed the simple criterion that for binary glasses lone pair of electrons must be greater than the 2.6 and ternary glasses should be greater than 1.0 [10].

Heat of Atomisation is the quantity of heat required to dissociate the material into individual atoms. For quaternary glass system like $Te_{10}Ge_{10}Se_{80-x}Sn_x$ ($x = 0, 4, 8, 12, 16$) heat of atomization is calculated as

$$Hs = \frac{aHs_{Te} + bHs_{Ge} + cHs_{Se} + dHs_{Sn}}{a+b+c+d} \tag{8}$$

Heat of atomization can be used to calculate average single bond energy $Hs/<r>$ which is the measure of average bond strength.

For quaternary compounds the energy gap can be calculated by the relation [11]

$$Eg = Eg_{Te} + Eg_{Ge} + Eg_{Se} + Eg_{Sn} \tag{9}$$

According to Chemically order network approach [12] formation of hetropolar bonds dominates over the formation of homopolar bonds. In the present system, $Te_{10}Ge_{10}Se_{80-x}Sn_x$ ($x = 0, 4, 8, 12, 16$) system we can observe that probability of formation of Ge-Se, Te-Se, Sn-Se bonds dominates over Se-Se homopolar bonds. Bonds formation occurs in the decreasing order of bond energy.

The energies of their hetropolar bonds is given by

$$E_{A-B} = (E_{A-A} \times E_{B-B})^{1/2} + 30(\chi_A - \chi_B)^2 \tag{10}$$

where E_{A-A}, E_{B-B} are homopolar bond energies and χ_A, χ_B are their corresponding electro-negativities.

Cohesive energy is the amount of energy evolved or absorbed during the formation of crystal from infinite array of atoms or to dissociate crystal to individual atoms. Cohesive energy can be calculated by summing up the energy of bond upon number of bonds expected.

$$C_E = \sum P_i E_i \tag{11}$$

where P_i is the number of bonds expected and E_i is the energy of corresponding bond.

Another parameter which can be studied is the mean bond energy which is the function of degree of cross-linking, co-ordination number and bond energy. Mean bond energy is the sum of two factors viz. Ec which is the contribution to bond energy by hetropolar bonds and Erm which is the contribution due to remaining matrix. Mean bond energy can be calculated by the relation [13-14]

$$E = Ec + Erm \tag{12}$$

where for quaternary system Te-Ge-Se-Sn can be given as

$$Ec = aE_{Ge-Se}r_{Ge} + bE_{Te-Se}r_{Te} + dE_{Se-Sn}r_{Sn} \tag{13}$$
$$Erm = (cr_{Se} - ar_{Te} - br_{Ge} - dr_{Sn}) \times E_{Se-Se}/<r> \tag{14}$$

where a, b, c, d are atomic concentration (in %) and r_{Te}, r_{Ge}, r_{Se}, r_{sn} are co-ordination number of Te, Ge, Se, Sn respectively.

Parameter R is the indicator which indicates that whether chalcogen atoms or metal atoms dominate the system. Parameter R is the ratio of covalent bonding of chalcogen atoms to non-chalcogen atoms and is given as

$$R = \frac{cr_{Se}}{ar_{Te} + br_{Ge} + dr_{Sn}} \tag{15}$$

where a, b, c, d are atomic concentration (in %) and r_{Te}, r_{Ge}, r_{Se}, r_{sn} are co-ordination number of Te, Ge, Se, Sn respectively. For $R > 1$, the system is said to be chalcogen rich whereas for $R < 1$, the system is said to be chalcogen poor but $R = 1$ marks the minimum amount of Se at which the system is still chemically ordered network i.e. the presence of hetropolar bonds.

Another parameter which can be calculated is glass transition temperature Tg which is important characteristic of glassy state. Glass transition temperature Tg is the transition from the rubbery to viscous or rigid state. Decrease in temperature in turn hinders the mobility of the molecular chains. Above Tg material is super cooled liquid but as we decrease the temperature material turns to be rigid or glassy [15].

According to Tichi-Ticha [13-14] Tg is influenced by bond energy and the empirical relation between mean bond energy and glass transition temperature can be given as

$$Tg_T = 311 \, (E-0.9) \qquad (16)$$

Lankhorst also proposed the relation between glass transition temperature and heat of atomization as [16]

$$Tg_L = 3.44 \, Hs - 488 \qquad (17)$$

where Tg_L is in Kelvin and Hs is in kJ/mol.

III. RESULT AND DISCUSSION

The values of average co-ordination number, number of constraints, floppy modes and lone pair electrons for quaternary glass system $Te_{10}Ge_{10}Se_{80-x}Sn_x$ (x = 0, 4, 8, 12, 16) are given in table 1. It can be observed from the table that average co-ordination number is increasing with the increase in Sn content in the system and finally <r> becomes greater than 2.4 thus the system is becoming over co-ordinated and rigid whereas number of floppy modes and lone pairs are decreasing which indicates that the system is losing its flexibility. Variation of effective co-ordination number, floppy modes, lone pairs and number of constraints with Sn concentration (in %) is shown in figure 1. Table 2 represents the variation of heat of atomization, Single bond energy, energy gap, Glass transition temperature using Lankhorst approach with the increase in Sn concentration. From table 2, it is observed that heat of atomization is increasing while average bond energy decreases with the increasing content of Sn. In the present system electronegative Se atom ($\chi = 2.55$) is replaced by electropositive Sn atom ($\chi = 1.96$), energy of lone pairs get enhanced and valence band moves towards energy gap. Thus energy gap decreases. Figure 2 represents the variation of average single bond energy, Cohesive energy, mean bond energy with Sn concentration (in %). From Table 3 it can be inferred that electronegativity χ is decreasing as electropositive Sn atom is replacing electronegative Se atoms. Stochiometery parameter R is also decreasing but still R>1 thus system is not chalcogen poor yet. Table 3 shows that hetropolar bonds Ge-Se, Te-Se, Se-Sn are increasing at the cost of homopolar bond Se-Se. Cohesive Energy is also increasing which reflects that stabilization energy per atom increases with increasing Sn concentration. From Table 4 it can be noticed that Ec which is the contribution to bond energy by hetropolar bonds is increasing at the cost of remaining weaker bonds resulting in the decrease in Erm. Values of glass transition temperature are also calculated from Tichy-Ticha formula. Bond energies of Ge-Se, Se-Sn, Te-Se, Se-Se are also shown in the table 5.

IV. CONCLUSION

It is inferred from present studies that number of hetropolar bonds is increasing at the cost of hetropolar bonds. Since average co-ordination number has increased from threshold point <r>=2.4 thus the system is becoming over co-ordinated, stressed and rigid. Stochiometery parameter R is decreasing but still R>1 so the system is not chalcogen poor so far. Mean bond energy and heat of atomization increases with increase in Sn concentration leading to increase in glass transition temperature.

V. ACKNOWLEDGMENT

TABLE 1

Values of Average Coordination No. (<r>), Constraints Bond bending (N_B), Bond Stretching (N_S) and Total (N), Effective Coordination Number, Floppy Modes (f) lone pairs of electrons(L) for $Te_{10}Ge_{10}Se_{80-x}Sn_x$ (x = 0, 4, 8, 12, 16).

	<r>	N_B	N_S	N_T	r_{eff}	f	V	L
$Te_{10}Ge_{10}Se_{80}$	2.2	1.4	1.1	2.5	2.08	0.166666667	5.8	3.6
$Te_{10}Ge_{10}Se_{76}Sn_4$	2.28	1.56	1.14	2.7	2.112	0.1	5.72	3.44
$Te_{10}Ge_{10}Se_{74}Sn_8$	2.36	1.72	1.18	2.9	2.144	0.033333333	5.64	3.28
$Te_{10}Ge_{10}Se_{68}Sn_{12}$	2.44	1.88	1.22	3.1	2.176	-0.033333333	5.56	3.12
$Te_{10}Ge_{10}Se_{64}Sn_{16}$	2.52	2.04	1.26	3.3	2.208	-0.1	5.48	2.96

TABLE 2.

Values of Heat of Atomisation (H_S), Average Single Bond Energy ($H_S/<r>$), Glass Transition Temperature (T_{gL}(Lankhorst)), Band Gap (E_g) for $Te_{10}Ge_{10}Se_{80-x}Sn_x$ (x = 0, 4, 8, 12, 16).

	H_a	H_s	$H_s/<r>$	T_{gL}	E_g

	(kcal/g-atom)	(KJ/mole)		(K)	(eV)
$Te_{10}Ge_{10}Se_{80}$	53.12	222.254	24.14545455	276.55376	1.72
$Te_{10}Ge_{10}Se_{76}Sn_4$	54.03	226.062	23.69736842	289.65328	1.716
$Te_{10}Ge_{10}Se_{74}Sn_8$	54.94	229.869	23.27966102	302.74936	1.712
$Te_{10}Ge_{10}Se_{68}Sn_{12}$	55.85	233.676	22.88934426	315.84544	1.708
$Te_{10}Ge_{10}Se_{64}Sn_{16}$	56.76	237.484	22.52380952	328.94496	1.704

TABLE 3.

Values of Electronegativity (χ), Deviation from Stoichiometry (R), Distribution of Bonds, Cohesive Energy(C_E), for $Te_{10}Ge_{10}Se_{80-x}Sn_x$ (x = 0, 4, 8, 12, 16).

	χ	R	Distribution of Bonds				C_E
			Se-Ge	Se-Te	Se-Sn	Se-Se	(Kcal/mol)
$Te_{10}Ge_{10}Se_{80}$	2.451	2.6666	0.25	0.125	0	0.625	45.3775
$Te_{10}Ge_{10}Se_{76}Sn_4$	2.427	2	0.263	0.1315	0.1052	0.5	45.9863
$Te_{10}Ge_{10}Se_{74}Sn_8$	2.403	1.5652	0.2777	0.1388	0.222	0.3611	46.6742
$Te_{10}Ge_{10}Se_{68}Sn_{12}$	2.38	1.2592	0.2941	0.147	0.3529	0.2058	47.4584
$Te_{10}Ge_{10}Se_{64}Sn_{16}$	2.356	1.0322	0.3125	0.1562	0.5	0.03125	48.3361

TABLE 4.

Values of Mean Bond Energy (E), Glass Transition Temperature (T_{gT} (Tichy-Ticha)), for $Te_{10}Ge_{10}Se_{80-x}Sn_x$ (x = 0, 4, 8, 12, 16).

	E_c	E_{rm}	E (Kcal/mol)	E (eV/atom)	T_{gT} (K)
$Te_{10}Ge_{10}Se_{80}$	28.604	20	48.604	2.107669	375.585059
$Te_{10}Ge_{10}Se_{76}Sn_4$	36.481	14.66	51.141	2.217684	409.799724
$Te_{10}Ge_{10}Se_{74}Sn_8$	44.358	9.6949	54.0529	2.3439562	449.0703782
$Te_{10}Ge_{10}Se_{68}Sn_{12}$	52.2358	5.0491	57.2849	2.484109	492.657899
$Te_{10}Ge_{10}Se_{64}Sn_{16}$	60.1131	0.6984	60.8115	2.6370369	540.2184759

Table 5.Values of Bond Energy for Ge-Te-Se-Sn System.

Bonds	Bond Energy (Kcal/mol)
Ge-Se	49.42
Te-Se	44.18
Se-Se	44
Se-Sn	49.233

Fig: 1 shows the variation of Number of constraints (N), Effective Coordination number (r_{eff}), number of floppy modes (f) and lone pair electrons (L) with In concentration for $Te_{10}Ge_{10}Se_{80-x}Sn_x$ (x = 0, 4, 8, 12, 16).
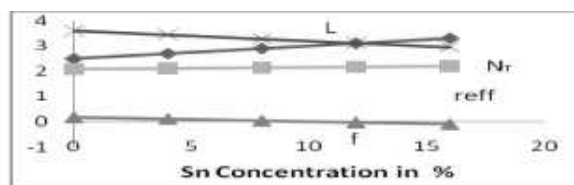
Fig.2. Variation of Average single bond energy (Hs/<r>), Cohesive energy (C_e) and Mean bond energy (E) with In concentration for $Te_{10}Ge_{10}Se_{80-x}Sn_x$ (x = 0, 4, 8, 12, 16).
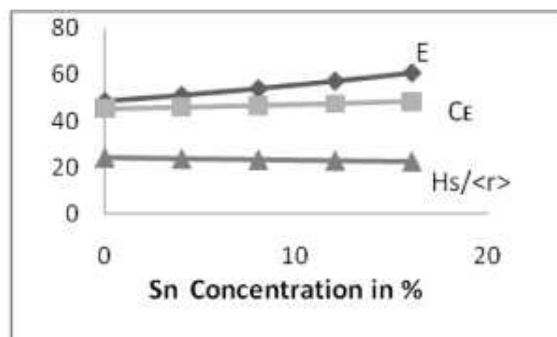
Fig. 3.Variation of glass transition temperature (Tg) with In concentration for $Te_{10}Ge_{10}Se_{80-x}Sn_x$ (x = 0, 4, 8, 12, 16).
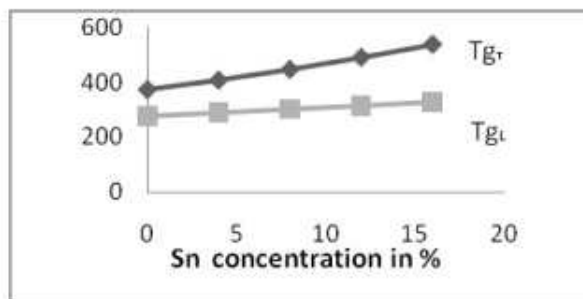
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Phytoremediation - A Technology to Remediate the Polluted Cultivation Soils in Punjab.

Rakesh Gupta
Department of Botany, Punjabi University
Patiala Punjab, INDIA

MIS Saggoo
Department of Botany, Punjabi University
Patiala, Punjab, INDIA

Abstract-Growing industralisation and urbanisation have lead to increasing water pollution since   effleuents are often released in the drains irrigating cultivation belts of Punjab. Toxic metals are getting accumulated in soil then to Crops which ultimately effecting the qulity of in addition to side effect on environment. Use of fertilizers, pesticides, weedicides etc had also aggrevated the problem. The heavy metal containing effluents from Leather and Sports Complex, Jalandhar are discharged in the Kalasinghia drain which moves through the agricultural fields of Jalandhar –Kapurthala belts in Punjab,India Many native plants had faced this stress since decades and are well acclamatized   due to genetic adaptaions and are resistant to metal stresses and also do accumulate them   . Due to this, theses Local weeds like Pathenium, Amarnthus, Xanthium etc were selected to remediate the soils as they are adapted to stress and good toxic metal accumulators and was confirmed during investigation. Soil and weeds samples were taken from four polluted sites. The control area was about 20 kilometers away where only tube well irrigation is taking place. Soil and the plants samples were collected from the polluted as well as the control site. Investigation was done on metal accumulation in the aerial parts, and roots. Samples were acid digested and heavy metal accumulation was estimated using ICAP-AES method. Pot experimentation, Hydroponics were conducted and Bioaccumulation factor (BAF), Enrichment Factor (EF), Translocation factor (TLF) were calculated for different heavy metals and better phyoremediator weeds were screened. Tolerance index (TI) and Phytoextraction Capacity (PC) were also evaluated to screen better remediators .Many plants are reported to be good phytoremediator due to efficent metal accumulations. According to Baker et al (2000) the local growing plants can be good phyoremediator in polluted soils.The wild growing species can remediate the polluted soils where they are growing (Delio etal 2000).By Above remediation potential evaluation, it was observed that Amarnathus Viridis emerged as a good metal accumulator weed as it was having good Biomass and a considerable metal accumulator in the leaves as was cofirmed from the BAF,EF,TLF,TI and PC Values in compare to other weed plants during investigation . Due to its better tolerance index values and Phytoextraction vales it can be suggested to be used to cure the toxic metal acculation in fields especially the Pb,Cr,Cu metals . only treated water should be released to the drain as it is without the high concentarion of these heavy metals .Farmers should be given strict instructions so that they avoid the use of this toxic drain water for irrigation purpose, Society and NGO should come forward to aware the farmers and the people to avoid the use of this toxic drain water and goverment should install maximum Common effluent treatment plants (CETP) so that furter toxicity of water effluents in drains can be stopped .

Keywords- Tolerance Index, Bioaccumulation factor, Transloaction factor, Phytoextraction capacity, Abiotic stresses.

I.   INTRODUCTION

Industriallization without proper environmental planning often leads to discharge of industrial effluents and sewage into rivers and water bodies. Industrial waste water are rich in heavy metals and other toxic elements. Waste disposal activities are one of most significant source of heavy metal pollution in the environment [1]. Waste waters often used for agriculture purposes, like irrigation thus leading to toxic metal contamination in cultivation soils. Cr Pollution in soil is due to industry waste waters. Food safety issues of such agricultural practices and potential adverse health risks make one of the most environment concern.health risks to human and live stocks due theses agricultural practicies. Heavy metals are known to accumulate in living organisms and there is inherent tendency of plants to take up the toxic elements.Use of contaminated soil for raising crops results into contaminated food grains and vegetables which ultimately affect the human health [2].

Growing industralisation and urbanisation have lead to increasing water pollution since effluents' are often released in the drains irrigating the cultivation belts of Punjab. Toxic metals are getting accumulated in soil then Crops which ultimately effecting the quality in addition to side effect on environment. Use of fertilizers, pesticides, weedicides etc had also aggrevated the problem. Many native plants had faced this stress since decades and are well acclamatized due to genetic adaptaions and are resistant to metal stresses and also do accumulate them   . Due to this, theses Local weeds like Pathenium, Amarnthus, Xanthium etc were selected to remediate the soils as they are adapted to stress and good toxic metal accumulators and was confirmed during investigation. Soil and weeds samples were taken from four polluted sites. The control area was about 20 kilometers away where only tube well irrigation is taking place. Soil and the

plants samples were collected from the polluted as well as the control site.

II. EXPERIMENTAL

A. Materials and Methods

1) Soil Analysis

Hundred grams of the soil sample was acid digested and total metal estimation was done using inductively coupled argon plasma atomic emission spectrophotometer (ICAP-AES) method (AOAC, 1984).

2) Metal Uptake

The samples were analyzed using ICAP-AES (Inductively coupled argon plasma atomic emission spectrophotometer) method (AOAC, 1984).

3) Biochemical Analysis

The fresh leaves were washed thoroughly to remove all traces of soil particles and were used for estimation of various nutritive constituents like total soluble proteins (Lowry et al., 1951), carbohydrates (Ashwell, 1957) and chlorophyll (UV-Visible Spectrophotometer (U.S. EPA 1994).

B. Observations and Results

1) Soil Profile

Soil analysis was done for all selected locations i e. Control and Polluted one P1, P2, P3, P4. The soils of various polluted fields as well as the control fields were subjected to phytochemical analysis covering pH of soil and metal profile. The soil samples taken from each location were subjected to elemental analysis following Plasma atomic Emission spectrophotometer (ICAP-AES) Method (AOAC 1984). The observations on various parameters of soil characters are done.

2) Metal Bioaccumulations

The specimens of presently selected species were collected .The dried shoots and roots of each species were separately acid digested and heavy metal content was estimated with the help of ICAP .

Estimations were made for heavy metals like Cr, Cu, Ni, Pb and Cd species are provided.

3) Phytoremediation Potential

a) Seed germination testing

Seed germination and seedling growth, the critical stages of plant development, are key factors in metal tolerance test. The seed germination ability and viability of species of plants under investigation under different concentartion of heavy metals like Cr, Cu, Ni, Pb, and Cd was tested .

The results showed that metal concentrations in medium had an obvious effect on seed germination and different species showed different responses towards these heavy metals.

In Metal tolerance test, the dried seeds (30) were placed in Petriplates in triplets with standardized concentrations. The seeds were given treatments on moistered filter paper with the water solution of the various concentrations (in µg/g) for heavy metals. The Germination percentage and radical growth analysis were done. Make various solutions of 25, 50, 100 mg/L of various metals. The salt used was Chromium chloride ($CrCl_3$) for Cr, Copper Sulphate ($CuSo_4$), $NiCl_2$ for Ni, Lead Chloride ($PdCl_3$) and Cadmium Chloride ($CdCl_3$) for Cd (Table 3).

Table 3: Effect of various metals on seed germination and root growth on Amaranthus spinosus

Concentration of Metal (µg/g)	Metal Exposure				
	Cr	Cu	Ni	Pb	Cd
Seed germination (%)					
25	67	60	65	67	68
50	65	55	55	67	60
100	55	55	59	65	57
Radical Size(mm)					
0	1.6	1.9	1.9	2.0	2.2
25	2.2	2.2	2.3	2.5	1.8
50	2.8	2.2	2.2	2.2	1.8
100	1.2	2.1	1.9	2.2	2.1

b) Pot Experiments

The concept of using metal accumulator and hyper accumulator plants to remove excess of metals from contaminated soil was first suggested by Dr. IIya Raskin in 1991, since then much attention has been focused on identification of plant species ideal for phytoremediation. The plants which efficiently extract metals or pollutants from the soil, have tolerance to adverse disturbed environment, fast growth, good biomass and have exceptionally high foliar metal concentration are considered ideal candidates to be used in remediation practice [3]. Presently, seven species of weeds from the study area (genotypes) from polluted areas were selected for evaluating their phytoremediation potential in vivo ,by conducting pot experiment as well as hydroponic experiment .

Pot experiments have been performed to check their metal tolerance, metal uptake and growth potentials. Five heavy metals common in the polluted soils under investigation i.e. Cr, Cu, Ni, Pb and Cd were selected for further study. Salts

like Chromium chloride (Cr), Copper oxide (for Cu) were used as source of heavy metals. Plants were raised in nursery beds using seeds of the selected plant species collected from fields of polluted village Chaemera. Fifteen days old seedlings were transplanted in the pots (9 inch diameter) filled with the normal garden soil amended with known quantity of Heavy metal salts to make the final concentration of metals 25 µg/g, 50 µg/g and 100 µg/g in the soil for each pot. Garden soil without mixture of any salt served as the control.

- Effect on Growth

The growth of Amaranthus spinosus was evaluated for the effect of Cr, Cu, Ni, Pb, Cd which was studied by making periodic observations Length, fresh and dry weights of roots and shoots after every 15 days of growth till 60 days from the date of transplantation. (Table 4)

Table 4: Effect of Chromium on growth of Amaranthus spinosus

Concentration of Cr (In µg/g) added in soil

Character	Plant parts	Control	25	50	100
At 15 days Treatment					
Length(cm)	Root	4.62±.77	4.52±.77	4.47±.32	4.32±.48
	Shoot	21.62±.92	21.57±.77	21.47±.32	21.32±.17
FW(mg)	Root	74.92±.62	74.67±.52	74.33±.67	74.17±.74
	Shoot	493±6.9	462±7.2	757±6.2	417±5.2
DW(mg)	Root	3.11±.64	3.11±.69	3.7±.67	3.5±.87
	Shoot	48.62±.56	48.55±1.2	48.36±1.4	48.22±.92
At 30 days Treatment					
Length(cm)	Root	5.71±.88	5.61±.62	5.42±.72	5.31±.52
	Shoot	29.42±.62	29.32±.54	29.1±.37	29.11±.22
FW(mg)	Root	133.42±.52	123.46±1.7	117.62±7.2	111.72±6.7
	Shoot	1594.33±7.68	1590.34±11.6	1566.92±22.4	1537.47±
DW(mg)	Root	21.44±.37	21.32±.46	21.27±.77	21.12±.56
	Shoot	282.74±7.62	282.62±7.4	282.43±6.2	282.41±6
At 45 days Treatment					
Length(cm)	Root	10.77±.49	10.67±.52	10.52±.37	10.41±.22
	Shoot	50.79±.66	50.67±.42	50.42±.32	50.32±.28
FW(mg)	Root	396.78±13.1	396.71±11.6	396.44±14.2	382.47±17
	Shoot	2894±7.6	2844±11.2	2832±22.6	2817±32.6
DW(mg)	Root	104±2.2	1020±4.2	101±2.3	96±3.3
	Shoot	1882.42±14.52	1842.62±17.2	1822.42±19.2	1811.62±22.6
Percentage Increase (15-30days)					
Length(cm)		33.88	33.88	33.08	34.24
Dry matter(mg)		488.01	488.35	483.37	486.87
Percentage Increase (30-45days)					
Length(cm)		75.23	75.61	76.54	76.44
Dry matter (mg)		552.9	841.47	533.19	528.27

Generally plants growing over Chromium amended soils showed dose dependent decrease in the plant dimensions in compare to control. There was a general trend of decreasing Fresh and dry weights of the roots and shoots of polluted plants in compare control plants and on average same trend observed after 30, 45 and 60 days of treatment for all metals i.e., Cr, Cu, Ni, Pb, Cd. The Plants growth rate was measured by the percent increase in the plant dimensions and the fresh and dry matter which showed a varied trend. Observations were taken for the average increase in the length of Roots and shoots including their fresh and dry weight for the Metal exposures and the non treated plants. The percentage increase in length and Dry weight was calculated for all metal exposures.

For Cr in Amaranthus spinosus, maximum percentage (%) increase was 34.24 in length with 488.35 in Dry matter in 15th day to 76.54 in length with 841.47 in Dry matter in 45th day. For Cu, maximum percentage (%) increase was 45.97 in length with 499.07 in Dry matter in 15th day to 78.84 in length with 550.93 in Dry matter in 45th day. For Ni, maximum percentage (%) increase was 45.4 in length with

3352.01 in Dry matter in 15th day to 84.01 in length with 12.81 in Dry matter in 45th day. For Pb, maximum percentage (%) increase was 49.69 in length with 478.28 in Dry matter in 15th day to 90.38 in length with 560.6 in Dry matter in 45th day. For Cd, maximum percentage (%) increase was 46.97 in length with 481.85 in Dry matter in 15th day to 91.22 in length with 711.9 in Dry matter in 45th day.

- Metal uptake

The Chromium uptake by Amaranthus spinosus was studied in pots. There was increase in all metals (Cr, Cu, Ni, Pb, and Cd) uptake by the plants with the increase in the concentration of these metals in the soil. Maximum metal uptake was observed in different parts in particular leaves in 100 µg/g exposure. Leaves showed a trend of higher uptake of metal followed by the roots and then the shoots. There was

negligible or nondetectable metal trace in Control plants. Metal uptake range from 20.69 µg/g to 69.82 µg/g (Cr), 17.82 µg/g to 41.32 µg/g (Cu), 32.62 µg/g to 82.69 µg/g (Ni), 11.69 µg/g to 26.59 µg/g (Pb) and 17.89 µg/g to 45.69 µg/g (Cd) for metal treated soils with range from 25 µg/g, 50 µg/g to 100 µg/g in pots.

Bioaccumulation is the ratio of metal contentin root to ratio of metal content in soil and Translocation factor is ratio of metal content in shoots to metal content in root .Following results were observed for different metals (Tables 6 and 7)

Table 6: Bioaccumulation factor (BF) in the *Amaranthus spinosus* plants raised on soil amended with different conc of metals.

Bioaccumulation Factor (BF)

Metal exposure	Cr	Cu	Ni	Pb	Cd
25ppm	0.97	0.79	0.71	0.71	0.35
50ppm	0.85	0.73	0.59	0.52	0.34
100ppm	0.62	0.57	0.68	0.53	0.35

Table 7: Translocation factor (TF) in the *Amaranthus spinosus* plants raised on soil amended with different conc of metals.

Translocation Factor (TF)

Metal exposure	Cr	Cu	Ni	Pb	Cd
25ppm	0.87	0.9	1.84	0.66	2.04
50ppm	0.77	0.76	2.4	0.57	1.26
100ppm	1.13	0.73	1.22	0.5	1.32

III.   Discussion and Conclusion

More than 400 metal hyperaccumulator flowering plants have been identified that can grow on metal rich soils and can accumulate huge amount of metals in their tissue without showing any toxicity [4]. These are considered good for phytoremediation work. A number of hyperaccumulator species may have little potential for phytoremediation because of their small size and slow growth [5]. The plants exhibiting high TF and BF value (< 1) are suitable for phytoextraction.

The efficiency of phytoextraction by a given species depends on two key factors biomass and metal accumulation factor [6]. Hyperaccumulator or high accumulator of a metal if has low biomass does not fulfill the requirement of a good phytoextractor. Plant biomass, bioconcentration factor and soil mass are the three key variables that define phytoremediation potential of a given species [7]. Since the phytoextraction of heavy metals depends on shoot biomass production, soil metal content, metal uptake and other factors, the phytoextraction capacity (PC) of the presently

investigated seven species was evaluated in vivo.

Amaranthus spinosus have the highest BF value for Cr if it compared with other weeds under investigation (Fig .1) .A remarkable deposition was observed in different parts of the plant specially the leaves for all metals also .By evaluationg the BF ,TF values it was found that *Amaranthus spinosus* show sigificant values for all metal exposuers specially Cr.Further their deposition was confirmrd by evaluating the correlation coefficient and have significant tolernance index .Since the plant have sufficeint Biomass (DW) so have good phytoextration values .From above discussion it is concluded that *Amaranthus spinosus* can be a potential remediator for heavy metals like Cr,Cu,Ni,Pb and Cd in particular Cr toxic soils .

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Numerical & Analytical Comparison for Current Transport in Schottky Barrier Diodes at Low Temperatures

Pankaj
CT Group of Institutes, Jalandhar
arorapankaj_1979@yahoo.co.in

Vinay Arora,
PUSSGRC, Hoshiarpur,
vinay2037@gmail.com

Abstract- The current transport studies of Schottky barrier diodes have been of immense interest in the recent past. The present understanding is incomplete, however, the despite progress is made in the theory as well as in experiments. The knowledge of conduction properties involved is rather essential for extracting information about barrier height, ideality factor, series resistance. For this, the current-voltage characteristics of the Schottky diodes are measured over a wide temperature range to give a better picture of the barrier formed at the metal-semiconductor interface which can in turn give insights into the different aspects that shed light on the validity of various processes. Generally, diode parameters like barrier height, ideality factor etc. derived from measured I-V characteristics on the basis of the TED mechanism, show abnormalities at low temperatures. In this paper, current-voltage characteristics of inhomogeneous Schottky diodes were generated to analyze the current transport in Schottky barrier diodes at low temperatures using analytically solved thermionic–emission diffusion equation incorporating Gaussian distribution of barrier heights and by direct numerical integration over a barrier height range. The discrepancies in the result of two approaches are highlighted.

I. INTRODUCTION

Schottky barrier diode is a simple semiconductor interface exhibiting non-linear impedance and is basically an extension of the point contact diode. This diode is known as hot carrier diode, a hot electron diode or an ESBAR diode (short for epitaxial Schottky barrier). The important aspect of metal-semiconductor junctions is the process which determines the flow of charge carriers over the barrier from the semiconductor to the metal and vice-versa. Detailed knowledge of the conduction process involved is essential to extract barrier parameters, namely barrier height, ideality factor and series resistance. Analysis of the current-voltage (I-V) characteristics of the Schottky barrier measured at the room temperature does not give detailed information about the conduction process and the nature of the barrier formed at the interface. The temperature dependence of I-V characteristics gives a better picture of various conduction mechanisms and allows one to understand different aspects that shed light on the validity of various processes involved. Moreover the Schottky diodes

with low barrier heights found applications in devices operating at cryogenic temperatures as infrared detectors and sensors in thermal imaging [19-21]. So information about their electrical characteristics at low temperatures is vital for better understanding which will enables us to tailor the devices to particular requirements. So, satisfactory interpretation of I-V characteristics over a wide temperature range is vital for a better understanding of the device for specific applications. The temperature dependence of diode parameters derived from experimental data shows abnormal behavior, which can not be understood on the basis of existing current transport theories. The spatial variation of barrier heights in Schottky diodes is considered in order to explain the anomalous behaviour. The influence of small patches with low barrier height within the contact area on the ideality factor and the importance of the contact area size in this effect were pointed out by Freeouf et al [5], Tung[10] and Sullivan et al[11] showed that various temperature dependence of the ideality factor can be obtained when a set of small patches with appropriate parameters is inserted into contact area. These approaches emphasize the interaction between the regions with different SBHs and are based on so called "pinch off " effect, that takes place when the SBHs varies laterally on a scale comparable to the width of the depletion region. The contact area is supposed to be sufficiently large and the size effect therefore negligible.

II. METHOD OF ANALYSIS

Gaussian distribution function is used to describe the barrier inhomogeneities in Schottky diodes. The current-voltage characteristics of inhomogeneous Schottky diodes can be generated using either analytically solved equation for total current through all elementary diodes, or by numerical integration over entire barrier height range. The simulation performed using two approaches 'Analytical approach' and 'Numerical approach'. In this chapter, two approaches of Gaussian distribution of barrier heights in inhomogeneous Schottky diodes have been analyzed for the variation of current transport through distributed barriers and it is observed that current at low bias is predominantly

contributed by low BHs and at high bias by high BHs in the distribution.

A. Numerical approach

The numerical approach is based on calculating the total current through an inhomogeneous diode by evaluating the current $i(V,\phi)$ through each elementary barrier by Newton-Raphson iteration method and performing the numerical integration applying Simpson's one third rule over a barrier height range, after multiplying the current through each barrier by its probability distribution function, $\rho(\phi)$.

B. Analytical approach

The analytical approach is based on calculating the total current by Newton-Raphson iteration method, obtained after analytically solving integral equation (1). The ln (I)-V curves of inhomogeneous Schottky contacts are generated using these approaches and analyzed for transport of the current through the inhomogeneous barriers in the distribution.

III. BASIC EQUATIONS

The current through a Schottky barrier at a forward bias V, on the TED theory [12] is given equation

$$I = A_d A^{**} T^2 \exp\left(\frac{-q\phi_b}{kT}\right)\left[\exp\left(\frac{q(V-IR_s)}{kT}\right)-1\right] \quad (1)$$

where A_d is the diode area, A^{**} is the effective Richardson constant, T is the temperature in Kelvin, k is the Boltzmann constant, q is the electronic charge, ϕ_b is the barrier height, q is the electronic charge and R_s is the diode series resistance. Since the barrier height invariably increases with the forward bias and if assumed to have linear dependence, one writes $\phi_b(V) = \phi_{b0} + \gamma V$, where ϕ_{b0} is the barrier height at zero-bias and $\gamma = (\partial\phi_b/\partial v)$ is positive. Making this substitution and introducing a parameter (called ideality factor) $\eta = \dfrac{1}{1-\gamma}$, Equation (1) becomes,

$$I = I_s \exp\left(\frac{q(V-IR_s)}{kT}\right)\left[1-\exp\left(\frac{-q(V-IR_s)}{kT}\right)\right] \quad (2)$$

where $I_s = A_d A^{**} T^2 \exp\left(\frac{-q\phi_{b0}}{kT}\right) \quad (3)$

is the saturation current at zero bias.

IV. NATURE OF I-V CHARACTERISTICS

The simulated log(I)-V characteristics of inhomogeneous Schottky diodes at various temperatures with diode area $A_d = 7.87\times10^{-7} m^{-2}$, corresponding to 1 mm diameter metal contact, effective Richardson constant $A^{**} = 1.12\times10^6 A\ m^{-2}K^{-2}$, standard deviation, $\sigma = 0.08$, $\overline{\phi} = 0.8V$ and $R_s = 20\Omega$ are

shown in Fig.1. These ln(I) plots are indeed linear over several order of current at low temperatures. Fig2 shows the values of ϕ_{b0} determined from I_s value at each temperature (T) using eq.(3). It is clear from the figure that ϕ_{b0} initially decreases slowly but later quite rapidly with fall in temperature. Moreover, the activation energy, $\ln\left(\dfrac{I_s}{T^2}\right)$ vs. $\dfrac{1}{T}$, plot becomes non-linear in nature. Obviously, there exists no single activation energy in each case and the nonlinearity is a consequence of decrease of barrier height with fall in temperature.
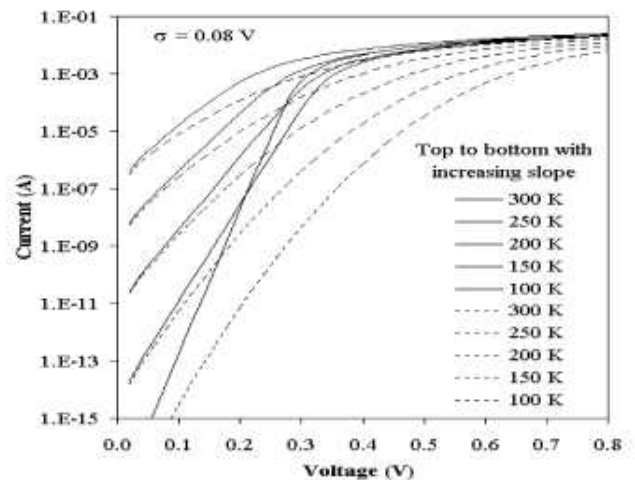
Fig. 1 Simulated I-V curves generated by, (i) using analytical equation for Gaussian distribution of barrier heights (solid) and (ii) numerical integration over a BH range (dotted), at various T.

The nature of barrier height decrease suggests a temperature dependence of type,

$$\phi_{b0}(T) = A - \frac{B}{T^n} \quad (4)$$

where A and B are constants and n stands for the exponent of T. The constant A and B can be determined from the intercept at the ordinate and the slope, respectively.
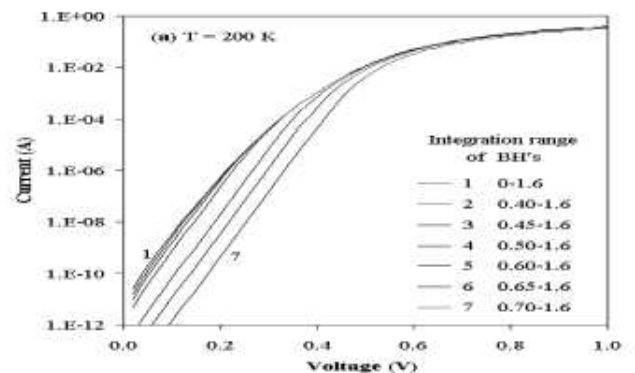
Fig. 2 (a)
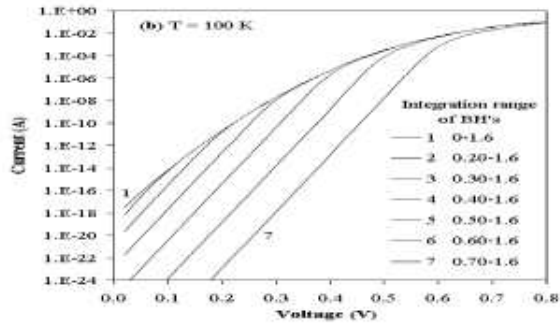
Fig.2 (b)

Fig. 2 The I-V curves obtained by numerical integration over different barrier height ranges, excluding low BH's, at temperature (a) 200 K and (b) 100 K.

It means that the temperature dependence of ϕ_{b0} is of the form $\phi_{b0}(T) = A - (B/T)$ and so $\phi_{b0}(T)$ should approach A with increase of temperature as (B/T) term progressively becomes negligible. Clearly, η increases initially rather slowly but very rapidly below ~ 100K. Thus, the observation that (i) ln(I)-V plots are linear over several orders of current even at low temperatures,, and (ii) ϕ_{b0} decreases and η increases with decrease in temperature are at first sight indicative of deviation from pure thermionic emission-diffusion theory. It may perhaps appear to be so due to excess current resulting by other processes, namely tunneling through the barrier and / or recombination in the depletion region. The parameters that determine the relative importance of tunneling (thermionic-field emission or field emission) and thermionic emission- diffusion is given by[12],

$$E_{oo} = \frac{h}{4\pi}\left(\frac{N_D}{m_e^* \varepsilon_s}\right)^{1/2} eV \qquad (5)$$

where, $m_e^* = (n_r m_0)$ is the effective mass of electrons, $\varepsilon_s = (\varepsilon_r \varepsilon_0)$ is the permittivity of semiconductor, m_0 the electron rest mass and N_D is the donor concentration in m^{-3}. The field emission (FE) becomes important when $E_{00} >> kT/q$, whereas the Thermionic –field Emission (TFE) dominates when $E_{00} \sim kT/q$, and thermionic emission-diffusion if $E_{00} << kT/q$. obviously, the condition prevailing is $E_{00} << kT/q$ and, therefore the possibility of FE and TFE can easily be ruled out. Also, the TFE causes reduction in the barrier height by an amount

$$\Delta \varphi_t = \left(\frac{3}{2}\right)^{2/3} E_{00}^{2/3} V_d^{1/3} V \qquad (6)$$

where, V_d stands for voltage corresponds to band bending.

Infact, lowering is temperature – dependent, whereas Eq.6 suggests reduction-independent of temperature. Moreover, the tunneling current at forward bias of V volts is of the form [12],

$$I_t = I_{t0} \exp\left(\frac{V}{E_0}\right)\left[1 - \exp\left(\frac{-qV}{kT}\right)\right]$$

(7a)

Where $E_0 = E_{00} \coth (E_{00}/kT)$ \qquad (7b)

also, the ideality factor η caused by tunneling current should vary with temperature according to [12],

$$\eta = \left(\frac{qE_{00}}{kT}\right)\coth\left(\frac{qE_{00}}{kT}\right) \qquad (8)$$

This predicts η very close to unity with negligible increase in the entire temperature range, i.e. too low to explain the measured data.

The variation of series resistance R_s as a function of temperature is shown in Fig3. The increase of R_s with fall of temperature is believed to result due to factors responsible for increase of η and / or lack of free-charge carriers at low temperatures [13].
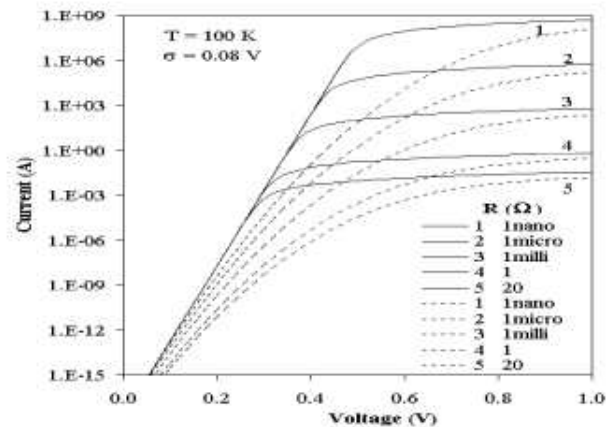
Fig.3 Simulated I-V curves generated by, (i) using analytical equation for Gaussian distribution of barrier heights (solid) and (ii) numerical integration (dotted), for various series resistances.

There are various type of distribution function have been proposed to describe barrier inhomogeneities, either discrete (usually two-level) [4-6], or continuous (Gaussian [7], log-normal [8], constant [9]). Here, Gaussian distribution function is used to describe the variation of barrier heights in inhomogeneous Schottky diodes A Gaussian distribution function has been utilized to explain (i) the difference in barrier heights obtained from C-V and I-V measurements in Al/p-InP [7] at 285-384 K and PtSi / Si [15] at 76-344 K. (ii) nonlinearity in the Arrhenious plot and findings of photoresponse measurements in PtSi/p-Si Schottky barriers [14] in the temperature range 77-120 K; (iii) influences of distribution parameters and temperatures on the barrier

height and ideality factor of Schottky diodes using numerical simulation [16]. Palm et al. [17] have even shown direct images of Schottky barrier height fluctuation in Au-Si contacts using ballistic electron emission microscopy technique and represented them with a Gaussian distribution function. One may therefore assume a Gaussian distribution of barrier heights, with a mean value of $\bar{\phi}$ and standard deviation σ, having the form [7, 14-16].

$$P(\phi_b) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left[-\left(\frac{(\phi_b - \bar{\phi}_b)^2}{2\sigma^2}\right)\right] \quad (9)$$

where the pre–exponential term is the normalized constant. The total current across the Schottky contact at a forward bias is then given by

$$I(V) = \int I(\phi_b, V) P(\phi_b) d\phi_b \quad (10)$$

where $I(\phi_b, V)$ is the current for a given barrier ϕ_b and bias voltage V.

The modified analytical equation with real practical limits removes the discrepancies and the total current through such an inhomogeneous diode having Gaussian distribution of BHs with barriers lying symmetrically around $\bar{\phi}_b$ in the range $0-2\phi$ is given by [17].

$$I(V) = A_d A^* T^2 \exp\left[\frac{-q}{kT}\left(\bar{\phi}_b - \frac{\sigma^2 q}{kT}\right)\right] \exp\left(\frac{q(V - IR_s)}{kT}\right)$$
$$\times \left[1 - \exp\left(\frac{-q(V - IR_s)}{kT}\right)\right] \times \left(\frac{erf(f1) - erf(f2)}{2}\right) \quad (11)$$

where the error function argument $f1$ and $f2$ are given as,

$$f1 = \left(\frac{\sigma^2 q}{kT} + \bar{\phi}\right)\frac{1}{\sigma\sqrt{2}} \quad , \quad f2 = \left(\frac{\sigma^2 q}{kT} - \bar{\phi}\right)\frac{1}{\sigma\sqrt{2}} \quad (12)$$

V.   RESULT AND DISCUSSION

In the present study, current-voltage characteristics of inhomogeneous Schottky diodes with Gaussian distribution of BHs are generated by using numerical simulation to analyze the current transport in Schottky barrier diodes at low temperatures. Eq. (11) is used to calculate I-V data by computer simulation for an inhomogeneous diode with area $A_d = 7.87\times10^{-7} m^2$, corresponding to 1 mm diameter metal contact, effective Richardson constant $A^{**} = 1.12\times10^6 A\ m^{-2}K^{-2}$ and ln(I)-V curves thus obtained at various T, for $\bar{\phi}_b$ =0.8, $\sigma = 0.08$ and $R_s = 20\Omega$ are shown in Fig.1 (solid lines). The intersecting behaviour of plots at low temperature is already discussed in [18]. The I-V data is also generated by numerical integration of Eq. (10) using Simpson's one third

rule, over same BH range of 0-1.2 v (0-2ϕ) in the steps of 0.005 V and the corresponding ln(I)-V curves are shown in Fig. 1 (dotted lines) at various T. It is evident from the Fig. 4 that the curves obtained by two approaches do not coincide at entire bias range. Also the curves obtained by numerical integration (dotted lines) do not intersect like the curve generated by analytical approach. In contrary to this, these curves bend downward without intersecting each other over entire bias range with decreasing temperatures. Another differences between the two approached is that curves obtained by numerical integration approach are curved over the whole bias range unlike the analytical curves which exhibits straight portion up to a bias at which current saturation occurs due to the series resistance. However, both type of curves originate from same current at zero bias and converge to each other asymptotically at high forward bias. Thus, the approaches used to generate the I-V data yields slightly different results. It indicates that the two approaches of BHs distribution are not consistent with each other completely. The curves obtained by two approaches are coincide at very low bias that too for high T and low σ and mismatch between the two increases with decreasing T and increasing σ. It is observed that differences in the results obtained by two approaches appear due to same series resistance considered for calculating the current through each elementary barrier in the distribution. This can be seen by generating ln(I)-V curves by two approaches at constant temperature T, and standard deviation σ, for different R_s values varying from 20Ω to 1nΩ in steps. The curves thus obtained are shown in Fig.3. It is clear from Fig.3 that with decreasing R_s the integrated curves approaches those obtained by using Eq.(11) and the mismatch between the two decreases. It appears that current at low bias is predominantly due to low BHs while that at higher bias it is contributed by high BHs around $\bar{\phi}$.
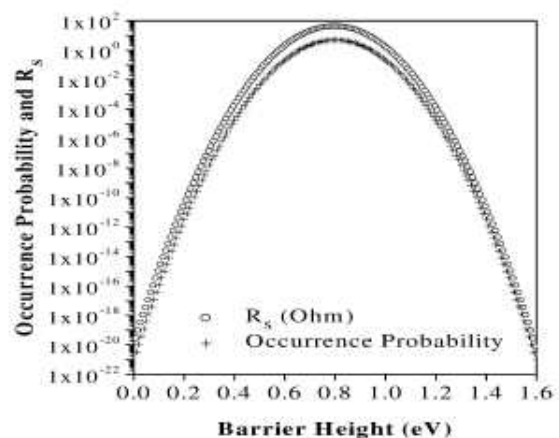
Fig. 4 Variation of series resistance of elementary diodes with their barrier heights ('o'symbol) proportional to occurrence probability

Fig.4 clearly shows that current at higher bias is contributed mainly by high barrier heights in the distribution.

VI.   CONCLUSION

The current-voltage characteristics of inhomogeneous Schottky diodes were generated using analytically solved thermionic – emission diffusion equation incorporating Gaussian distribution of barrier heights and by direct numerical integration over a barrier height range. The discrepancies in the result of two approaches are highlighted and it is shown that current at low bias is contributed by low BHs and at high bias by high BHs in the distribution.

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Radon Exhalation Study in Some Soil Samples of Bathinda District of Punjab, India

Nisha Sharma
Dept. of Physics, Guru Nanak Dev University, Amritsar-143005, India.
E-mail: nisha584n@gmail.com

Jaspal Singh
Dept. of Physics, Guru Nanak Dev University, Amritsar-143005, India.

Abstract— Soil is a source of radon. The infiltration of radon gas (^{222}Rn) from soil has been identified as one of the main mechanisms influencing indoor radon levels in many buildings. In the present investigations, the radon exhalation rate from some soil samples collected from various locations in Bathinda district of Punjab, India has been estimated. For the measurement of radon exhalation rate from these samples we have used alpha sensitive LR-115 type II plastic track detector. The radon exhalation rate varied from 9.7 ± 1.3mBq/kg/h to 32.9 ± 2.3mBq/kg/h with a mean value of 19.7 ± 1.8mBq/kg/h.

Keywords— Radon, Soil, Can technique, LR-115.

I. INTRODUCTION

Soil is the prime source of uranium and it forms a major component of building materials. As a result radon reaches us through these building materials. Radon in small quantities is widely distributed in soil due to the presence of radium in trace quantities. It has been reported that a worldwide average of 60.4% of indoor radon comes from the ground and surrounding soil of buildings [1, 2]. Radon enters air-filled pores in the soil mainly due to recoil of the radon atoms on decay of ^{226}Ra in ^{238}U decay series [3]. High values of radon may arise from concentrations of radium and may be due to the occurrences of uranium nearby. Radon and its daughter products present in natural environment results in a significant risk to general public. Due to alpha emitting short lived daughters, ^{218}Po and ^{214}Po, it has known to be causative agent for lung cancer. These daughter products can attach to the surface of airborne particles and remain airborne for a long time. These radioactive particles in the inhaled air deposit in the lung and irradiate the tissue, infact; it is the first known cause of lung cancer among non smokers [4]. According to several researchers, breathing low level of radon may increase the possibility of lung cancer [5, 6]. The concentration of radon and its decay products show large temporal and local fluctuations in the indoor and outdoor atmosphere depending upon the building materials, underground soils, ventilation conditions and wind speed etc. In the present work, we report the radon exhalation rate from soil collected from Bathinda district of Punjab, India. In total we have collected 22 soil samples from this area.

II. EXPERIMENTAL PROCEDURE

We have used the Can Technique for the present study [7]. The collected samples were dried in the sun and then passed through a sieve of mesh size 200. 500 grams of each sample was taken in a plastic container of 5 liter capacity. A small piece of LR-115 type -II plastic track detector was fixed on the glass slide which was then fixed on the upper inside of the lid of the chamber. All the chambers were made air-tight by using vacuum grease and then covering the joint with cello-tape. These systems were kept undisturbed for a period of 3 months. The detectors (LR-115) continuously registered tracks of alpha particles from radon and its daughters exhaled from soil. After a period of three months the detectors were removed. Etching of these detectors was carried out in 2.5N NaOH solution at 60°C for 2 hours. The detectors were then washed under running tap water for a period of 15-20 minutes, dried in open air and were fixed on glass slides for counting of the tracks. Exhalation rate (E_x) was calculated using the following equation:

$$E_x = \frac{CV\lambda/M}{T + 1/\lambda(e^{-\lambda t} - 1)} (Bq/kg/h)$$

Where C = Integrated radon exposure (Bq/m^3/h)

V = Volume of can (m^3)

λ = Decay constant for radon (h^{-1})

M = Mass of the Sample (kg)

T = Time of exposure (h)

III. RESULTS AND DISCUSSION

The results of the present investigations are presented in Table1. From the table we find that radon exhalation rate in the soil samples of Bathinda varies from a minimum of 9.7 ± 1.3mBq/kg/h to maximum of 32.9 ± 2.3mBq/kg/h with a mean value of 19.7 ± 1.8mBq/kg/h. The minimum value is observed for the sample SSB-5 and maximum for SSB-19. We find that there is much variation of radon exhalation rate by a factor of 3.4. As radon comes from radium, this variation in the radon exhalation rate may be due to the variation in the radium content in soil. Apart from variation in the radium content, soil porosity may also be responsible, because more is the porosity more is the exhalation rate. These investigations are under study. The values of radon exhalation rate in soil as reported by other workers are given in Table 2. It is evident from the table that the observed values of radon exhalation rate in the analyzed samples are in general comparable to those reported for other parts of India.

Table 1 Radon exhalation rate from soil samples of Bathinda District, Punjab, India

S. No.	Sample Code	Radon Exhalation Rate (mBq/kg/h)
1	SSB-1	24.4 ± 2.0
2	SSB-2	28.0 ± 2.7
3	SSB-3	19.6 ± 1.7
4	SSB-4	14.7 ± 1.6
5	SSB-5	9.7 ± 1.3
6	SSB-6	17.0 ± 1.7
7	SSB-7	14.7 ± 1.7
8	SSB-8	15.2 ± 1.4
9	SSB-9	24.6 ± 2.0
10	SSB-10	19.3 ± 1.7
11	SSB-11	14.8 ± 1.6
12	SSB-12	27.7 ± 2.1
13	SSB-13	15.9 ± 1.6
14	SSB-14	11.1 ± 1.3
15	SSB-15	13.7 ± 1.5
16	SSB-16	21.6 ± 1.9
17	SSB-17	17.8 ± 1.7
18	SSB-18	26.2 ± 2.1
19	SSB-19	32.9 ± 2.3
20	SSB-20	22.9 ± 1.9
21	SSB-21	23.9 ± 1.9
22	SSB-22	17.0 ± 1.7

a.

Table 2 Comparison of the average radon exhalation rates in soil samples in different part of India.

S.No.	Location	Radon exhalation rate (mBq/kg/h)	References
1	Margherita Thrust area	10.9	[8]
2	Kangra (H.P)	24.3	[9]
3	Villages of Haryana and Himachal Pradesh States, India	12.8	[10]
4	Aravali hills in India	25.5	[11]
5	Jamtara district	18.9	[6]
6	Bulandshahr district	23.1	[12]
7	Present Study	19.7	-

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Structural Study of Al Modified GeSbTe Bulk using XRD Analysis

Sharanjit Sandhu
Semiconductors Laboratory,
Department of Physics,
Guru Nanak Dev University,
Amritsar, Punjab, India
sharanjitkaursandhu@yahoo.com

D. Singh
Semiconductors Laboratory,
Department of Physics,
Guru Nanak Dev University,
Amritsar, Punjab, India

S. Kumar
Semiconductors Laboratory,
Department of Physics,
Guru Nanak Dev University,
Amritsar, Punjab, India

R. Thangaraj
Semiconductors Laboratory,
Department of Physics,
Guru Nanak Dev University,
Amritsar, Punjab, India

Abstract— Bulk samples of chalcogenide material with composition $Al_x(Ge_2Sb_2Te_5)_{1-x}$ are prepared. The bulk samples obtained are analysed using XRD spectra. It was observed that the all the samples prepared are crystalline and the grain size first decreases and then increases with increase in Al content. The observed variation is explained using theoretical and some quoted results in literature for similar materials.

Keywords—chalcogenides, PCRAM, thin films

I. INTRODUCTION

The ability of mankind to preserve knowledge has been an important aspect of human development. Technological advances such as book printing have enabled the more widespread distribution of knowledge, with a profound impact on the structure of society. In present days most of the information is no longer stored in the form of books. Instead video tapes, compact disks, hard disk drives and semiconductor memories store the vast amount of data created in modern society. The next step in information technology is mobile computing and storage where any kind of information is potentially available everywhere for everyone. This requires devices that enable non-volatile memories. In recent years, non-volatile solid state memories employing "flash" random access memories have become very popular, successful, widespread and inexpensive. They are not only found in personal music players such as MP3 or in digital cameras but could even replace or supplement hard disk drives in other areas such as personal computers.

As the Flash memory scaling trend is slowing down, alternative memory concepts are being investigated to provide a better trade-off between scalability and reliability. Among them, phase change memory (PCM) is attracting growing interest. The main advantages of PCRAM-based non-volatile memories should be the low production costs, the compatibility with CMOS technology and the relative ease of integration. At the same time there are several issues, which are not yet well understood, that could endanger the potential success of PCRAMs. GeSbTe (225) is one of the most successful material for use as PCRAM but still some optimization of some of its properties is required. For same purpose we modified the composition by addition with addition of Al and investigated its structural properties in this paper. Al was chosen as theoretical investigation suggests increase in glass transition temperature [1] which will increase high temperature stability.

II. EXPERIMENTAL DETAILS

The polycrystalline bulks of $Al_x(Ge_2Sb_2Te_5)_{1-x}$ X= 0, 0.15,0.20,0.25,0.30 were synthesized from 99.999% pure elemental Al, Ge, Sb and Te sealed in quartz ampoules (length 10 cm, internal diameter 6 mm) evacuated to 10^{-5} Torr. The ampoules were heated gradually up to a temperature just above the melting point of the elements and were kept at that temperature for 48 h with constant shaking. After 48 h, the furnace was switched off with the ampoule inside, to make a polycrystalline ingot for the deposition of highly stoichiometric films utilizing the sharp melting points of the crystalline form of the materials. The obtained samples were examined by X-ray powder diffraction, and accordingly the obtained samples are found to be crystalline.

III OBSERVATIONS

Figure 1 shows the XRD scans of bulk samples named as X0,X1,X2,X3,X4 with Al content fraction X=0, 0.15, 0.20, 0.25, 0.30 in $Al_x(Ge_2Sb_2Te_5)_{1-x}$. The peaks obtained confirms formation of $Ge_2Sb_2Te_5$ crystals. Peaks corresponding to planes (111), (200), (220), (222) are identified for all the compositions [2].
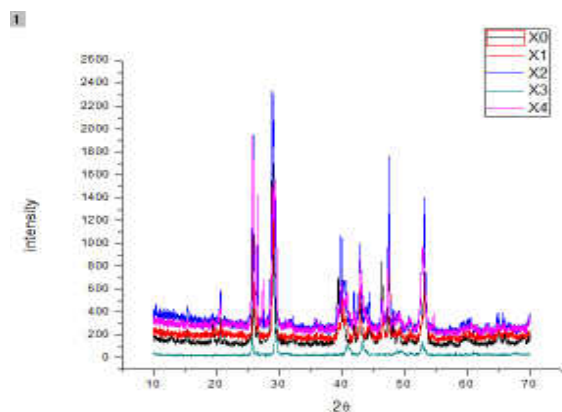
Fig 1 : XRD scans of bulk samples

The Peaks are analysed for FWHM using origin8 software.

From the data obtained grain size and lattice strain factor is computed using linear fit of $\sin(\theta)$ vs $\beta\cos(\theta)$ graphs where β is FWHM. Intercept obtained gave value of $k\lambda/d$ d being crystallite size and slope led to lattice strain measure parameter [3]. The obtained results are tabulated in table I

Table 1: Variation of grain size and strain measure.

Comp	grain size(nm)	Strain
X0	3.584192	2.075408
X1	1.225667	1.16616
X2	0.965001	0.683309
X3	1.244631	0.96565
X4	16.6775	1.944109

III.   RESULTS

Both the grain size and strain measure decreases first till composition corresponding to x=0.20 and increases thereafter.

IV. DISCUSSION

When do pants are added in a system two influences must occur.

(a) The rate of crystallite growth may be influenced;

(b) An internal strain will be induced in grains

Al addition increase defect density and reaction kinetics as well as reduce the crystallite size of samples [4]. Therefore the first decrease in crystallite size is explained but the rise thereafter is yet to be understood.

At low Al concentrations Al enters into vacancies in FCC lattice as radii of all elements are of same order resulting in decrease in strain. Thereafter at high concentration Al enters voids in FCC resulting in increase in strain.

V ACKNOWLEDGEMENT

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Density Functional Study of Vibrational Frequencies of Some Common Drugs

A K Sharma
Dept. of
Physics,
Maharishi
Markandeshwar
University
Mullana,
Ambala, 133207
(Haryana)
e-mail:
anil67042@gmail.com

Anish
Kumar
Sharma
Dept. of
Physics,
Maharishi
Markandeshwar
University
Mullana,
Ambala,
133207
(Haryana)

J K
Sharma
Dept. of
Physics,
Maharishi
Markandeshwar
University
Mullana,
Ambala,
133207
(Haryana)

Kundan
Kumar
Vishwakarma
Dept. of
Physics,
Maharishi
Markandeshwar
University
Mullana,
Ambala,
133207
(Haryana)

Sweta
Dept. of
Physics,
Maharishi
Markandeshwar
University
Mullana,
Ambala,
133207
(Haryana)

Ipsa Jain
Dept. of
Physics,
Maharishi
Markandeshwar
University
Mullana,
Ambala,
133207
(Haryana)

O P Singh
Dept. of
Physics, Paliwal
(P.G.)
College,Shikohabad-205135(
Uttar Pradesh)

Abstarct- Density functional theory DFT(B3LYP)/6-31G(d) has been applied to compute the geometry optimization, dipole moment and vibrational frequencies of Aspirin, Paracetamol and Phenacetin. From the comparison of vibrational frequencies it is observed that the value of O-H stretching in Aspirin is lower as compared to Paracetamol shows its greater tendency to form cation whereas Paracetamol has least tendency to form cation as the O-H stretching in Paracetamol is at greater frequency even than that of Phenacetin, which explains that why there is displacement of –COOH by –OH group in aspirin i.e. (aspirin) acetyl-salicylic acid readily converts into salicylic acid which is responsible for most of its actions. The greater values of O-H and C-H stretching of Paracetamol than Aspirin and Phenacetin explains its selective behavior to inhibit cyclooxynase-2 (COX-2) and poor inhibitor of the synthesis of prostaglandins which is responsible for pain headache and infection. On comparison of dipole moment of it is also observed that the order is Aspirin > Paracetamol > Phenacetin and from our earlier ADMP studies of total energy curve vs time in trajectory curve of Aspirin , Paracetamol and Pehnacetin at DFT/6-31G(d) it is found that the energy required to release Hydrogen from these drugs are in the order Paracetamol > Phenacetin > Aspirin, therefore from infrared spectra,dipole moment and ADMP studies of Aspirin, Paracetamol and Phenacetin it is concluded that Aspirin is most reactive which explains that why it inhibit the synthesis of prostaglandins responsible for pain , headache and fever; restricts the blood supply to the tumor in effect- not allowing it to grow than a pea and Paracetamol is a poor inhibitor of prostaglandins synthesis, does not have anti-inflammatory action; Phenacetin shows more reactive sites than Paracetamol but less than Aspirin which give the evidence that why it is being replaced Aspirin.
Keywords : Quantum chemical calculations/ DFT/ HF/ vibrational frequencies / IR / dipole moment/ polarizability/ Aspirin / Paracetamol/ Phenacetin

I. INTRODUCTION

Analysis of vibrational spectra of organic molecules has played an important role for a long time determining their molecular structures, intramolecular and intermolecular forces. The frequencies calculated by the Restricted Hartree-Fock method are, however consistently higher[1] than the experimental wavenumbers of fundamentals by 10 because of the neglect of electron correlation and anharmonicity effects. Therefore, we have applied density functional theory[2-5] as an alternate to Restricted HF method which includes electron correlation, having affording opportunities of performing vibrational analysis of aspirin, phenacetin and paracetamol.

In order to handle dreadful diseases like aids, cancer, alzheimer's etc, there is a need for new research in the field of medicine, concerning drug-DNA interactions. Many physcio chemical techniques as well as quantum mechanical approaches are in vogue in studying these techniques, as action mechanism of drugs at molecular level is still unclear. An attempt is made by Murthy and his school [6-10] to correlate electron ionization cross section with drug dosage and its toxic effects. The present study is an effort to understand the mechanism and other aspects of medically important systems of some common drugs (aspirin, paracetamol and phenacetin), through the determination of vibrational frequencies, dipole moment and comparision of these properties with the earlier computed ADMP [26-29]. The drug-DNA interactions are mainly based on electron transfer and electronic polarizability, and the process of transferring or gaining electron. These interactions can better be explained by exploring the concept of interaction of drugs towards protons and electrons. Measurement of these fundamental chemical properties of drugs now being possible with modern mass spectrometric techniques such as fast atom bombardment (FAB)[11,12], secondary ion mass spectrometry(SIMS)[13] and the soft ion techniques, elecetrospray ionization (ESI) and matrix assisted laser desorption ionization (MALDI)[14-17], high pressure mass spectrometry[18], fourier transform ion cyclotron resonance (FTIR) mass spectrometry[16] and kinetic methods [11,17,18-24] have been used in evaluating the chemical behavior in gas phase. Undoubtly an accurate experimental determination is the ultimate choice for obtaining chemical properties even then sophisticated high level ab-initio calculations have become attractive alternative when the experimental

determination is difficult or ambiguous. Aspirin (acetyl-salicylic acid) is an organic acid and stable in dry air.
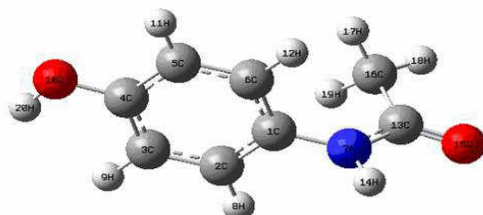
Fig. I Aspirin   Fig. II   Fig. III Phenacetin
Fig. I-III :   The optimized structures of aspirin, paracetamol and phenacetin, respectively calculated at DFT(B3LYP)/6-31(d)

It is known for its analgesic, antipyretic actions and helps even in curing the disease like cancer, but still it is unclear that which one among the three drugs taken for the present study has better pain relieving effect i.e. which one stop the synthesis of prostaglandins responsible for pain, headache and fever without any or minor side effect. Regular aspirin intake may reduce the risk of colorectal cancer by 50% however,the mechanism of this chemopreventive effect is not known. Efforts have been made here by studying the molecular properties of these drugs, to explain above mechanism at molecular level.

The availability of quantum mechanical programs G-03W and GAUSS View 4.1 Version[25] which include all electron of the systems and in which all integrals are evaluated without approximation, promoted us to use quantum mechanical programs to explore the finer details of aspirin, paracetamol and phenacetin to provide information on the infrared spectra of aspirin, phenacetin and paracetamol taken for the present study and on comparison with the experimental findings and our earlier studies to see upto which extend these calculated results authenticate the adequacy and the reliability of the ab-initio method.

II. COMPUTATIONAL DETAILS

The neutral gas phase of aspirin, paracetamol and phenacetin were fully optimized by employing HF/6-31G(d) and DFT(B3LYP)/   6-31G(d) and then this optimized structure is started as initial geometry for calculation of vibrational frequencies of aspirin, paracetamol, phenacetin with RHF/6-31G(d), DFT(B3LYP)/6-31G(d) at ab-initio level. Fig.I-III   are the optimized structures of aspirin, paracetamol and phenacetin, respectively calculated at DFT(B3LYP)/6-31G(d) and All calculations in the present work were carried out on Intel Core-i3 using G-03W and GAUSS VIEW 4.1 VERSION[20] of ab-initio quantum mechanical program out in the Department of Physics, MMEC,MMU, Mullana, Ambala.

III. RESULT AND DISCUSSION

The mid infrared region ranging from 4000 cm^{-1} to 3200cm^{-1} is the O-H and N-H region. In case of Aspirin, Paracetamol and Phenacetin the peaks obtained in this region in the calculated IR Fig.V at DFT(B3LYP)/6-31G(d) are 3217.01 cm^{-1} in   aspirin   corresponds to O_{20}-H_{21} stretching and the experimental Fig.IV IR of Aspirin (Chemistry M01B Laboratory Manual) is also in the region 3200-2500 cm^{-1}. 3601.58 cm^{-1} and 3429.78 cm^{-1} in Paracetamol corresponds to O_{10}-H_{20} stretching and N_7-H_{14} stretching respectively, 3475.63 cm^{-1} in Phenacetin is assigned as N_{10}-H_{20} stretching respectively. All these assignments are as expected to general conventions.

As C-H in-plane bending in between 1300-1000 cm^{-1}, C-H out of plane bending in between   900-675 cm^{-1} and skeleton vibration in between   1600-1585cm^{-1} are the most important characteristic bands in the spectra of aromatic compounds. In case of aspirin the calculated IR peaks are obtained

at 1261.31 cm^{-1}, 1239.85 cm^{-1} corresponds to C-H in plane bending.

946.61 cm^{-1}, 878.55 cm^{-1}, 777.16 cm^{-1}, 750.56 cm^{-1} and 704.315 cm^{-1} all these are assigned as out of plane bending and 1588.86 cm^{-1} corresponds to skeleton vibration or ring distortion gives the evidence of aromatic hydrocarbons and the experimentally observed IR is in the region 1600-1400 cm^{-1} corresponds to skeleton vibration.

Similarly the calculated IR frequencies in the region 1300-1000 cm^{-1} of Paracetamol Fig.1.3 and Phenacetin Fig.1.4 are 1275.13 cm^{-1}, 1149.35 cm^{-1}, 1083.04 cm^{-1}, 1023.16 cm^{-1}, and 1299.43 cm^{-1}, 1242.24 cm^{-1}, 1169.27 cm^{-1}, 1112.81 cm^{-1}, are assigned as C-H in plane bending. In the region 900-675 cm^{-1} the calculated IR are 909.53 cm^{-1}, 820.35 cm^{-1}, 787.01 cm^{-1}, 690.18 cm^{-1}, and 946.17 cm^{-1}, 905.31 cm^{-1}, 798.03 cm^{-1} are C-H out of plane bending. 1580 cm^{-1}, 1504 cm^{-1} and 1609.783 cm^{-1} are assigned as C_4=C_3, C_1=C_2 and C_3=C_2, C_5=C_6 stretching or skeleton vibrations.
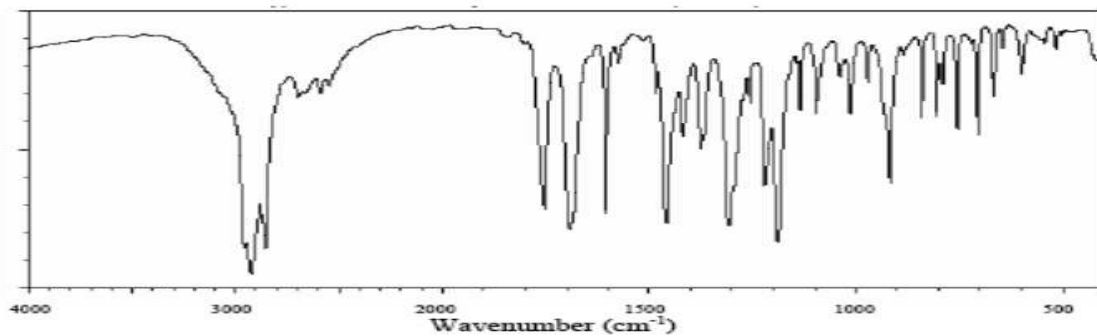
Fig.-IV
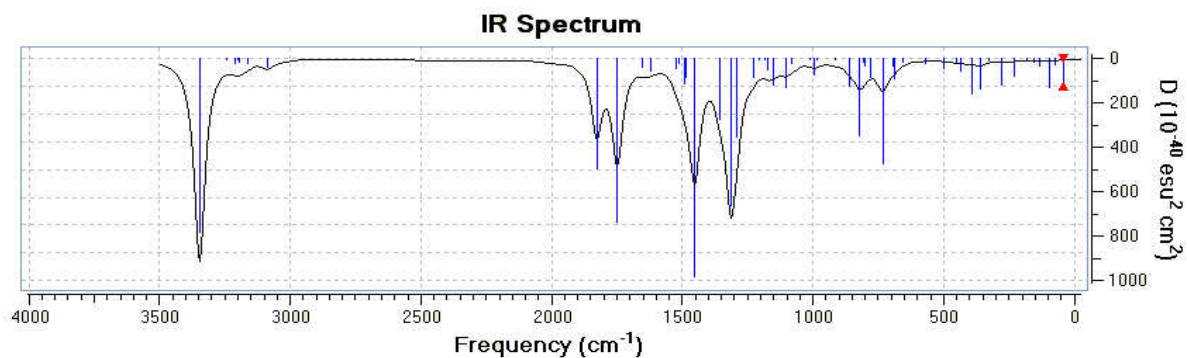
Fig.-V Aspirin

Fig.- IV and V are the experimental IR Aspirin and calculated IR at DFT(B3LYP)/ 6-31G(d)
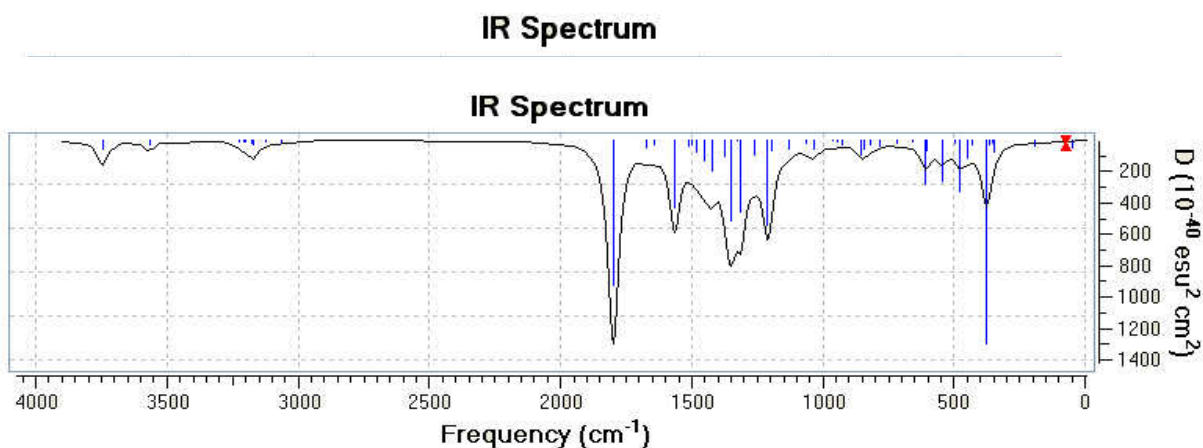
Fig.-VI Paracetamol
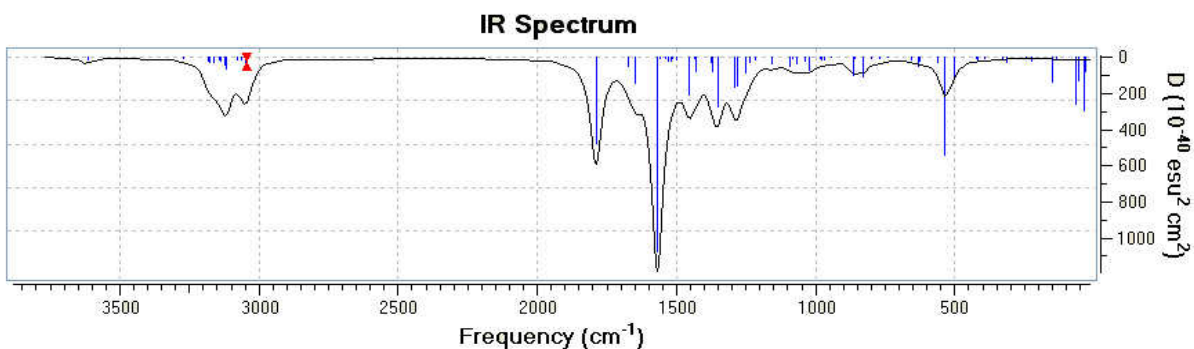
Fig.-VII Phenacetin

Fig. : VI-VII are IR spectra of Paracetamol and Phenacetin calculated IR at DFT(B3LYP)/   6-31G(d)

The most important characteristic vibrations of COOR (ester) and COOH is C=O stretching, the observed IR peak of C=O stretching in aspirin is in the region 1750-1730 cm^{-1} and 1725-1700 cm^{-1} for ester and carboxylic respectively

and the corresponding calculated IR is at 1756.30 cm^{-1} and 1680.85 cm^{-1} respectively.

The calculated IR 1264.51 cm^{-1} is attributed to C_{11}-O_{14} stretching and the observed peak is in the region 1300-1000 cm^{-1}. However, the C=O stretching in the calculated

IR of Paracetamol and Phenacetin are at 1729.45 cm^{-1} and 1720.22 cm^{-1} respectively, which are at lower frequencies than the C=O of ester stretching in aspirin, it is because resonance strengthen the C=O bond in aspirin, as a result absorption take place at higher frequency then that of aldehyde, ketone and alcohol.

From the comparison of vibrational frequencies with the earlier observed IR frequencies, we conclude that the calculated vibrational frequencies at DFT level are at par with the experimental values. However, if we use 0.8929 scaling factor for Hartree-Fock method with different split-valence basis sets then we get the vibrational frequencies approximately nearer to the experimental values. We have calculated vibrational frequencies of Aspirin, Paracetamol and Phenacetin with DFT(B3LYP) and 6-31G(d) basis set, and given assignments to all the frequencies of the molecules which explains, how the aspects of molecular structure of Aspirin, Paracetamol and Phenacetin serve as a powerful tool in explaining their involvement in medicine e.g. The lower value of O-H stretching in Aspirin as compared to Paracetamol shows its greater tendency to form cation whereas Paracetamol has the least tendency as the O-H stretching in Paracetamol is at greater frequency even than that of Phenacetin, which explains that

TABLE I

Dipole Moment (in units of Debye) of Asp calculated at HF and DFT methods with different basis sets :			
Methods / Basis sets	Aspirin	Paracetamol	Phenacetin
HF/6-31G(d)	6.38852	4.5069	3.5875
HF/6-31G(d,p)	6.9161	4.5253	3.5882
HF/6-31+G(d,p)	7.0790	4.7136	3.7110
HF/6-31++G(d,p)	7.0767	4.7152	3.7094
HF/6-311G	7.9885	4.7766	3.9994
HF/6-311G(d)	6.8951	4.5279	3.5897
HF/6-311G(d,p)	6.8789	4.4916	3.5515
HF/6-311+G(d,p)	6.9501	4.6286	3.6439
HF/6-311++G(d,p)	6.9497	4.6285	3.6444
DFT(B3LYP)/6-31G(d)	6.6536	4.5116	3.2752

why there is displacement of –COOH by –OH group in aspirin i.e. (aspirin) acetyl-salicylic acid readily converts into salicylic acid which is responsible for most of its actions e.g. inhibition of prostaglandins, its anticoagulation behavior, analgesic, antipyretic and anti-inflammatory effects, which favors the experimental pharmacokinetic studies (G. Levy ,1965, 1976; L.Y. LO, BYE et al. 1980; J.R. Vane et al. 2003) of aspirin on humans. The greater values of O-H and C-H stretching of Paracetamol than Aspirin and Phenacetin explains its selective behavior to inhibit cyclooxynase-2 (COX-2) and poor inhibitor of the synthesis of prostaglandins which is responsible for pain headache and infection. Meanwhile, Paracetamol is standard antipyretic but has poor analgesic and anti-inflammatory actions. The present work on vibrational frequencies opens a new approach to the study of drug interactions inside the body besides the other physico-chemical methods that are available today, it explain all possible aspects of molecular structure of all these drugs involved in drug designs and these aspects alone are sufficient to give an insight into medical activity of the drugs inside the body without using the highly expensive physico-chemical method.

On comparison of dipole moment of Table I Aspirin, Paracetamol and Phenacetin it is observed that the order is Aspirin > Paracetamol > Phenacetin. This observation shows that aspirin is more asymmetric as compared to Paracetamol and Phenacetin. It is found that dipole moment depends on the substituents being in the order –COOH > R-COOR′ > -OH > -NHCOCH$_3$ > -C$_2$H$_5$. In other words, the order of dipole moment is the order of their reactivities. It is in accordance to their behavior in medical activities i.e. rapid conversion of (Aspirin)acetyl–salicylic acid into salicylic acid which is responsible for most of its actions e.g. its anticoagulation behavior, analgesic, antipyretic and anti-inflammatory effects.

From our earlier ADMP[29] calculations of total energy curve vs time in trajectory curve of Aspirin , Paracetamol and Pehnacetin at DFT/6-31G(d) it is found that the energy required to release Hydrogen from these drugs are in the order Paracetamol > Phenacetin > Aspirin and therefore, Aspirin is most reactive which explains that why it inhibit the synthesis of prostaglandins responsible for pain , headache and fever; restricts the blood supply to the tumor in effect- not allowing it to grow than a pea and Paracetamol is a poor inhibitor of prostaglandins synthesis, does not have anti-inflammatory action; Phenacetin shows more reactive sites than Paracetamol but less than Aspirin which give the evidence that why it is being replaced Aspirin. Therefore, it is concluded that aspirin is more reactive as compared to others drugs under consideration.

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Significance of Hubble Flow in Virgo Cluster & its Surrounding Galaxies

Varsha Gupta
Dept. of Physics, Vikram University
Ujjain (M.P.), INDIA
ms_v_gupta@yahoo.co.in

G. K. Upadhyaya
Department of Physics, Vikram University
Ujjain (M.P.), INDIA
gopalujjain@yahoo.co.in

Abstract— This paper presents Hubble diagram plotted by using data of 190 galaxies of Virgo cluster and its surrounding galaxies (having redshift < 1), collected from SDSS-III DR9 database. The diagram clearly brings out that at smaller distances there is strong deviation from linear relation whereas at larger distances less scattering and a roughly linear relation is observed in the flow, making it resembles the global Hubble flow.

Keywords— Virgo cluster, Redshift, Hubble diagram, Hubble flow.

I. INTRODUCTION

Galaxies exist in clusters. Clusters of galaxies are among the largest gravitationally bound structures in the observable universe. The sites of these clusters provide venue for many exhaustive studies for eliciting valuable information about their formation and evolution. Among the major densely populated galaxy clusters in the nearby Local super cluster (like- Fornax, Abell 1367, Ursa Major, Virgo, Coma and others), the Virgo has been a very important celestial cluster for extra galactic astronomy. It is the nearest and best studied, rich cluster of galaxies in the Northern Hemisphere. In most respects, its properties are typical of large clusters. This cluster is a home of nearly 1500 and possibly up to 2000 galaxies of almost all known Hubble types and luminosity.

Studies showed that the structure of Virgo cluster is quite complex. It is an irregular cluster with significant sub structures. Mass estimates of this cluster vary significantly $(0.15 - 1.5) \times 10^{15}$ M$_\odot$ [1] [2] [3] [4] [5] [6] but generally fall within the range typical of rich clusters [7]. It contains vast quantities of X-ray emitting gas [2] [3] [8] and shows clear evidence for both substructure and nonvirialized motions [1] [9] [10].

Indeed, the property that sets Virgo aside from other clusters is its distance ≈ 17 Mpc [11] [12]. Its proximity allows its mapping to an unsurpassed level of depth and morphological details. In particular this cluster serves as an important reference for the determination of distance scale of the universe. Altogether cluster serves as an ideal laboratory and provides ample opportunity to explore the wealth of morphological diversity and physical process which motivates astronomers to carry out many systematic studies.

II. DISCOVERY OF EXPANDING UNIVERSE & ITS IMPORTANCE

One of the greatest and most important discovery of 20th century is the concept of expanding universe which says that the dominant motion in universe is smooth expansion. Earlier everyone including astronomers had assumed that the universe was a stable unchanging stage, on which astronomical events played themselves out. During 1910s and 1920s several physicists and astronomers came up with several astonishing discoveries that defied easy explanations but at the same time opened new doors to explore the universe. Albert Einstein in 1915 developed the general theory of relativity in order to explain that how gravity works. When Einstein applied his theory to the whole universe, a strange result was obtained, that all of the space should be dynamic; either 'contracting' or 'expanding'. Einstein, himself did not believed his finding and thought that he could have committed some mistake. Like other astronomers he too believed that the size of the universe is not changing. The work by Harlow Shapley and Heber D. Curtis, 1920; Alexander Friedmann,1922[13]; Georges Lemaître, 1927[14]; Vesto Slipher[16] and several others provided hints of cosmic expansion- the Big Bang and Steady State theories of origin and evolution of universe were proposed. However the real breakthrough in understanding the universe came only after the publication of Edwin Hubble's 1929 article 'A relation between distance and radial velocity among extra-galactic nebulae' through which he confirmed the expanding universe theory [15]. Hubble made a famous plot which today called as Hubble diagram. Through this diagram Hubble showed that galaxies recede from us in all directions and more distant ones recede more rapidly in proportion to their distances. Hubble's work convinced the scientific community that we live in an expanding universe.

III. HUBBLE LAW

According to Hubble the dominant motion in the universe is the smooth expansion. The equation that describes the linear fit is known as Hubble Law given by:

$$v = H_o \, D$$

or $$cz = H_o \, D$$

where v is the observed velocity of the galaxy away from us, usually in km/sec, D is the distance to the galaxy in Mpc (1Mpc = 3.26 Million light years), c is the speed of light, z is redshift of galaxy & H_o is proportionality constant known as Hubble's "constant" estimated from the slope of that line and the reciprocal of H_o is the Hubble time.

Hubble's Law can be easily depicted in a 'Hubble Diagram'. Figure 1 shows plot of velocity against distance (the original Hubble diagram) in which the velocity (assumed

approximately proportional to the redshift) of an object is plotted with respect to its distance from the observer.
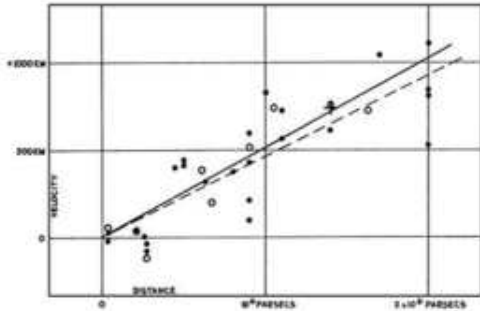
Fig. 1 Original Hubble Diagram: Velocity-Distance Relation among Extra-Galactic Nebulae (courtesy: E. Hubble, PNAS

A straight line of positive slope on this diagram is the visual depiction of Hubble's Law.

Extensions to Hubble's work with today's technology have opened vast new arenas for exploration. Now if we accept the expanding universe theory and consider that the whole universe is expanding, then this expansion could also be inferred in Virgo cluster: being very small part of this huge universe. Therefore to infer signatures of Hubble flow in Virgo cluster and its surrounding galaxies Hubble diagram is plotted, using recent data of 190 galaxies collected from SDSS III DR-9 database. Methodology used to plot Hubble diagram is as follows:

In order to plot Hubble Diagram two quantities are required first is the distance to galaxy and second is the velocity of galaxy. These values are estimated in our work by using the following methods:

A. Estimating Distances to Galaxies

In astronomy it is very difficult to measure directly the real or absolute distances to galaxies. However, it is easier to calculate and compare their relative distances. For which the apparent magnitude of galaxy is compared with respect to a convenient but arbitrary standard, here we have considered star Vega as standard and used galaxy's apparent magnitude value 'm' (obtained from SDSS DR9 database [17]) as a substitute for distance to calculate the relative distance to galaxy (as magnitude varies with distance). By selecting 'r' magnitude values for our sample galaxies and assuming that galaxies emit same amount of light and the difference in their magnitudes are only due to their different distances from us. The normalized relative distances to 190 galaxies are calculated by using the following method:

Method:

Step 1: Record the 'r' magnitude value for each of our sample galaxies from SDSS database.

Step 2: Calculate the value of radiant flux 'F' by using formula F= 2.51^{-m}. Where, F is a relative number that compares the arriving radiant flux to the star Vega.

Table1

Step 3: Calculate the relative distance 'd' by using formula d= $1/\sqrt{F}$.

Step 4: For simplification normalize these distance values such that d1 / d2 = 1 / x, for each galaxy.

Where d1 is the relative distance to the nearest galaxy, d2 is the relative distance to another galaxy and x is the normalized distance to the other galaxy.

B. Estimating Redshift

Here we have considered redshift as a substitute of velocity and also that the degree of redshift or blue shift of light waves is proportional to object speed in the direction we are looking. The method of estimating the redshift value is as follows:

Method:

Step 1: Obtain galaxy spectrum from SDSS DR9 database.

Step 2: Record the observed wavelength value corresponding to H□ line from spectrum.

Step 3: Calculate the shift of H□ line with respect to its expected wavelength by using formula:

$$z + 1 = \frac{\lambda observed}{\lambda rest} \qquad or, z = \frac{\lambda observed}{\lambda rest} - 1$$

where, $(\lambda rest)$ H□ =4862.7A □

where, positive 'z' value mean the galaxy has a Redshift; negative 'z' value mean the galaxy has a blueshift.

Finally by using the data as calculated and tabulated in table 1 and considering the relative distance values on X axis and the redshift values on Y- axis Hubble diagram is plotted, as shown below:
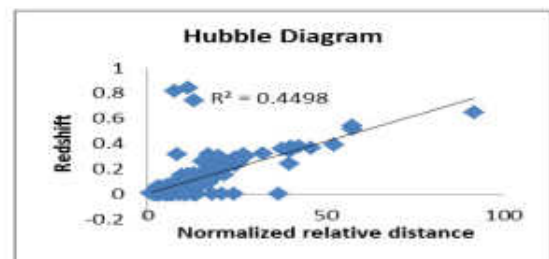
Fig.2 Hubble Diagram of by considering 190 galaxies

IV. RESULT

At smaller distances strong deviation from linear relation is observed (shown in figure 2 as we get $R^2 = 0.4498$). Here the galaxies are much more clustered and exhibit low redshift. This gives an indication that it might be due to larger mass of the cluster which provide gravitational pull for these galaxies. However at larger distances, less scattering and a roughly linear relation is observed in the flow making it resembles the global Hubble flow.

ObjID	RA	Dec.	Magni-tude 'm'	Flux (F) =2.51^{-m}	Relative distance 'd'	Normalized Relative Distance	λobs A°	Redshift $z = \dfrac{\lambda o}{\lambda r} - 1$ $\lambda r (H_g) = 4862.7$ A°
1237661812812873985	187.67892059	12.53960337	18.06	6.05191E-08	4064.935932	13.52311	5279.588	0.08571
1237661812812808373	187.5850n469	12.58372373	18.14	5.62236E-08	4217.359708	14.03019	5290.54	0.08796
1237661950255693934	187.63645847	12.71917882	18.64	3.5488E-08	5308.344308	17.65965	5706.897	0.17358
1237661950255693850	187.64283239	12.75380231	17.41	1.10073E-07	3014.114495	10.02727	5314.96	0.09298
1237661950255693986	187.66555825	12.7929538	18.38	4.50814E-08	4709.789535	15.66839	5268.658	0.08346
1237661950255694330	187.63942988	12.90089779	18.02	6.27884E-08	3990.802453	13.27649	8466.424	0.74106
1237661813886550206	187.58423654	13.33841717	17.76	7.97618E-08	3540.810193	11.77947	5338.263	0.09778
1237661813886550213	187.58773072	13.43708591	18.07	5.99647E-08	4083.683483	13.58548	5269.871	0.08371
1237661813886615569	187.6412046	13.44915672	21.2	3.36447E-09	17240.16618	57.35409	7367.158	0.515
1237661813886615625	187.60420664	13.46206435	16.76	2.00202E-07	2234.939576	7.43513	5266.232	0.08296
1237661951329435676	187.64780631	13.62150414	20.41	6.9608E-09	11985.89111	39.87432	6047.836	0.24369
1237661068190613603	187.63872623	13.75811361	18.69	3.38921E-08	5431.889508	18.07065	5628.595	0.15748
1237661068190613592	187.62280247	13.78534984	18.28	4.9427E-08	4497.983048	14.96376	5627.299	0.15721
1237661068190613738	187.68592321	13.79943139	17.91	6.94774E-08	3793.832703	12.62121	4883.149	0.00418
1237661068190613700	187.62908823	13.81319862	17.93	6.82103E-08	3828.907839	12.7379	4975.079	0.02309
1237661068190613612	187.65372008	13.90792952	18.02	6.27884E-08	3990.802453	13.27649	5101.525	0.04909
1237664289392689370	187.62217555	13.94796204	17.91	6.94774E-08	3793.832703	12.62121	5349.338	0.10005
1237664289392689306	187.66645501	14.06159188	16.2	3.35186E-07	1727.257726	5.74619	5208.348	0.07106
1237661068727484463	187.61598497	14.16017778	15.08	9.39551E-07	1031.667763	3.43212	4960.209	0.02003
1237664289392689442	187.58498366	14.14011929	18.59	3.71591E-08	5187.609073	17.25799	6389.987	0.31406
1237661068727484560	187.68949665	14.26262527	19.35	1.84635E-08	7359.414351	24.48389	6287.819	0.29304
1237661068727484549	187.65161215	14.3068563	19.59	1.48044E-08	8218.718429	27.3418	6295.062	0.29453
1237661068727484507	187.68676809	14.34742898	19.1	2.32398E-08	6599.70094	21.82262	5868.134	0.20674
1237661069264290035	187.60655231	14.69190934	18.41	4.38538E-08	4775.23542	15.88618	5460.092	0.12283
1237664290466431099	187.62569307	14.95677501	17.39	1.12118E-07	2986.503364	9.93541	5425.003	0.11561
1237662525766959237	187.59691438	14.99331644	18.31	4.80811E-08	4560.504831	15.17176	5426.253	0.11587
1237662525767024716	187.67558509	15.04797282	18.09	5.88711E-08	4121.438378	13.71108	5081.594	0.04499
1237662525767024713	187.67202579	15.07430066	17.43	1.08065E-07	3041.980899	10.11997	5321.083	0.09424
1237662525767024687	187.66615439	15.12068378	15.03	9.83794E-07	1008.203073	3.35406	4861.833	-1.99E-04
1237662525767024822	187.72068356	15.1740636	18.71	3.3274E-08	5482.108977	18.23772	6011.737	0.23627
1237662525767024834	187.73722317	15.17343799	19.06	2.41112E-08	6440.069671	21.42464	6000.674	0.234
1237662525767024752	187.75523792	15.10413377	18.42	4.3452E-08	4797.278977	15.99945	5725.323	0.17737
1237662525766959207	187.5595623	14.99005054	18.74	3.23679E-08	5558.310071	18.49123	5766.337	0.18581
1237662525766893691	187.43574009	15.02478292	16.23	3.26058E-07	1751.266539	5.82606	4884.274	0.00442
1237662525766893633	187.36673563	14.99915597	17.79	7.75898E-08	3590.027312	11.9432	5142.804	0.05758
1237664290466300056	187.33846119	14.78931371	15.43	6.80823E-07	1211.944581	4.03186	5143.989	0.05782
1237661069264224401	187.31990349	14.73476503	17.94	6.75855E-08	3846.566825	12.79665	5136.887	0.05636
1237661069264158899	187.29305528	14.72869177	18.99	2.57156E-08	6235.940826	20.74555	6250.288	0.28533
1237661069264158851	187.26972728	14.62443213	17.93	6.82103E-08	3828.907839	12.7379	5260.173	0.08172
1237661069264158847	187.2629739	14.61357202	17.86	7.27491E-08	3707.544162	12.33415	5142.804	0.05758
1237664289929429097	187.28982081	14.52365769	17.05	1.53307E-07	2553.985784	8.49653	4961.352	0.02027
1237664289929429120	187.33074214	14.43754609	18.15	5.57086E-08	4236.810531	14.0949	5258.962	0.08147
1237664289929363608	187.24102252	14.41708778	17.15	1.39828E-07	2674.250968	8.89662	5349.338	0.10005
1237664289929363518	187.23260671	14.36981276	18.08	5.94154E-08	4102.517499	13.64814	5457.579	0.12231
1237661068727287971	187.29435514	14.31747249	16.62	2.27731E-07	2095.504634	6.97126	5066.406	0.04187
1237661068727353366	187.36059239	14.24242788	17.48	1.03206E-07	3112.779271	10.3555	5207.149	0.07081
1237664289392558378	187.35301537	14.14673377	20.55	6.11935E-09	12783.43267	42.52756	6698.846	0.37757
1237661068727222458	187.11442594	14.15538134	16.88	1.7927E-07	2361.81681	7.85722	8843.008	0.8185
1237664289392427011	186.98428499	14.12313161	20.72	5.23312E-09	13823.55531	45.98781	6629.793	0.36337
1237664289392427163	186.9616064	14.10645658	20.46	6.64776E-09	12264.84801	40.80234	6637.431	0.36494
1237664289392361716	186.90135708	14.00833796	19.18	2.15903E-08	6805.671602	22.64091	6014.507	0.23684
1237664289392361717	186.9016623	14.00986486	20.42	6.89704E-09	12041.17023	40.05822	6678.824	0.37345
1237664289392362261	186.92779429	13.99053903	20.42	6.89704E-09	12041.17023	40.05822	6675.749	0.37282
1237664289392427169	186.99892133	13.98128801	19.19	2.13925E-08	6837.059472	22.74533	5938.818	0.22128
1237661068190285935	186.97403963	13.92425728	19.21	2.10023E-08	6900.270163	22.95562	6089.758	0.25232
1237661068190351526	187.02829826	13.91175159	15.13	8.97298E-07	1055.678564	3.512	4980.81	0.02427
1237661068190351419	187.05231262	13.89922579	14.84	1.17177E-06	923.8022451	3.07328	4978.517	0.02387
1237661068190351587	187.02909307	13.7339277	18.17	5.46926E-08	4275.98093	14.22521	5422.505	0.1151
1237661951329173792	187.06074859	13.68765436	17.54	9.76614E-08	3199.915701	10.64539	5094.482	0.04764
1237661951329173752	187.09996956	13.61537998	21.01	4.00733E-09	15796.92092	52.55274	6759.273	0.39
1237661951329173624	187.03481987	13.60552351	18.56	3.81993E-08	5116.490067	17.02139	5659.786	0.16389
1237661951329173645	187.05649793	13.57057281	16.08	3.74323E-07	1634.469123	5.4375	4960.209	0.02003
1237661813886353551	187.08277267	13.52829618	17.99	6.45461E-08	3936.090048	13.09447	5658.483	0.16363
1237661813886353535	187.04432768	13.50448001	16.59	2.34106E-07	2066.776523	6.87569	5268.658	0.08346
1237661813886353615	187.07259239	13.44953363	18.72	3.29692E-08	5507.392554	18.32183	5570.575	0.14555
1237661813886419056	187.18147582	13.4330688	19.41	1.74716E-08	7565.427382	25.16845	6100.986	0.25462

1237661813886419019	187.24579377	13.37966863	18.54	3.89089E-08	5069.619891	16.86547	5706.897	0.17358
1237661813886550028	187.46803851	13.42746479	12.92	6.85828E-06	381.8495127	1.27033	4900.044	0.00766
1237661813886550159	187.51976443	13.44224697	17.65	8.8259E-08	3366.050227	11.19808	5266.232	0.08296
1237658629695537161	187.49625761	12.34867546	12.64	8.8741E-06	335.6896256	1.11676	4894.406	0.0065
1237661949718626441	187.1886768	12.41152959	18.68	3.42054E-08	5406.952554	17.98769	5610.48	0.15376
1237661949718561026	187.05964613	12.41815971	17.35	1.16322E-07	2932.03759	9.75422	5601.444	0.1519
1237658629695209653	186.79505416	12.38652722	18.72	3.29692E-08	5507.392554	18.32183	5657.18	0.16336
1237658629695144080	186.63810703	12.3875103	18.57	3.78494E-08	5140.087404	17.09989	5295.415	0.08896
1237658629695078609	186.49747394	12.37762232	17.35	1.16322E-07	2932.03759	9.75422	5286.887	0.08721
1237661949718298709	186.38592454,	12.41675623	16.89	1.77628E-07	2372.709548	7.89346	5310.067	0.09198
1237658629694881934	185.93478215	12.39248646	18.38	4.50814E-08	4709.789535	15.66839	5622.199	0.15616
1237658629694750884	185.70304983	12.35615027	18.21	5.27159E-08	4355.411907	14.48946	5310.067	0.09198
1237658629694750751	185.6842655	12.33946833	18.3	4.85256E-08	4539.568268	15.1021	5321.083	0.09424
1237658629694750797	185.62359472	12.34508414	19.36	1.82943E-08	7393.356091	24.596	5986.872	0.23116
1237661949971797	185.57081316	12.39686724	16.09	3.70894E-07	1642.007322	5.46258	4967.067	0.02144
1237658629694619762	185.40717776	12.35821044	19.09	2.34546E-08	6529.58638	21.72244	5618.236	0.15535
1237658629694619805	185.3427675	12.34852022	19.43	1.7153E-08	7635.372056	25.40114	6065.966	0.24742
1237658629694488751	185.13618772	12.39185372	16.67	2.1749E-07	2144.274933	7.13351	4991.143	0.02639
1237658629694488714	185.09209971	12.34883394	17.51	1.00395E-07	3156.046778	10.49945	5337.034	0.09752
1237658629694488696	185.02652544	12.38108029	16.98	1.63508E-07	2473.032908	8.22721	5148.729	0.0588
1237661949717708877	184.94965204	12.42193433	14.85	1.16103E-06	928.0628364	3.08745	5153.473	0.05977
1237661949717643408	184.91952143	12.40549021	16.58	2.36271E-07	2057.288276	6.84413	5152.286	0.05953
1237661949717643394	184.91560656	12.39175524	16.66	2.19501E-07	2134.430902	7.10076	5146.358	0.05831
1237661949717643294	184.89186581	12.42072196	16.38	2.84017E-07	1876.410173	6.24239	5147.543	0.05856
1237661949717643488	184.80951551	12.37799219	19.18	2.15903E-08	6805.671602	22.64091	6058.987	0.24599
1237661949717577812	184.68313837	12.38581863	16.59	2.34106E-07	2066.776523	6.87569	4865.192	4.92E-04
1237661949717577822	184.68920607	12.36218143	17.47	1.0416E-07	3098.488989	10.30796	5314.96	0.09298
1237661949717512405	184.63157942	12.47111097	17.46	1.05123E-07	3084.264311	10.26064	5138.07	0.05661
1237661949717512316	184.48512316	12.46241641	18.69	3.38921E-08	5431.889508	18.07065	4861.833	-1.99E-04
1237661949717512325	184.49310957	12.38007561	18.13	5.67434E-08	4197.99856	13.96578	5328.439	0.09576
1237661949717446822	184.42602411	12.45274302	17.4	1.11091E-07	3000.277167	9.98124	5318.633	0.09374
1237661949717446772	184.39062142	12.38809375	14.92	1.0886E-06	958.442277	3.18852	4859.594	-6.59E-04
1237661949717381212	184.28867029	12.45393848	14.74	1.28472E-06	882.2574357	2.93507	4896.661	0.00696
1237661949717381378	184.18474855	12.41403117	18.34	4.67718E-08	4623.895665	15.38264	6112.234	0.25694
1237661949717315637	184.16504934	12.46822733	17.3	1.21799E-07	2865.350083	9.53236	5191.585	0.06761
1237661949717381357	184.20488604	12.38758636	18.69	3.38921E-08	5431.889508	18.07065	5565.446	0.14449
1237661949717250229	184.00985756	12.42877728	19.57	1.50794E-08	8143.429946	27.09133	6403.243	0.31678
1237661949717250075	183.9230868	12.46317685	18.53	3.92686E-08	5046.34606	16.78804	5490.35	0.12905
1237661949717184658	183.82051695	12.4202222	18.19	5.36951E-08	4315.513672	14.35673	5492.879	0.12957
1237661949717119083	183.67193858	12.37713816	18.58	3.75027E-08	5163.793572	17.17876	5583.416	0.14819
1237661949717053548	183.42459495	12.37285632	18.2	5.32033E-08	4335.416089	14.42294	5178.453	0.06491
1237661949716857000	183.09626126	12.46455349	17.64	8.90749E-08	3350.597217	11.14667	5445.027	0.11973
1237658630768820350	186.53213508	13.11362031	19	2.548E-08	6264.701089	20.84123	4866.313	7.22E-04
1237661813349220495	186.51594114	13.11212091	13.22	5.20371E-06	438.3724968	1.45836	4864.072	2.62E-04
1237661950792106283	186.59900892	13.14449594	18.15	5.57086E-08	4236.810331	14.0949	5117.997	0.05248
1237661950792106189	186.51731959	13.23961818	19.03	2.47862E-08	6351.780182	21.13092	6064.57	0.24714
1237661951328977125	186.53969251	13.67307469	17.68	8.58556E-08	3412.83819	11.35373	8970.156	0.84465
1237661068190089373	186.51070463	13.745641	18.06	6.05191E-08	4064.935932	13.52311	5380.22	0.1064
1237661068190154940	186.52537511	13.81258192	19.18	2.15903E-08	6805.671602	22.64091	5973.103	0.22833
1237661068190154956	186.55530879	13.87274064	19.97	1.04356E-08	9789.085212	32.56605	6432.799	0.32286
1237664289392230566	186.54704056	14.01019962	20.29	7.77356E-09	11342.00683	37.73226	6606.934	0.35867
1237661951329304590	187.28199266	13.69975516	17.9	7.01198E-08	3776.415811	12.56327	5461.35	0.12309
1237658629695733981	188.01211438	12.3733429	17.53	9.85643E-08	3185.225389	10.59652	5102.7	0.04933
1237658629695734017	188.05797548	12.33932996	17.95	6.69664E-08	3864.307255	12.85567	5303.957	0.09072
1237661949719085113	188.20376603	12.37672564	18.73	3.26671E-08	5532.792739	18.40634	5722.687	0.17683
1237661949719216267	188.5341265	12.40345399	18.78	3.11981E-08	5661.561701	18.83472	5985.494	0.23087
1237661951329042501	186.72816267	13.56617059	16.06	3.81276E-07	1619.496387	5.38769	4855.12	-0.00158
1237661951328977047	186.6349627	13.57877164	14.88	1.12942E-06	940.9628725	3.13037	4883.149	0.00418
1237658630231883978	186.3133465	12.71462394	14.68	1.35766E-06	858.2328143	2.85514	4857.357	-0.00112
1237661949718102040	185.93529176	12.47833535	14.11	2.29405E-06	660.2343339	2.19645	4855.12	-0.00158
1237664291002450113	185.71247927	15.27510559	17.57	9.5002E-08	3244.394401	10.79336	4854.003	-0.00181
1237661070337245213	185.68573654	185.68573654	17.03	1.56155E-07	2530.589714	8.41869	6395.875	0.31527
1237661950792040705	186.38972673	13.22721358	16.72	2.07709E-07	2194.1803	7.29954	4857.357	-0.00112
1237661950792040510	186.40505295	13.14372074	16.09	3.70894E-07	1642.007322	5.46258	4850.651	-0.0025
1237661950792040719	186.46048619	13.19764282	16.28	3.11395E-07	1792.025119	5.96166	4854.003	-0.00181
1237661812812415179	186.66589203	12.51353774	16.08	3.74323E-07	1634.469123	5.4375	4858.475	-8.89E-04
1237661950792171680	186.71353029	13.18294179	19.34	1.86342E-08	7325.628431	24.37069	4862.952	3.13E-05
1237661950792171682	186.71436492	13.17302185	15.99	4.06647E-07	1568.163724	5.21692	4862.952	3.13E-05
1237662525766631444	186.72729378	15.05259471	14.37	1.80588E-06	744.1417801	2.47559	4861.833	-1.99E-04
1237661949181624903	186.84237672	12.0687089	17.98	6.51428E-08	3918.02097	13.03436	4859.594	-6.59E-04
1237658629695275533	186.84791201	12.33156985	18.08	5.94154E-08	4102.517499	13.64814	4842.839	-0.0041
1237661812275675183	186.92541762	12.08954419	16.32	3.00141E-07	1825.313926	6.0724	4865.192	4.92E-04

1237664289392558115	187.2769013	14.00491469	17.22	1.31105E-07	2761.790567	9.18785	4855.12	-0.00158
1237661813886484702	187.38341187	13.51042114	17.7	8.42898E-08	3444.390915	11.4587	4864.072	2.62E-04
1237661068190548092	187.46338805	13.86794401	15.92	4.33705E-07	1518.458136	5.05156	4852.885	-0.00204
1237658629158666270	187.47084075	11.962287	17.98	6.51428E-08	3918.02097	13.03436	4856.238	-0.00135
1237662525767024687	187.66615439	15.12968378	15.03	9.83794E-07	1008.203073	3.35406	4861.833	-1.99E-04
1237661950255759478	187.83094855	12.73798912	16.36	2.89293E-07	1859.22111	6.1852	4856.238	-0.00135
1237662526840897747	188.09511262	16.01887087	15.32	7.53353E-07	1152.127934	3.83287	4860.713	-4.29E-04
1237661950256021509	188.332409	12.85343083	14.91	1.09866E-06	954.0422185	3.17388	4854.003	-0.00181
1237662524694069565	189.50162538	14.17881935	17.6	9.2415E-08	3289.491352	10.94338	4862.952	3.13E-05
1237661974399484128	184.5600662	6.60364193	15.15	8.80933E-07	1065.438633	3.54447	4904.559	0.00859
1237654606947155983	184.84266267	6.09867794	12.59	9.29197E-06	328.0545584	1.09136	4891.026	0.0058
1237655126620045406	184.89898355	5.84675158	13.22	5.20371E-06	438.3724968	1.45836	4903.43	0.00836
1237661974399680630	184.97698705	6.64115942	18.59	3.71591E-08	5187.609073	17.25799	5644.169	0.16068
1237661971722469381	185.03117254	7.69184873	13.63	3.56818E-06	529.3908271	1.76116	4905.689	0.00882
1237655126083240130	185.10125194	5.57286483	14.36	1.82257E-06	740.7255417	2.46422	4877.531	0.00303
1237661970111922354	185.25354813	6.39525324	18.18	5.41916E-08	4295.701825	14.29082	5456.322	0.12205
1237655126620176584	185.28469625	5.90789419	17.99	6.45461E-08	3936.090948	13.09447	5232.389	0.076
1237654604410481727	185.23269225	5.83878824	18.21	5.27159E-08	4355.431907	14.48946	5330.893	0.09626
1237661971722797134	185.79510893	7.51137902	20.24	8.13962E-09	11084.03941	36.87406	4861.833	-1.99E-04
1237661970649055281	185.79404932	6.76528427	19.01	2.52466E-08	6293.593993	20.93735	6006.203	0.23513
1237661970112184751	185.77724019	6.42600859	21.2	3.36447E-09	17240.16618	57.35409	7483.418	0.53891
1237661970112185211	185.79038981	6.24603547	22.22	1.31598E-09	27566.08212	91.70605	8013.09	0.64783
1237662237468590245	190.04687567	9.89613023	15.61	5.7689E-07	1316.598622	4.38002	4894.406	0.0065
1237662526841749529	190.08197396	15.9352324	14.28	1.96182E-06	713.9542306	2.37516	4889.9	0.00557
1237661070872870923	182.65628346	16.03290574	12.4	1.10674E-05	300.5917613	1	4897.778	0.00719
1237661070872870999	182.64965722	15.993695	17.96	6.63529E-08	3882.129504	12.91496	5382.698	0.10691
1237661950790795288	183.47330837	13.172841	13.01	6.31313E-06	397.994947	1.32404	4902.301	0.00812
1237661971184812213	183.32653603	7.22471013	16.95	1.68086E-07	2439.129111	8.11442	5185.612	0.06638
1237674597852053622	182.21510797	9.13165117	15.51	6.325E-07	1257.389155	4.18305	4994.592	0.0271
1237662525765713987	184.592125	15.05426565	18.31	4.80811E-08	4560.504831	15.17176	5310.067	0.09198
1237662525765648620	184.54257276	15.06026801	18.15	5.57086E-08	4236.810331	14.0949	5173.685	0.06393
1237662525765517358	184.14071881	15.10962554	18.36	4.59188E-08	4666.644985	15.52486	5440.014	0.1187
1237662525765517399	184.13571657	15.11935005	18.29	4.89742E-08	4518.72782	15.03277	5435.006	0.11767
1237662525765451939	184.06100302	15.09142019	18.66	3.48408E-08	5357.421564	17.82292	5615.65	0.15482
1237662525765452020	184.04196555	15.12364455	17.52	9.94756E-08	3170.602518	10.54787	4873.04	0.00211
1237661069799588057	183.82665664,	15.05576573	17.68	8.58556E-08	3412.83819	11.35373	5633.782	0.15855
1237661069799522395	183.63282541	15.07729772	18.9	2.79362E-08	5982.967834	19.90396	6328.489	0.30141
1237661069799391384	183.31749804	15.05543609	20.42	6.89704E-09	12041.17023	40.05822	6565.987	0.35025
1237661069799325765	183.11999966	15.07090006	18.09	5.88711E-08	4121.438378	13.71108	5216.75	0.07279
1237661069799260259	182.97822539	15.11850857	18.72	3.29692E-08	5507.392554	18.32183	5440.014	0.1187
1237661975473291464	184.67584225	7.46526958	17.67	8.66494E-08	3397.170384	11.30161	5495.409	0.13009
1237661975473356952	184.71451566	7.48744288	20.41	6.9608E-09	11985.89111	39.87432	6525.293	0.34188

Column 1 - Object ID is the galaxy identity from SDSS-III DR9 database.

Columns 2 & 3 - Galactic position; Right Ascension (RA) & Declination (Dec.) in Degrees.

Column 4 - Galaxy magnitude 'm' by using 'g' filter value, directly lifted from SDSS DR9 database.

Column 5 - Apparent Flux of galaxy using $F = 2.51^{-m}$.

Column 6 - 'd' is the Relative distance to galaxy.

Column 7 - Normalized Relative distance to galaxies.

Column 8 - λobs is the observed wavelength of H_β line through spectrum.

Column 9 - Calculated Redshift of galaxy 'z'.

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Track 4

Technical Session: 3

Communication Skills

Articulating the Unarticulated: The Subaltern Voice In the Prominent Indian Women Writers

Amit Sharma
CT Institute of Engineering
Management and Technology,
Shahpur, Jalandhar -144020

Simerjit Kaur Nagi
CT Institute of Engineering
Management and Technology,
Shahpur, Jalandhar -144020

Vikrant Rehani
CT Institute of Engineering
Management and Technology,
Shahpur, Jalandhar -144020

Abstract-Indian women novelists have emerged as a class apart. They have carved for themselves a niche in the literary horizon. They have clearly observed the Indian scenario very well and they are aware of the fact that in India the condition of woman is deplorable. Though the condition of the women in the society is transforming very rapidly yet the fact remains that their situation is still not enviable. Indian women novelists have articulated the long silence of the women and they have emphatically given vent to the women's problems. Being women themselves they have the edge to experience the tumultuous life of women. There is a surge of Indian women novelists after 1970's writing about the essential female voice. Their depiction of the women is so realistic that they have bagged appreciation worldwide.

Keywords: Feminism, Subjugation of Women, Passive spectators.

I. INTRODUCTION

Feminism can be defined as anti patriarchal movement. Feminism, as M.H.Abrams points out, holds the view that our society is:

male centred and controlled, and is organized and conducted in such a way as to subordinate women to men in all cultural domains; familial, religious, political, economic, social, legal, and artistic."[1]

Feminism questions the age long superiority of man and holds man responsible for the abject and lamentable plight in which a woman finds her own self. This movement was kicked off to provide equal opportunities to woman in all fields of life. Many feminist writers have created awareness among womenfolk to contend for their own rights, to fend off the male oppression and helped women to inculcate a sense of self respect so that women can really come to know about their potential so that they may wake up from the stupor that have so long hazed their vision about themselves.

Many of the Indian woman novelists and poets have articulated the miserable condition of women in

Indian society. They have notched up great accomplishments worldwide. A special mention can be made of Anita Desai, Kiran Desai, Jhumpa Lahiri,

Arundhati Roy, Kamala Markandaya, Kamala Das, Gita Hariharan, Shobha De, Mahashweta Devi, Imtiaz Dharker and Shashi Deshpande. All these writers have been successful in attaining recognition for themselves. They have stimulated a kind of writing which bespeaks on the behalf of the silenced and marginalised women. The subaltern voice is too loud in their writings. This present paper deals with the three of them i.e., Kamala Das, Mahashweta Devi and Imtiaz Dharker and evaluates their creative works as an expression of the subaltern voice.

Kamala Das is a bi-lingual poetess writing both in Marathi and English. Kamala Das is a rebel. She rebels against the so called social norms which assign the role of a keep to women. The main thrust of her revolt is male attitude of love making. Das herself had faced the same lust of her husband which had shaken her mental equilibrium and this shock is a recurring theme in her poetry. She hankers after true love which is only a utopia for her as what she gets is only lust not love. So love remains a distant dream for her women persona.

In the poem "The Invitation", the woman suffers headache anticipating the agony of lustful night with her husband on Sunday. She finds another man to find emotional fulfilment but is dismayed to find that love is a fleeting word as she finds herself trapped into another's lust. "The Sunshine Cat" emphatically points out male's inability to love truly as:

I do not love, I cannot love, It is not

In my nature to love.[2]

"The Freaks" by Das is a negative poem in which love turns to lust. The woman in the poem complains bitterly against the attitude of her man because there is no love between them and what keeps them together for a moment is the lust of the blood. When love becomes mere lust, the woman expresses her disgust because what she needs is tenderness both lovable and lasting resulting in their consummation of love. In desperation she concludes:

I am a freak. It's only

To save my face, I flaunt, at

Times, a grand, flamboyant lust.[3]

In her poem "Looking Glass" the poetess projects the theme of male lust very emphatically as woman can easily tempt a man for sexual unison. She needs to be frank about her own hunger and have to gift the man all the pleasures of her body:

Gift him what makes you woman, the

scent of Long hair,

the musk of sweat between the breasts,

The warm shock of menstrual blood, and

all your Endless female hungers.[4]

But a woman cannot crave for true spiritual fulfilment as once man is satisfied, he will turn to another woman for the gratification of his physical hunger thus the woman is left to her own plight as Das says:

Oh yes, getting

A man to love is easy, but living

Without him afterwards may have to be

Faced.[5]

Mahashweta Devi- The recipient of Padamshree (1986), Mahasweta Devi is one of the most noted Indian writers. She is awarded Sahitya Academy (1979), Joan pith (1996) and Ramon Magasaysay (1996) awards for her outstanding contribution to literature. Her depiction of women and their problems brings Devi as a staunch feminist despite the fact that she herself refuses to have adhered to any branch of feminist ideology. She believes that women suffer because, "their condition of work or education suffer from gender or class discrimination."[6] Her works:-

"Represent a profound concern for human predicament and sincere hope for the better future of mankind."[7]

Many of Mahasweta Devi's stories are about tribal women who are the victims of social injustice which is being meted out to them in West Bengal. In one of her stories, she disdains the idea of comparing these girls to the Devdasis or temple dancers of South India. Mahasweta Devi observes that In the heart of West Bengal, a Left Front-ruled state for 30 years, this cruel practice of purchasing a young girl, making her sing and dance to please her male clients, taking all her money treating her like a pariah goes on and on. She said their buyers make them dance at public functions to augment their income but do not provide basic amenities to their children born out of wedlock, ostracize them and dump their bodies as garbage, depriving them even a dignified funeral health, education, equality and dignity in life and death.

In her short story Draupadi, she brings out the oppressions on the women very overtly. In the story, tribal women are the focus of attention. Draupadi or Dopdi, the female protagonist is what the government is mad after arresting as she is suspected to have terrorist links. She is a rebel, whom the government tries to kill so that they may dominate these tribal groups. Dopdi is arrested ultimately and what comes as the most shocking is the treatment that the police force metes out to her. She is brutally raped for many days by the lust stricken men who are representative of government to establish peace. But Dopdi even after she is set free is not panicked but rather throws a gauntlet to her oppressors by her resolution to meet her enemies stark naked. The name of the story is a deliberate attempt to link it with the story of Draupadi as the mythological Draupadi too was mishandled and her robes were torn apart in public.

'Breast Giver', another of her story is about a female character Jashoda. Compelled by the social system and her own crisis she has to become a surrogate mother. She keeps feeding numerous of the new born babies of a rich family as she is paid in return. She is always pregnant so that the flow of her milk will not cease as through breast feeding only she is able to sustain her living. Jashoda falls a prey to deadly cancer with her breasts carrying big wounds and she dies without any of her breast fed son to light her funeral pyre.

With the example of her story 'Giribala', she is asking all women to break loose the chains of patriarchal dominance and be free. They must come out of their claustrophobic ambience and move towards more humane realm i.e. physical, intellectual and spiritual liberation. It tells what human beings are capable of doing when the limit of endurance is reached. Certainly a simple story such as Giribala can help hundreds or thousands of women of any country to claim agency, to gain control over themselves and their lives. The story talks overtly about the need of education for the betterment of women. It is about education and consciousness-raising, the process of breaking free of the imposition of men's ideology on women and about engaging in acts of glorious self-determination.

Imtiaz Dharker- (b. 1954) is a poet, artist and documentary film maker. She is a "Scottish Muslim Calvinist" as she describes herself. Born in Pakistan but later brought up in Glasgow, Scotland, she moved to India after her marriage. It is this varied cultural experience that shapes her poetry and drawings. She has published five books of poetry, Purdah And Other Poems (1989), Post Cards From God (1997), I Speak For The Devil (2001), The Terrorist At My Table (2009), and Leaving Fingerprints (2009) in which she mainly deals with themes like home, freedom, journeys, communal conflict and gender politics.

Her poetry deals with her concern for humanistic and

feministic values. Her poetry does not limit itself to the problems of women's liberty rather is a commentary on the social, religious and ethical freedom allotted to woman folk in India. Dharker's poetry is a slap on the Islamic cultural practices that keep women subjugated. She reflects on the condition of women in contemporary world.

Dharker's main focus is on the system of the practice of veil; 'Purdah' system that engulfs the woman's life in the Muslim culture and is a part and parcel of her life. It is not according to her a kind of covering of the face only but the writer vociferously finds hidden implications in this prevailing system. It is a system that denotes the curbing of all freedom, limiting their right to self growth and development. Purdah is a death; death not of the body but of the more graver sort; death of intellectual faculty just as the earth covers the dead person-keeping them unaware of the experiences of the world:

The cloth fans out against the skin

Much like the earth that falls

On coffins after they put the dead men in.[8]

Though Dharker has rejected the idea of wearing a veil yet in the Islamic countries there are women folk who have come forward in their protest against veil as they are bent upon accepting veil as it is a strong symbol of their commitment to their religious faith. Countries like India and Pakistan show adherence to the cultural norms but there are some enlightened women like Dharker who believe that women are not the other who need protection from the male stares' rather they are human beings who are at par with the men in every sphere of life and as such they do not need to camouflage themselves behind anything.

The conservative Muslim society is appalled when they encounter the awakened women who are out and out rebels against the traditional codes and defy complying with them. They are punished severely and society is too harsh with them in treating them. "Purdah-II" poems by the poetess, is a comprehensive evaluation and appraisal of the anger that women have to face as they challenge against the traditional codes. Patke believes:

"Purdah-I" offers deeply felt evocations of the experience of growing up as a woman in an Islamic society while as "Purdah-II" elaborates on how the symbolic veil divides and suppresses."[9]

II. CONCLUSION

These writers are very much acclaimed and they have been ruthlessly crude and realistic when the issue of divulging deep into the psyche of the female protagonists meets their eye. They have voiced the unvoiced and the marginalised. No doubt in our country the idea and conception of women is in transition and women are not merely content with the chores traditionally assigned to them in the society. Women are aware of the times and know well that they have to be on the track of seeking fulfilment and success.

Consequently as times change they even come into conflict with their families who hamper in their way of seeking utter freedom. The writers discussed above have worked painstakingly in highlighting the subaltern voice of women who are always on the periphery be it the social sphere, religious, moral, political or economic. Nowhere has the woman been showered complete independence. Not only political sphere but also the cultural, social and religious spheres she has been subjugated; not being able to raise her own feminine voice. She is a dependent as far as her lot is concerned.

The women writers of India discussed above are very candid when they dwell on the theme of enumerating the trials and tribulations and the grilling situation women are faced with. They have no independence of their own. These women writers are of the opinion that women need to shirk this dependence syndrome and it is the time to strike; strike below the belt of the customs, traditions and social practices that thwart their growth and progress.

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State of Affair in Management Education: A Rational Shift to Soft Skills Training

Shivani Thakur
Lovely Professional University
Jalandhar (Pb)

Mamta
HMV College
Jalandhar (Pb)

Pankaj Vij
CT Group of Institutions
Jalandhar

Abstract - Unprecedented wave of change has stroked the business world. Companies these days are enduring pressures from different stakeholders due to the paradigm shift in business world. This changing environment has created a threat to all business organizations. To face this change, managers have to look for best possible ways of striking the implications brought. Today corporate do not require manager who are well in qualification only but managers who are well in using that qualification. The survival in today's business world depends on competitive sustainability. The one specific quality of a corporate house which makes them different and better than the rest is a certificate for survival. Key words for success in future business are variety, flexibility and customization. Knowledge alone can not serve the purpose of business but an individual need to possess combination of knowledge, skill, attitude and a desired value system for carrying out assigned tasks and responsibilities. A complete personality needs to have a perfect blend of soft skills and hard skills as well. Most of the recruiters admit that graduates today have abundance knowledge of hard skills but they lack soft skills like interpersonal skill, social skill and Leadership which are necessary to manage people. Employers perceive "employability skills" more important than the technical skills even. In this research paper my focus of study is to see :

1) **Paradigm shift in management education**

2) **reason of this paradigm shift.**

3) **Role of soft skills in new management education paradigm**

I. INTRODUCTION

21st century has brought drastic changes in business world. The days of mass production and standardize product are gone now.Globlisation of the businesses needs changes in employees and this change calls for a paradigm shift in the management education

The corporations today want to give a clear message to the business school regarding their role to play in this context, means to put all necessary efforts to come with proper set management skills to face the challenges. The leading business schools have got proven records of maintaining standards in terms of vision, program design and offerings which makes

their students different and remarkable among business world. It implies that the business school has to change their style of teaching with the needs of changing situations to produce future managers with all the required skills.

Paradigm means a strongly accepted and shared framework of basic assumptions, theories and models that are within a particular field of activity, at particular point time.

First objective of this paper is to find the main assumptions of what is commonly referred to as the traditional management paradigm and identifies the main drivers of modern alternative management paradigm. And then attempts to evaluate today's management education standard to develop management skill in the paradigm shift of managing business. This research evaluates the changing scenario of managing business organizations, and then explains the reshaping of management education with the emerging needs of the business management, and the roles played by leading business school have been analyzed in the context of changing situation. This research aims at examining the changing need of management education to produce future leaders of the corporate world. The research questions that whether the roles played by leading business schools can be considered as the one according to the expectations of corporate management generally and that whether the products of leading business school have got all the required management skills to meet the contemporary challenge of business management.

The paradigm shift of management

This rapidly changing business environment needs capable managers who are crucial for organizations' success in gaining and sustaining competitive advantage. This sustainability can be achieved through intensified competition, incessant change, a power shift to the customer, collaborations across organizational and geographical boundaries, and a need to maintain high levels of talent. Business colleges across the nation recognize the need to change in response to external pressure from key stakeholders of business word. An important dimension of such change is the

redesigning of business curricula according to the need of changing business environment. Achieving greater integration between curriculum and extra curriculum is often a central focus of such efforts. In response to the challenges posted by increased competition, the globalization of business and rapid change in information technology Business organizations continue to transform them. Because of the accelerating rate of change, the workforce in terms of human resources and social resources should be seen as one of the major factors in

developing and maintaining competitive sustainable advantage along with traditional factors such as technology and protected market. An appropriate development of the workforce and appropriate management are closely related factors. Related to this perspective and from a knowledge based view of the firm, Leonard-Barton (1995) saw core capability as comprising managerial activities and systems or what she describes as "the whole system of knowledge management" bound up with a particular competitive advantage. intense and global competition, rapid technological change, new complex organizational forms, organizational alliances, and international capital markets are creating an increased demand for change in leadership but such leadership is increasingly difficult to find because of lose training of future managers.

Quinn and Snyder (1999) suggests that before expecting others to change, a leader should understand strategies necessary to be a successful leader in this competitive environment , which are as confrontation, facilitation, persuasive discourse, and the management of meaning to ensure that their actions are consistent with their vision of the future. The need of the time suggest that individual employees, who can work with the technological revolution and globalization of business and can continually acquire new knowledge and remain flexible become leaders and ideal for contemporary world. Therefore it becomes duty of business schools, which are responsible to educate future leaders of business organizations, need to understand the challenges faced by the organizations. This is how these management institutes can try to bring necessary changes in their curriculum according to the needs of the changing situation of the business environment. Now the question arises that Which are the challenges, important to consider? The following section of the paper describes the nature of the organizational challenges today. It can be termed as 'paradigm shift' required to manage today's businesses. The management of business organizations has changed in significant ways since early 1990s (Drucker 1995; Naisbitt 1997; Ohame 1995; Rohwer 1996). The sources of these changes include the following (Hallinger and Snidvongs 2008).

· Competition has raised its standard in all sectors providing goods and services due to growth and integration of a global and increasingly free market economy
· Grater aces to global information and exchange of cross broader business due to greater openness of political systems among nation and states
· Developments in information technologies have fundamentally changed the way in which business is conducted, allowing for less expensive communication, easier sharing of information, and greater efficiencies in production and management of goods and services. Reviewing the literature it is evident that today's business management faces tremendous pressures from globalize economy. Against this backdrop of the study the driven forces of globalization can be synthesized to understand the nature of implications.
Globalization is being driven by the spread of economic logics centered on freeing, opening, deregulating, and privatizing economies to make them more attractive to investment, and, by the digitization of technologies that is revolutionizing communication. So, opening market increases scope of investment to anywhere in today's world, and movement of technology, money and people in some place increase to avail of the opportunity of deregulation. At the same time it poses challenges to existing players of economy and to new entrants as well.

Globalization is speeding up industry life cycles by accelerating the pace and the rhythm at which firms must develop new technologies and produce and new products and services on a global scale to stay in competition. So, the new management challenge are with managing team of Management Education for Contemporary Challenges: The Role of Business School 652 experts from different culture as dispersed worldwide using digitally adopted organizational structure. To use the words of Bettis and Hiltt(1995), new competitive landscapes are emerging, marked by increased levels of uncertainty and ambiguity, leading to what is now known as hyper competition . Management educators may be interested in accompanying these challenges to help managers in shaping organizations in such a way as make them willing and able to respond to complex organizational challenges. It will be advantageous to expose business students and managers to complication . The other challenges of managing businesses are created from the need to speedy decision making in resources deployed, managing diversity, searching right direction of knowledge management for the people, timeliness of the process and innovative approaches, synchronization need of process and activities, industry life cycle effects on the firms operations, and the social responsibility of present generation for future generations. More specifically, global change forces have brought fundamental changes

to the way in which business organizations were managed. For example, we find the following management trends (Hallinger and Snidvongs 2008):

· Organizations are more restructured in response to more open competition (Ohame 1996).
· There is an increased emphasis on entrepreneurship and entrepreneurial management as engines of global economic growth (Drucker 1995).
· The recognition that ethical crises and environmental problems located in a single nation or organization are magnified in a global society has led to a greater emphasis on moral
leadership and corporate social responsibility among business leaders (Csikszentmihalyi
2004).
· The ability to manage and use information for decision making is now a core competency required of managers throughout business organizations (Drucker 1995).
· There is increased emphasis on linking corporate goals with human resource practices,
especially through the use of performance management and measurement (Norton an
Kaplan 1996).
· Knowledge is viewed as a key currency of organizations that requires conscious, proactive management (Buckman 2004; Stewart 1997, 2001).
· Capacities for innovation and change are viewed as competencies that distinguish organizations that thrive vs. others that flounder in a rapidly changing, turbulent environment (Drucker 1995; Kotter 2002; Rohwer 1996).
       These changes require a cadre of business leaders who possess a broader set of both leadership and management capacities. Now attention from both academics and practicing managers has focused on the formulation and implementation of strategic initiatives within the realm of human resource management.

Organizational survival, development and prosperity reflect the extent to which an organization is able to obtain, allocate and control its resources to take advantage of changes in its environment perceived as opportunities. And how an organization avoids or overcomes the threat posed by changes perceived as constraints. Managerial competency is vital in such responsibility of the organizations. More dynamic is the environment; more strategically important management development is to the organization. There is a growing awareness that survival and future success reflect to a considerable extent the ability of an organization to develop its management resource in appropriate and anticipated ways according to future challenges. In response, educational institutions have made significant adaptations in the curriculum designed for business leaders. The next section of the research describes the dynamics of business school to get

a picture of redesigning or reshaping of management education addressing the contemporary challenges of managing business organization.

II .REASON FOR PARADIGM SHIFT REQUIRED IN MANAGEMENT EDUCATION

       Business schools have come under question in recent years for the poor job they do of providing relevant training and skills for their students due to which either students do not get jobs or get poor jobs. There is growing corporate demand for pedagogical techniques which focuses on their immediate problems rather than on lofty theories or even case studies. Business speakers at a recent international Association for Management Education (AACSB) symposium on continuous learning continued to make this plea as they challenged business schools to "be more proactive and partner with business leaders in their communities…and to make their curricula more relevant" (AACSB 1999).

       Teaching about uncertainty and increasing environmental turbulence is not new but these concepts have been discussed since the late 1960s. Most teaching model and materials are geared toward enhancing the ability of large organizations to adapt to change and challanges. Those that are more person-centered treat change as necessary evil and present topics such as resistance or coping with change (McDonald and Mansour 2000). Teachers and learners are facing utmost uncertainty, paradox, pervasive rapid change, and dramatic challenges to the status quo and traditional mindset. In response, the individual's ability to adapt to change and embrace ambiguity should be central in the curriculum.

       Even the actors in business schools mostly tried to accommodate the change issue into their curriculum, there were resistances everywhere. But there had been pressure from different stakeholders to bring necessary changes into the programs of management education. Change is driven by many other factors also as, including the increasing importance of international rankings, public pressure on teaching performance and the more focused agendas of governmental funding agencies. Primarily as a result of the changes in the way business organizations function, colleges of business are subject to pressures form a number of stakeholder groups, including employers, advisory boards, accrediting bodies, alumni, legislators, and students to do the necessary changes. As institutions of higher education are perceived to exist for the public good, they are increasingly held accountable for the quality of product produced. The previous section of literature suggested that the business curriculum has to be changed remarkably to address the issues raised as challenges before the organizational management. The business organizations have been increasingly trying to

cope with the changing demands of the environment, looking for managerial expertise with required skills. So, an emphasis on skill development has transformed the curriculum debate. The discussion has moved away from determining the appropriate balance of content, which is a discussion rooted in traditional functional areas, to a determination of effective methods for developing softer skills, self directed learning, an a holistic understanding of the internal and external environment of organizations(Hamilton, Diane et.al.2000). Traditional functional curricular approaches often do not address to these issues. Hence business curricula are gradually shifting from functionally fragmented to convergent and coherent, with a focus on developing specific competencies require for contemporary business. The redesigned curricula must cut across traditional boundaries to develop and reinforce the appropriate bundles of technical knowledge as well as social, Leadership and organizational skills. In the 1950s, business schools in the United States were criticized for being overly narrow and vocational in their orientation (Gordon and Howell 1959; Pierson 1959). To remedy this, they were encouraged to, hire faculty from a variety of disciplines relevant to organizations and management so as to enhance their scholarly legitimacy. Now, however, the faculty who were hired to achieve academic respectability for business schools are being criticized by the corporate community for their lack of experience in business firms, for the perceived irrelevance of their research, and for their unwillingness to provide the kinds of training in practical professional skills the corporate world feels in need today. to remove these loopholes in management education there rises a rigorous need for a paradigm shift in management education.

III. PARADIGM SHIFT REQUIRED IN MBA PROGRAMME

Corporate leaders have been demanding to the business school to redesign the programs while they need management skills to face the challenges. This reshaping of management education goes to the context. So, a critical review of management education has been given first. Then the evolution of management education has been described to know the changes happened with the contemporary challenges. Finally, the restructured MBA program has been examined to evaluate the roles of business school.

Most MBA students fail to understand the interrelationships among the knowledge, skills and abilities they are acquiring in this discipline. MBA students merely perceive the difference between numbers and people. Thus recruiting companies complain that MBA graduates fare linear thinkers who lack flexibility. Business schools need to reposition an restructure themselves to leverage the present wave of change in

business. The first step in redesigning MBA programs is to establish a vision or purpose according to the changing business scenario. Such a vision must be worthy of the faculty's commitment. For example, a vision that would get faculty commitment is as follows "An internationally recognized business school that prepares high potential individuals to manage, build, and lead value creating, globally competitive organizations primarily by providing integrated management education" in which there is an integration of soft an hard skills. So, the vision of MBA program should be to create talented future leaders and successful entities. Next step in the redesign MBA process is to develop a structure for the business school that will enable it to function effectively while focusing on current and emerging market demands. From this perspective functionalism in an MBA program appears to be dysfunctional. Whether growing leaders are for profit or nonprofit organizations, the organizational challenges are similar for both. Three points to be taken care are : One must understand the environmental influences that affect the organization and the dynamic nature of those influences. An organization needs to develop strategies for competing effectively within the organization. Managers must know the key financial drives of an organization, because it is difficult to implement a strategy unless the firm has the financial strength to do so. Finally, and Most important is that the organizations must have the leadership capabilities to put a team in place that can implement the strategy indifferent environments in ways that allow the organization to prosper. Teaching students the leadership, strategic, and financial skills necessary to successfully compete globally must be fully integrated. To MBA graduates of the 21st century master one aspect of this challenge and not the others which condemns their career marked by frustration, ineffectiveness, and inefficiency. If business schools have to survive and prosper in the future, they will need to be structured around five core integrated subject areas: (a) leadership skills that capitalize on knowledge of (b) strategy, (c) finance and (d) information technology (IT) within the context of and influenced by a (e) global economy. To understand the financial drives of a business, one must have a command of basic accounting principles (Brealey and Myres 1996); to craft a business strategy, one must understand market dynamics (Porter 1998); to meet market imperatives for high quality as low cost with minimal delay, IT competencies is crucial (Mitchell and Zmud 1999); to exercise leadership, one must be aware of global and cultural influences (Yukl 1998). It follows from this reasoning that the core competencies

The Role of Business School should be fivefold, namely, the (1) leadership capability to build a team that will implement (2) competitive strategies that will enable an organization to be (3) financially healthy in a (4)

global market place, through effective use of (5) information technology

McDonald and Mansour (2000) emphasized on the academics' role to ensure that

Organizational change and transformation is at the core of the MBA programmer's curriculum. To ensure that the new MBA program has got the competencies described above, the curriculum goals and objectives should include functional knowledge, problem solving, global perspective, leadership, ethical judgment and decision making, adaptability, communication, managing information technology and finally management competency. Only the blend of hard skill and soft skill can produce future leaders require to face future changes.

IV. CONCLUSION

The conclusion says that business organizations have been giving pressures to universities to fix their professional mode. It becomes crucial for their successful survival in creating knowledgeable people to face the challenges of the contemporary environment. The management education has to be reshaped into the needs of the industries today. But in today's situation survival of business school is questionable due to lack of professionalism in its management. The issues from the literature review of the study can be considered as proper set of guidelines for business school. In the changing scenario of managing, each business has to depend on such a business school to fulfill the required management skill. Business schools need to produce future leaders who have sufficient of hard skills i.e. technical knowledge and enough of soft skills to meet the contemporary changes and challenges.

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Need of Professional Communication Within Workplace

Shalika Sharma
Department of Management and Technology
CT Group of Institutions
Jalandhar, India
Email: shalika06@gmail.com

Jatinder Kaur Ubhi
Department of Applied Sciences,
CT Group of Institutions
Jalandhar, India
Email: jkaur.ubhi@gmail.com

Abstract—**Mankind has always throughout its history had the necessity for communication. It starts from one's birth and continues throughout his life .Communication is just the right means of success and advancement in a workplace. Communication is one of the means to connect to different people at far distances. Also it has been observed that a lack in good communication skills especially within a workplace can result in conflicts and chaos hence hindering the productivity of an organization. Thus there is a dire need for developing good and effective communication skills which will result in increase in productivity and will enhance its efficiency.**

Keywords—**communication,professional communication , workplace communication, effective communication need of good communications skills.**

"WORDS ARE THE MOST POWERFUL DRUG THAT THE MAN CAN EVER INVENT"

I. INTRODUCTION

Communication is the glue that holds a society together. Most humans communicate from the moment of birth. The ability to communicate enables people to form and maintain personal relationships. Communication is essential to establishing relationships with family, friends and community members.. And the quality of such relationships depends on the caliber of communication between the parties .Communication is simply the act of transferring information from one place to another, whether this be vocally, written, visually, or non-verbally .How well this information can be transmitted and received is a measure of how good our communication skills are. Communication is essential to the process of obtaining and keeping employment; and is the mainstay of politics and developing skills in handling people. Developing your communication skills can help all aspects of your life, from your professional life to social associations and everything that is in between. The ability to be able to communicate ideas and opinions accurately, clearly and as intended, is a vital life skill and something that should not be ignored. It's never too late to work on your communication skills and by doing so improve your quality of life .Observers are able to judge the speaker's characteristics and evaluate his capabilities through communication.

A. Professional Communication

Professional communication encompasses written, oral, visual and digital communication within a workplace context. This blends together educational principles of grandiloquence, technology, sociology and linguistics, psychology and designs to improve communication in a variety of settings. It is a new discipline that focuses on the study of information the modes and means by which it is created, handled, distributed, and consumed. Since communication in modern society is a rapidly changing area, the progress of technologies seems to often outstrip the number of available expert practitioners. This results in a demand for skilled communicators which will continue to surpass the supply of trained professionals.

The section of professional communication is closely related to that of technical and practical communication, though professional communication covers a wider variety of skills. Professional communicators use various tactics, theories, and latest technologies to effectively communicate in the business world.

Successful communication skills are precarious to a business. All businesses involve the following techniques writing, reading, editing, speaking, listening, computer applications & graphics, and Internet research. Aspirated candidates seeking job with professional communication backgrounds are more likely to bring to the organization erudite vistas on society, culture, science, and technology.

"The single biggest problem in communication is the illusion that it has taken place." - George Bernard Shaw

The importance of communication in the workplace is preordained, as in an organization people belonging to different social and professional backgrounds come together to work for the same goals. An organization where there is no sharing of information, ideas and opinions between two or more individuals, various workplace issues such as wastage of organizational resources, employee switchovers etc. often arise. To avoid these, effective communication at work should be encouraged for the overall success of the organization. One of the key foundations of any successful workplace is being able to communicate effectively. It helps people to receive and share information better, demarcate and understand goals, and even avoid the negative effects of conflicts and chaos. Studies

also show that good communication can build rapport, enhance inter-personal relationships, endorse self-confidence and have a positive overall impact on the working environment. Effective professional communication fosters services and products in organizations.

B. Importance Of Professional Communication

The prominence of effective communication in the workplace, has never been as ardent and intense as it is in today's fast growing, divergent and multicultural workplace. An effective communication skill acts as the backbone of an organization that keeps it alive, functioning and ultimately progressing.

In today's professional life, people send and receive a number of messages, information and other data than even before. In organizations, people are under constant pressure to understand and implement new processes and to achieve higher standards and expectations. There the effective communication is essential to build a unified team for healthy relationship that can boost the overall performance.

Effective communication is a core responsibility for high performance managers. It is a prominent management skill that supports everything an effective manager wishes to do. Leadership, productivity, Team work, planning and organizing all rely on effective communication. In fact communication is the epicenter of these management responsibilities .You need to improve your own interpersonal skills for better communication within your own team environment and also to manage a diverse team.

The most important thing in Communication is how you convey the actual message that you want to. So communicating in the workplace a great challenge and can be a very difficult task at various times. It needs a strong sense of self and personal confidence to allow yourself to become competent and adjustable with your colleagues that you interact with. Effective Communication is thus essential to build good relationships, to avoid misunderstanding and to navigate the deadlines .Communication also includes an element of coherence. If you do not possess coherence or unity, you will be seen as individual that lacks plausibility. You cannot communicate effectively when you are not viewed as a credible and trustworthy person.

In this challenging world, communication plays the vital role to make people aware of certain things and help them to prepare themselves for changes in their working environment. . The clearer the communication about the changes that will occur and what are the expected behaviors from the employees, the more amenable and open minded employees will be to the change.

The workplace is a very diverse group of individuals, where employees from every background are a valued part of the organization. They are engaged in different projects; decision making, problem solving and resolution processes that take place. Lack of effective communication with employees can cause chaos and create such a difficult working environment where significant breakdown of communication will occur. This type of environment in communication will decrease productivity and can be destructive to an organization.

Another major challenge with communication in the workplace is the ability to share information with various departments in an organization. If the message is not concise and clear to all individuals and they get wrong information due to over or under communication, it will change the message the organization tries to convey. The core message needs to be the same with all individuals or major conflicts could occur.

The successful organizations create atmospheres where employees feel valued. Encouraging an open communication environment is necessary so that every employee has the opportunity to share ideas and be heard. The organizations clearly communicate that they appreciate the suggestions and plans given by the employees.

Good communication is essential in the working environment and in all aspects. No organization can exist without communication. The good quality of the communication is mandatory for the smooth and successful environment. And effective communication adds that little extra to the organization that makes the ordinary extraordinary.

C. Four Types Of Communication In The Workplace To Increase Efficiency And Productivity

There are four types of communication:

- Visual Communication
- Written Communication
- Verbal Communication
- Non-Verbal Communication

D. The Role Of Communication In An Organization

- Creates Job Satisfaction

  The organizations which encourage an open and easy correspondence between seniors and subordinates, face lesser employee switchover. If the work environment is friendly where the members are encouraged to communicate their ideas to their managers regarding various work-related problems, and their feedback is given due attention, it motivates the employees to work better and makes them feel valued in the organization. Hence, effective communication in the workplace helps in building loyalty and trust which consequently attributes to greater job satisfaction.

- Lesser Conflicts

  Open communication in the workplace can help prevent and resolve many conflicts. For instance, if two employees have a difference of opinion over some issues, and instead of solving it and coming at a result, they end up taking the whole thing personally. If the conflict persists for a very long period, it may lead to work-related issues wherein they might even refuse to

talk or work together in the future. Such issues can be stopped at an early stage if the managers act as a mediator and let the two belligerent employees put across their thoughts and opinions to each other through open and clear communication. When a conflict is solved through conjoint discussions, the employees build reverence for each other, and this can lead to one's personal and professional growth.

- Increases Productivity

Effective communication at work is the most important issue for the success and failure of an organization. Every organization possesses set of clearly well-defined goals, objectives and apparition. The manager should be able to clearly explain to his employees these goals and ensure that all his team members are working towards the same objective. He also needs to put out to his employees their job assignments and duties, ways and decorum of doing work also the expected results from them. If the manager is clear in his communication, the underlings will know unerringly what the organization wants and therefore, will be able to put their best foot forward. Thus, the significance of communication skills can be arbitrated from the fact that it leads to better deliverance of work, increasing workplace productivity and efficiency.

- Better Work Future

As we all know that communication is a reciprocal process, and being communicative leads to a better work future. All employees in an organization should communicate accurately, frankly and honestly. Managers should create a convivial working relationship with their employees, so that the employees don't vacillate to accost them for resolving any work-related problems that may arise in the organization. Therefore, by developing a good solidarity with underlings and co-workers, one not only builds up their morale but also increase their work efficacy, leading to improved productivity. In addition, employees too, should be given a chance to provide feedback to the management. This will help the management accommodate their policies and programs to suit the needs of their employees. Thus, establishing a good working relationship between employees and employers can go a long way in securing a better work future for the organization.

- Formation of Relationships

Open correspondence, whether between the employees and employers or between the management and employees, results in the formation of improved inter-personal and professional relationships. This makes the employees feel more cared and valued for their genuine worth, and thus, they will remain more loyal to the company. Consequently, a friendly environment is created which promotes a better working relationship which is advantageous to the employees.

- Proper Utilization of Resources

If an organization faces problems, undergoes some critical situations and encounters conflicts due to miscommunication between the employees, it causes uncalled-for delays in the routine work. This further leads to wastage of resources and slashes the overall work efficiency. So an environment of good communication is a must for any organization to better utilize its resources and increase productivity and competency.

The importance of communication within the workplace can be summed up in two words, **"work satisfaction"**. If the employees are satisfied working in an organization, the future of that organization is absolutely secure. All organizations today should craft an environment wherein different plans, issues, problems, opinions, thoughts and ideas related to ingenious manners may be enhanced through positive and effective communication.

E. Professional Communication Skills And Tips – Improve Your Life Now

Nowadays, communication skills are a great contributing factors of our success. According to an influential survey, about 85percent of our success in life is directly a trait to our communication and relationship building skills. No matter whatsoever is your ambition and your capability, you hardly achieve success in career as well as life without good communication skills which are needed to really get along to people. Furthermore, effective communication also helps us in understanding people or situations around us with a better perspective and allows sorting out differences, establishing trust and respect, and creating environments where creative ideas, problem solving, geniality, and benevolent traits can burgeon. There are many common ways to improve communication skills, however, not everything is suitable for most of you. Here are some of them:

1. Make A Good First Impression

The first impression plays a significant role in communication. This is one of the most primary one in many tips on professional communication skills. A poor first impression could be made in a few seconds, but could have a greater impact on how the other person views you afterwards. Try to bear a smile and have eye contact with people, while appearing pliable.

2. Do Not Monopolize

Many people, especially who are outspoken can cartelize a conversation, particularly with people who are reclusive by nature. So, if you are a person like that take your time, give a minute of silence, let the other person collect his or her own thoughts and get a word in edgewise. There are many people who usually take the lions share in the conversation because of

their talkative nature. With them, the first thing they need to do is to lessen the number of words coming from their mouths.

3. Be A Good Listener

"God has given us one mouth to speak to but two ears to listen to…" Thus, the importance of listening can't be unheeded. One cannot become a good communicator unless he is a good listener. By making the right judgment you will know what to say and what not to say. This strength of mind will ensure that you do not fall into any emotional persuasions.. However, people often think that they are listening, but actually they are thinking what to say if the speaker stops. If you pay heed to them, listen to them carefully, then you'll understand them better and they will also show concern while are a speaker.

Thus,, in order to be an effective listener, you need to do the following:

- Avoid interrupting
- Give attention to the speaker
- Do not be judgmental
- Show your concern
- Stay calm and focused

4. Try To See Their Point Of View And Empathize

In a conversation, the majority of people want others to be heard and understood. They usually tend to boost a lot about themselves, their thoughts, etc. They seem to get the other person see things with their own viewpoint. Sardonically, if they do this all the time, there is very less chance of concentrating on the other person's point of view, and as such, nobody feels understood. So, try to listen to the other side with your true ear, and then you can better explain yours.

Also, you need to show compassion and see things from the point-of-view of others. When in a conversation, try not to be hypercritical or partial by predetermined ideas or beliefs – instead response from the other person's perspective and their view situations. Just stay in touch with your own feelings to help you understand the emotions and feelings of others.

5. Use Non Verbal Communication

When communicating, people use both verbal and non-verbal modes of communication. Wordless communication is considered as the effective way to show your emotions and feelings which consists facial expressions, eye contact, body movement and gestures, tone and pitch of the voice, muscle tension and breathing. Therefore, the ability to understand is enhanced and it assists you to come in connect with others, helps you to express yourself, and build better rapport with colleagues, friends, and people around. One can develop the non-verbal communication by:

- Practicing observing others
- Being aware of the individual differences across different cultures and countries.

- Accumulating non-verbal communication signs as a group
- Match non-verbal message with verbal-messages
- Making use of kinesis such as facial expressions, arms uncrossed, nodding, gestures etc to convey positive emotions

6.First weigh then speak

Once you have a clear idea of the information that you are talking, it will empower you to present your ideas, opinions in a well-organized and trustworthy message.

7. Be Honest And Open

Honesty is the most crucial factor while communicating with others. To effectively communicate with people around, you need to show them your real worth. People can easily identify a bogus from a mile away. Therefore, be "you" and people will listen to you. It can help you in getting along with others and at the same time will support you in getting the reverence and respect of the receiver. Be honest and you will never have to face repentance for anything you have said.

Furthermore, you need to be open and frank in communicating.

8. Be Conscious Of What You Are Communicating

Do not make the mistake of talking just to say something. There should be meaning and aim behind the things you say; otherwise you cannot expect to be taken seriously. And take your time to stay calm before deciding to continue a conversation or postpone it.

9. Take It Slow And Smooth

While communicating, collect and arrange your ideas first and then present them by using easy and simple words. Do not elide your words together or babble

You should be audible and clear to your audience so do not mutter. You have to speak at a suitable pace and pronounce the words clearly. Then the audience will take interest in your speech and you would be understood. Do not elide your words together or babble.

10. Do Not Overwhelm The Other Person

When communicating with others, it's important for you to express your ideas without trying to manipulate the conversation. People like to express their opinions and points of view, so give proper time and chance to others to speak.

Besides, you can use some motivational and impressive words for your audience. Make other people feel valued and appreciated in your communication by using the you approach. Consider your audience and try to speak in their favour.

11. Provide Productive Criticism

No one likes to be criticized; thus, if you feel like you need to criticize others remarks, make sure that you use constructive criticism. It must focus the work and not the

person. Try to use timely, specified and actionable criticism , that can be proved as a valuable tool in enhancing and maintaining the performance standards. The positive criticism done with good intentions by keeping some goals in mind can influence others' lives for betterment.

12. Recognize When You Are Becoming Stressed

Stress Management is important while communicating otherwise it can impact your conversation in negative ways, it can obstruct your possibility to think creatively and clearly, and speak fluently. Once you are stressed, you tend to misapprehend others and send confusing non-verbal signs ; like fidgeting, shaking legs, playing with knuckles and not making an eye contact etc. Therefore try to be calm and confident to communicate effectively.

Being a good communicator means that you also have to cope with pressure and stress in certain situation. So learn tips on how to manage and control stress, and how to conquer depression effectively forever.

13. Treat People Equally

It is necessary for you to communicate on an equal basis with people if you want to become a perfect communicator. Do not backbite others, try not to develop favorites. By treating the other person in courteous manner, you will be able to build a good rapport. After saying something, you should take required feedback to ensure that people have understood your message. It helps a lot to avoid any kind of confusion. Believe in others' competence and try to be sensitive to other people's feelings.

The process of l Communication Skills- to connect with World earning professional communication skills and tips require efforts, time and patience. But you can learn the skills by continuous practice and definitely open new future opportunities for yourself.

II. CONCLUSION

"Soft Words break no bones but win hard hearts."

In today's fast growing, business and technological world, Effective Communication acts as the nerve center. The success and progress of an organization depends not on a single worker rather its teamwork, where greater coordination and effective communication is required. The employees from different cultures and backgrounds work together. They should have good oral, written and technological communication skills for the smooth working and better inter personal relationships. Effective Communication helps to avoid unnecessary conflicts in the workplace and thus provide a harmonious environment to the workers. It enhances the productivity of the employees in all aspects and hence leads to the success of the organization.

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Treatment of Existentialism in Kamala Markandaya Work

Simerjit Kaur Nagi
CT Institute of Engineering
Management and Technology,
Shahpur, Jalandhar

Vikrant Rehani
CT Institute of Engineering
Management and Technology,
Shahpur, Jalandhar

Amit Sharma
CT Institute of Engineering
Management and Technology,
Shahpur, Jalandhar

Abstract- Existentialism is a very wide and ever growing ideology .Through this work an effort has been made to explore the philosophy of existentialism in the past, present and its prospects in future. Man, by and large, has ceased to have a human heart throbbing with emotions and sentiments, joy and love, pity and peace. He has become a mere machine, and his life mechanical. Modern man is reduced to the state of robot and is functioning as a computer, a recording machine without and discrimination of evil and good.

Keywords: Existentialism, nymphomania, flabbiness, anti-theist, finitude absurdity and alienation.

The word 'existentialism' is made by adding the suffix 'ism' to the word 'existential' which is an adjective and whose substantive is 'existence'. The Latin existential, the German 'Existenz' the French 'existence' is used in the sense of the 'state of existing or being'. But for the existentialists the word refers to the act of existing rather than to the state of existing. Existence, therefore, is an act, the actual transition from the possibility into reality Foulquie [1] and thus, is a living, changing concrete fact.

Existentialism lays stress on the subjectivity and individuality of human existence and paves the path of individual freedom. Sartre writes:

"It's true that existence is prior to essence, man is responsible for what he is .Thus the first effect of is that it puts everyman in possession of himself as he is." Srinavasam [2]

- The Nowhere man [1972].
- A Handful of rice [1966].
- Nectar in a Sieve [1954].

This topic has been chosen to prove what existentialism is and to discuss the impact of existentialism on human life and society. Through this work an effort has been made to explore the philosophy of existentialism in the past, present and its prospects in future and to discuss how the life of an individual is influenced. In reference to existentialism it is explored that how difficult it is to survive and maintain

Existential perspectives in Kamala Markandaya's work have been studied in The Nectar in a sieve, A Handful of Rice, The Nowhere Man as this aspect have been widely explored and treated by the novelist. Kamala Markandaya is one of the outstanding women novelists of Indian English fiction .She had skillfully dealt with the conditions of existence of the individual person and his or her emotions. His above said selected works lay more stress on the "uniqueness of each human existence in freely making its self defining choices",with foundation in the thoughts of Kierkegaard [3].

Kamala Markandaya has emphasized on the "freedom and personal responsibility" and in The Handful of Rice and The Nectar in a Sieve we observed that she regards human existence in a hostile universe as unexplainable. Even in The Nowhere Man we find suffering protagonist "struggling hard to create meaning in an unknowable, chaotic and seemingly empty universe"

The existential concerns in Kamala Markandaya's works are quiet prominent and dominant. She has vividly depicted an individual's struggle for existence and identity in almost all her works. Her protagonists struggles hard for their survival even under the most hostile and inhumane circumstances. Though in almost all of her novels this perspective is strongly displayed but the deep and careful study of her works shows that in following three novels, her existential concerns speaks more loudly.

ones identity. This topic has been chosen as it will explore something new and contribute to the literary world.

Existentialism is a very wide and ever growing ideology that stress that a person's judgment is the determining factor for what is to be believed rather than by religious or secular world values. There is a wide variety of philosophical ideologies that make up existentialism so there is not a universal existentialism definition. It is necessary to remain open and realize that most existentialist have a different view and form. It is a 20th century philosophy concerned with human existence, finding self and the meaning of life through free-will, choice and

personal responsibility. The belief that people are searching to find out who and what they are throughout life as they make choices based on their experiences, believes and outlook without the help of laws, ethnic rules or traditions.

Life has grown today ''indefinitely vast'' without any proper ''interlinkage'' Jasper [4] to hold it together from falling down. There is a gap between what an individual professes and what he really practices, between what he really is and what he would like to appear ,and between what he aspires for and what he really achieves .This gives rise to split personality and utter moral confusion. Man, today, say Victor Anant, lives on ''an adhoc basis'' in ''no man's land of values''. He is bound to two sets of customs and torn by dual code of behavior. He lives ''by opportunism, treachery, cowardice, hypocrisy and wit''

According to Anant, is due to his ''mental inertia and flabbiness'' Partison [5]. These absurd situations give rise to psycho-social disorder and loss of moral values. These attributes of human conduct compel, man to commit blunders, sometimes sins that ultimately disturb his mental peace and harmony and produce discomfort, depression and frustration. At times he comes under the grip of criminal conduct.

The modern man is undergoing a chaotic disorganization as he does not know by which stars to guide his steps .He fails to have faith in his divine existence. He fails to understand that a human soul is part and parcel of god. It is conscious, pure and full of divine bliss.

The modern woman ceases to have faith in her family life, being a good house wife loving with all warmth her husband and children. She deletes the age old standards of morals. She is not ready to be the passive spectator dominated by her male partner .She revolts against the established norms. She is not satisfied with her life within the four walls of her house. The smooth shade of her family roof no longer gives her rest and consolation. No longer is her sweet home the centre of her attraction .She prefers to come out and be man's equal .She likes employment elsewhere. She shouts for ''equal pay for equal job ''.She attends hotel, clubs, coffee-houses, and theatres freely, frankly, and fearlessly .She smokes cigarettes, drinks wine, enjoy picnics, and celebrate.

The husband-wife relationship is no longer harmonious blend of love and warmth, sentiments and emotions. Its not the true union of two souls and two bodies any more. The sweetness of touch is altogether missing in sexual relationship. Sexual intercourse is mere biological need of human body. It is only a mechanical process. The husband and the wife develop with the male and female counterparts of their choice. They are known to so many. Sex is deprived of love and all idealistic standards. It has pushed other noble values into the background. With the result,

there is the revolutionary change in the life of man and woman. When a child is born, none of the parents has time to look after it. The child is looked after by a hired maid servant, an ''aaya'' and is ignorant about parental love and affection. Therefore the harmonious relationship between parents and children is altogether destroyed. The lack of the filial relationship makes the family life dull, dreary and dry. Consequently the diseases like hysteria, nymphomania and activities like sudden divorces and repeated abortions are increasing terribly. Sex-crimes and drug addiction has become the common feature of the restless and the rebellious younger generation.

The existential thinkers have also focused attention on human nature. According to them, there is no settled human nature, the will is more important than the reason, and that the choice that the individual makes of his own nature is more basic than the rational analysis of that nature. According to Sartre, human nature is a possibility. Self is what it makes of itself .His concept of human nature lays full burden of responsibility on the shoulders of an individual. Heidegger emphasizes on the ecstatic existential nature of man and character and content of authentic existence and remarks:

"The being that exists is man. Man alone exists. Rocks are but they do not exist .Trees are but they do not exist .Horses are but they do not exist .Angels are but they do not exist. God is but He does not exist .The proposition ''man exists 'Means: man is that being whose Being is distinguished by

the open –standing, standing-in, in the unconcealedness of being from being, in being. The existential nature of man is the reason why man can represent beings as such, and why he can be con-scious of them .All consciousness presupposes ecstatically understood existence as the essential of man-essentia meaning that as which man is present in so far as he is man."   Kaufmann [6]

Existentialists attach special importance to the facts of life like, anguish,   anxiety, alienation, boredom, choice despair, dread, death, freedom, frustration, finitude, guilt, responsibility etc. as they are fully conscious of tragic elements of human existence. They show their deep concern with the fundamental problems of the human existence. They opine that the man in the present age has been dehumanized by being deprived of his freedom. Therefore they encourage man to face the situation, to make his choice, and to take his decision as free and responsible individual. It is in this way the man can truly be said to exist and the ills and the evils of the modern society can be cured. Thus the existentialism has come to stand not ''as a passing fad'' but as a valid school of philosophy. It speaks of the active participation in the problems of life even in ''the agonizing situations of living in times of crisis when day to day decisions had to be made. 'The existentialists

affirm that man should choose, decide and act as active participant in the life situations and thereby should try to save the modern world from deep distress, distrust and dissension in every walk of life.

Most of us aren't aware of ourselves at all. We have an imagined version of who we are, but it's at best incomplete – We can claim as we are not aware about ourselves, have never tried Self Exploration. Learning about our Blind spots, weaknesses, insecurities, aims, passions, hobbies is emotionally difficult. We all have the potential to do things, discovery requires risk and life provides chances for everyone to make their own positive discoveries.

Self Exploration – the trickiest thing to develop to rule the world: To become more self- aware, you have to be aware enough about yourself to know you need to know yourself better. How can anyone else …. For the Human Beings to exist the self Exploration becomes inevitable.

Albert Camus (1913-1960) has developed a kind of existentialism of the absurd .In his approach he has been described as an "anti-theist" rather than an atheist. His slogan is "to create, to transform the humanity of the world into the image of the man, to humanize what is inhuman, in short to civilize". His revolting hero has to create personal values for himself: "Meaning has to be created, not found, and it has to be created by the individual out of the actual experience of revolt." Cruickshank [7]

Existentialism deals with the conditions of the existence of the individuals and their emotions, actions, responsibilities and thoughts. Soren Kierkegaard, an early 19th century philosopher is also regarded as "Father of existentialism" Marino Gorden [8] maintained that the individual is solely responsible for giving his own life "meaning"and living that life "passionately and sincerely" Lowrie, Walter [9] in spite of many existential obstacles and distractions including "despair, angst, absurdity, alienation and boredom" Corrigan, John [10]. It is in this context that existential concerns have been discussed in Kamala's work.

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Democracy in a Class Room Teaching: Ranciere's Perspective and its Practility in Communication

Vikrant Rehani
CT Institute of Engineering
Management and Technology,
Shahpur, Jalandhar-144020

Simerjit Kaur Nagi
CT Institute of Engineering
Management and Technology,
Shahpur, Jalandhar-144020

Amit Sharma
CT Institute of Engineering
Management and Technology,
Shahpur, Jalandhar-144020

Abstract: The equality at the societal level can't be achieved unless education is implied equally to all. This can happen when we move from equality to equality. And for this to happen we have to start with the minimum equality –as Ranciere says. This Trilogy of Democracy, Equality and Self Emancipation can come into complete existence only in an active and fertile classroom where the

communication process gets completed with a proper feedback from the receiver of the message; where the teacher –taught are the receiver and the sender of the message or vice-a –versa.

Keywords: Equality, Democracy, Self-Emancipation, Communication process, Feedback, Pancastique theory.

I. INTRODUCTION

This research work will focus on the key ideas of a French philosopher and a well-known literary figure-Jacques Ranciere, who has given deep insights into the domains of philosophy, literature, politics, critical theories, and sociology. The main area of concerns in this work is the democracy in the class room teaching for the equality and self-emancipation of the pupils. This work will focus on the fact that equality and democracy impacts the communication process in the class room and vice a versa. At some places Jacques Ranciere may be referred as J.R.

"…All those people who are looking for the best path- from inequality to equality, but the only good part is to move from equality to equality"[1]. Jacques Ranciere strongly advocates equality. He propagates Joseph Jacotot's, a French teacher and educational philosopher of the 18th century and the creator of the method of "Intellectual Emancipation" message that all men have equal intelligence. J.R .simply believes that everyone can think .He is known for sometimes "remote position in contemporary French thought" .Most of his works "operate from the humble motto that the cobbler and the university dean are equally intelligent"[1]. He has lavishly compared the works of great luminaries like Plato,Aristotle, Gilles Deleuze with relatively unknown thinkers like joseph Jacotot and Gabriel Gauny.

In one of his crucial works - The Ignorant School Master:Five lessons in Intellectual Emancipation (1991), which is inspired by the experiences of a radical early 19th century teacher Joseph Jacotot, Ranciere sought to rethink the idea of pedagogy away from the idea of moving from unknown to the known and from those who possesses knowledge to those who don't, to look at how all forms of Ignorance are also conditions of knowledge.

"… the idea of starting from inequality to reach equality: it's impossible because in the very process, you ceaselessly recycle practices of inequality. You must not go towards equality, but must start from equality"(Excerpts from the interview)[2].

We shouldn't confuse ourselves as Rancierehas evidently elaborated that it should bepresumed that all the citizens have equal chance to learn and then manifest their capabilities. "Youhave to start with the minimum equality"(Excerpts from the interview)[2].As briefly discussed, Ranciere was inspired by the philosophy of joseph Jacotot on intellectual emancipation, which underlines that there is always some equality in the class room.

Whenever a teacher,master or an instructor is explaining something in a class he simply supposes that the student can understand his lessons, instructions and explanation. If a student can follow and understand his teacher's explanation; thenand there as J.Rsays: "a Kind of Equality" germinates. The equality of Knowing,Understandingand Sharingthe "same language".

Now in a class room a true learning comes not through a one way flow of information. The one way channel fails to even serve the very purpose. The classroom is a medium of communication. And

communication, we should always remember;is a flow of information, expression of ideas, emotions, feelings and thoughts. It is a process which requires a sender of message who encodes the message. This message is received by the receiver who decodes it. Now at this stage the communication process is incomplete it has to be completed. To complete the process the receiver of the message will send a feedback. The feedback may be the positive or negative. The feedback may be a further query or sharing and imparting of additional information. It may even include illustration of a similar incident. Such a feedback in communication makes a process complete and active. The active participation is an active process and the classroom in which activity and active participation is going on becomes a ground for growth of fertile minds. And healthy discussion brings equality.

A Passive classroom, on the contrary, is a barren land where there is no activity, where the communication circuit is incomplete. There is no feedback. In such a classroom teacher do not teach but preach or rather dictates the term. He is Mr. Know all and Mr. Do all. Thus giving non-stop lecture, leaving students with nothing to think or speak except writing and taking lecture notes quickly. Such a teacher is projected as a superior brain, thus leaving no space for active participation or discussion as equals. Can such a place where there is fear or inhibition to speak be breeding place for equality? NO. This won't be a democratic classroom. Rather it would be a place where a learner will be sitting as an inferior and scared person.And a teacher becomes a dictator.

Ranciere is amongst very few philosopher thinkers who believe that the process of learning is not at all a "process from ignorance to knowledge but as a process of going from what is already possessed, to further knowledge of new possessions { Excerpts from interview with LawerenceLieing}.

Majority of his works on the Concept of self-emancipationsays that no man is ignorant. Even the so called ignorant "Always knows something, always ask something and always has the capacity….."It becomes ateacher to make the best of his capacity and start from equality.Equality anddemocracy leads toself-Emancipation. The self-emancipation strengthens equality and democracy. Thus each one energises the other two inside the class room as well as on the broader spectrum.

The so called ignorant -a 19th century carpenter Gilbert Gauny was a self-taught philosopher who, according to Ranciere wrote certain texts from within the philosophical tradition especially Plato and realized that philosophy "the same conceptual heart as Plato"

This means Plato–the great philosopher-a Beacon of Intellect and Gauny – a self-taught carpenter converges on a same fact that: "the worker is not primarily a social function,but a certain relationship with the logos, and that he is assigned to certain temporal categories."[Jacques Ranciere, Democracy means Equality: Interview in Radical philosophy. March/April 1997(English)]J.R strongly advocates equality.His concerns about the very existence of the working class and their relationship with the education and the knowledge are quite evident in his in his works like – The Nights of Labor (1989),The Ignorant Schoolmaster: Five Lessons in Intellectual Emancipation (1991),Staging the People : The Proletarian and his Double (2011).

J.R'sprojection of Jacotot's Emancipatory or "Panecastique Theory" is the need of an hour .As it will lead to the equality,emancipation and democracy .Its practical application can complete the trilogy of knowledge, philosophy and power. This"Pancastique Theory" says:

1. All men have "equal intelligence".

2. All men have "received from God the faculty of being able to instruct themselves".

3. We "can teach" what we "don't know".

4. "Everything is in everything".

J.R. in one of his eminent works :The Ignorant Schoolmaster :Five Lesssons in Intellectual Emancipation(1981) talks to educators and educators to-be that there wisdom and intelligence should not be dominating one .There should be zero tendency to dominate to subordinate others. To educate means to emancipate .J.R says that "whosoever teaches without emancipating stultifies" and also"there is stultification whenever one intelligence is subordinated to another's" [4].

This process of educating is called as "stultification" by J.R who asserts that education should not be from inequality to equality but this process can be fruitful if the voyage is from equality to equality. The concerns about the stupidification of the learners and the degenerated education system raised by J.R are quite apt today. Through the story of Joseph Jacotot,he asks his readers to consider equality as an initial point rather than a goal.

Today, when '…technology continues to find ways to solve and then create moreproblems; fossil fuel burns and burn…" [5] .What we need to do is "only pick up a newspaper, flip on a television or visit a web page to bear witness to current state of things"[5].Life has grown "indefinitely vast"

without any proper "inter-linkage"[6].Amidst this "discord" and "disorder" the literature and arts plays crucial role .It depicts the present scenario and shapes the future for the coming generations.Ranciere has very well observed the reasons –"the social security is running a deficit".For all these effects, he identifies only one cause –"democracy,that is the reign of the limitless desire of an individual in modern mass society"[7].The democracy and equality in the class room may backfire in this era of consumerism. In the "reign of immaturity",the teacher is "compelled to discuss the things equal to equal with his students, who themselves end up being put in the position of judging their schoolmaster"[7].Thus it has become all the more important ,as Dominique Schnapperobserves, to "monitor" the democracy very closely otherwise the "intelligentsia and the technical experts may be robotised" and all the professions may "become trivialised":

…Democracy need to be monitored thoroughly or the intelligentsia and the technical experts may be robotised ,for instance, doctors are gradually becoming the salaried employees of social security system. In this way all professional practices tends to become trivialised in this sense…[8]

Through Ranciere's concepts of democracy, equality and self-emancipation,it can be easily siphoned out that equality has everything to do with education.Only Proper education can bring equality in the society. All the same; his important observations on the "failure of educational institutions to give to the children from the more modest classes"and of "most deprived cultural background equal chance"cannot be ignored.J.R

has uncovered "various forms of inequalities and the means to achieve equality"[9]. The equality at the societal level can't be achieved unless education is implied equally to all. This can happen when we move from equality to equality. And for this to happen we have to start with the minimum equality –as J.R says. This Trilogy of Democracy, Equality and Self Emancipation can come into complete existence only in an active and fertile classroom where the communication process gets completed with a proper feedback from the receiver of the message.

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Quest for the Happy Existence in Co-Existence

Shashi Kant
dr.shashikant.kant@gmail.com

Vikrant Rehani
CT Institute of Engineering Management and
Technology, Shahpur, Jalandhar-144020

Abstract: Harmony in thoughts, speechand acts is the mother of real happiness. Not counting our blessings is the evil twin of destruction. Our thoughts are the creators of peace and happiness. Happiness lies within our self. A meaningful life is the mother of happiness. Meditation is most important to get real happiness. All the religious scripts and the world's thinkers show the path of real happiness. Analyses and transformation is the hope for real happiness.

Keywords: Happiness, Purity, Spirituality, Desire, Rituals, Meditation, Tradition.

I. INTRODUCTION

One of the real sources of unhappiness is consistent inconsistency to respond to the situation in a responsible and reasonable way. A human being of this magical postmodern era cannot decide what to do and what not to do. He fails to identify the options .If somehow the options become evident; he fails to pick the correct one. Due to the lack of self-introspection and self-exploration he is confused and surrenders by asking: "what should I do now?"

Although,he may see "dozens of choices but lacks immediate feeling of like or dislike". It seems human being is caught in a mess and imbroglio which is leading him to nowhere except a fiasco. Today in the era of consumerism where the mighty customer is the king, who unfortunately do not know how to decide and what to decide; he is facing a problem of many. "We need only use the reason to weigh the pros and cons when two or three possibilities seem equally good"[1].Happiness cannot be planted from the outside source, it springs from within. One cannot agree more to the well said lines of Mahatma Gandhi that one can attain the state of happiness only when, "What you think, what you say and what you do are in harmony"[2].When our lips don't follow our thoughts and our actions are in other direction there is complete disharmony in the self .In the uncoordinated fields of soul, mind and body one may witness the birth of unhappiness.

Now happiness may mean that something happened and we like to be in that situation .We does not want that situation to end. Thus to be in a state of liking something is happiness. Every human being has tendency for the comfort where there is no struggle or conflict. He wants to be in that state in continuity. That state may be called the state of happiness. It's a physical, psychological, emotional, spiritual, social and philosophical state.

Some philosophers like Frederick Keonig opines that "Happiness doesn't come as a result of getting something we don't have, but rather of recognizing and appreciating what we do have" [2]. Very little effort is needed to make a happy life. We are only to awaken our mind. An educated heart is the only source of real happiness. We should count our blessings. To forget about our blessings is an evil twin of destruction. We should not waste our energy to focus on things that we do not have instead we should count the blessings.

Real happiness is nothing but a state of mind.Happiness doesn't come from outside. It is experienced from within. Of course we are to grow together to get real happiness but we should not depend upon others to get feeling of happiness. We should fell in love with the whole universe to diminish our hatred and unhappiness. This is a wonderful source of happiness- a real happiness.Peace is a close associate of happiness. Where there is peace there is happiness. If we don't let our peace go away from our upper chamber, happiness shall stay forever and ever.

We are the creator of our happiness. We should accept what we are as "Mr. Perfect" is the person who exists nowhere. If we change our thoughts our world will be changed. Our thoughts determine our real happiness. If we compare ourselves with others that will add to our grievances as there is no end of competition. If we want to compare ourselves we must compare what we were yesterday.

In one of his famous books, Dan Baker suggests that "unhappiness comes when we underestimate and stop loving ourselves". The modern man must realise that no one is perfect .He should be open to accept things in the positive manner by being receptive towards the positive and constructive criticism. Ignoring the negativity also helps a great deal. In the current scenario the human is busy picking a quarrel, or argument. Thinking negative against his ownself; arguing and spreading disharmony robes him of all his peace leaving him unhappy. Dan Baker further says that: "They just begin to lose that cohesive force, the power of personality, that makes them unique, individualized being [3].

So, one needs to stay positive and busy in a constructive manner. In celebrating his uniqueness, one celebrates his life and earns happiness. Absence of needless desires is the real

fertilizer for happiness as the desire is the root cause of our unhappiness. One should never forget that desires invite the sufferings. If desires go untamed they will rein our happiness to ruins.

Oprah's words are appreciated all around that,"Successes don't equal happiness in our lives"[4]Success does not bring always happiness. If we are given choice to select success or happiness, we shall prefer the later.A meaningful life is a source of real happiness. If we are on our journey of life without any purpose it will cause dissatisfaction in our life. It is the universal law. We must think what for we are on this earth. If we forget it, real happiness will also forget us. We should constantly think what we have done for others. Good and meaningful life person who radiates happiness.

It has been seen that meditation helps us to calm down our mind. It helps us to focus on the purpose of our life. It has impact on our health and prolongs our life. It is an industry of real happiness. Meditation does not mean we need a particular religious group or particular rituals as there are number of non-believers who are good to others and spend some of their time counting their blessings and never forget what they have in their life. Their way of good life results in lasting happiness.

We should not waste our energy to focus on things that we do not have instead we should count the blessings. Most of time we are worried about the problems which may not come in our lives or they are dissolved like a wafer with a slight touch. Thus we simply wasted our time and energy thinking about tomorrow. All that we need to do is "think properly" as suggested by Michael Bernard Beckwith fonder of Agape International Spiritual Centre.To think properly is the great power:

The moment you begin to think properly, this something that is within you, this power within you that's greater than the world, it will take cover your life. It will feed you .It will cloth you.it will guide you, protect you, direct you and sustain your very existence [5]

If we think nothing happened against us but everything happened for us, we can make out many wonderful things in every situation and create a wonderful life. To bring real happiness in life it is important to cultivate emotional balance in order to neutralize the effect of hyper activity disorder… etc. We must heal our minds. The first and foremost thing is to know about the cause of hyper activity or depression which is the beginning of the path of happiness. If we are capable to maintain the balance it will further the steps towards the real happiness.

Often we get impulses in our brain. Before the feeling of fear, anger hate and craving is converted into a storm in our mind we must stop the feeling. We should not give the energy to any one of them arising in our mind rather we should stop

them then and there. By doing so we stop the above said to dominate our mind. Reaction to any one of them will devoid us of real happiness. We should focus on our needs rather than our greed. All the spiritual sects and the religions like Hinduism, traditional Hermetics, Buddhism, Judaism, Christianity and Islam; even the ancient civilizations like the Babylonians and Egyptians through their holy scriptures and writings have never failed to deliver the message that whatever comes into our life is invited by us be it agony or happiness.According to Buddhism:

All that we are is the result of what we have thought. It is founded on our thoughts. It is made up of our thoughts. If one speaks or acts with an evil thought, pain follows one, as the wheel follows the foot of the ox that draws the wagon.All that we are is the result of what we have thought. It is founded on our thoughts. It is made up of our thoughts. If one speaks or acts with a pure thought, happiness follows one, like a shadow that never leaves.[6]

Buddhism stresses on purity of acts and thoughts as it leads to the spiritual happiness. Every spiritual tradition and the great teachings of the world open the gates to real happiness. "Truly, in remembering God do hearts find rest" [Quran, 13:28][7].According to The Bible, "You keep him in perfect peace whose mind is stayed on You, because he trusts in You. Trust in the Lord forever, for the Lord God is an everlasting rock" (Isaiah 26:3) [8].There is number of teachings in The Bible which bestow upon us the real happiness.

20thMarch was celebrated as the day of international happiness. It was pledged that we shall help others to be happier by giving them ideas and clearing the clouds around the vision.

People are running helter-skelter in search of happiness. It is the responsibility of this elite and intelligentsia group to bring the people of this planet to one stage where they are awakened and may understand the real happiness. The word real happiness will not remain a Greek for us if we do self - analysis and transform ourselves. We ourselves is the source of our happiness and the joy of the people. We can "create anything. Know anything within the field of our consciousness, which ultimately is universal consciousness which runs the universe" [9] therefore being a creator we are the possessors of the limitless power as Dr John Hagelin, a world renowned quantum physicist, educator and public policy expert says:

We are the creators of the universe .So there is no limit, really to the human potential. It's the degree to which we recognise those deep dynamics and exercise them,the degree to which we harness our power .And that really has to do again with the level at which think [9].

It simply suggests as John Milton says that mind itself is capable enough to create a heaven or a hell around itself. What we think we start imagining that .Those images attracts the words and accordingly our actions complement our thoughts, images and words. The key to the real happiness lies in the self -exploration and self introspection. Through the self -exploration and self-introspection comes the real self- realization and earning the self-realisation is just the beginning of HAPPINESS!!

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Green Marketing

Need of the Day

Jaskiran Kaur

Deptt. of Applied Sciences, CTIT, Jalandhar
jas.kiran@yahoo.com

Abstract—**Green marketing refers to the process of producing and selling products and services based on their environmental benefits. This paper contents are concepts, importance, adopts by firms and challenges in green marketing.**

Keywords—**Green marketing, green products, consumer behavior, environmentally friendly product.**

I.   INTRODUCTION

The promotion of environmentally safe/ beneficial products, green marketing began in Europe in the early 1980's when specific products were identified as being harmful to the earth's atmosphere. As the result new "green" products were introduced that were less damaging to the environment. The concept caught on in the United States and has been gaining steadily ever since.

Green marketing is also known as sustainable marketing, organic marketing and environmental marketing. It is the marketing of products that are said to be environmentally safe and benefit the environment in away or the other. This includes many activities like product variation, transformation in the manufacturing process, using recycled board or paper for packaging and different forms of advertising. Green marketing also ties closely with issues of industrial ecology and environmental sustainability such as extended producers' liability, life-cycle analysis, material use and resource flows, and eco-efficiency. Thus, the subject of green marketing is vast, having important implications for business strategy and public policy [4]

Divergent aspect of green marketing includes ecologically safer products, recyclable and biodegradable packaging, energy efficient operations and better pollution controls. Advances produced from green marketing include packaging made from recycle paper, phosphate-free detergents, refillable containers for cleaning products and bottle using less plastic.

People are now getting more awareness about the damages that chemicals, toxic wastes and industrial gases are causing to the environment and disturbing the natural balance. Businesses are beginning to modify their own thoughts and behavior in an attempt to address the concerns of consumers [8]. They are now using such products that do not use chemicals like fertilizers to increase food production or preservatives that will ensure the useful shelf life of food. This is one way of putting into practice, the green marketing phenomenon by using food that is grown with natural organic fertilizers that maintain the natural environmental balance of the earth [8].

As today's consumer become more and more conscious of natural products, Green marketing is becoming more important to businesses because of consumers' genuine concerns about our limited resources on the earth. By implementing green marketing measures in order to save the earth's resources in productions, packaging and operations, businesses are showing consumers that they too share the same concern about environment; boosting their credibility [1] Government has also taken certain initiatives by making regulations relating to green marketing in order to protect the environment.

Green marketing involves developing and promoting products and services that satisfy customers want and need for Quality, Performance, Affordable Pricing and Convenience without having a detrimental impact on the environment [7]. The Obvious assumption of green marketing is that potential consumers will view a product or service's "greenness" as a benefit and base their buying decision accordingly.

II.   IMPORTANCE OF GREEN MARKETING

Since early 1990's, a major concern on ecological impact of industrial house on environment has been surfaced on marketplace. Not only the relations between human, organization and natural environment has been redefined, but the implication thereof are being interpreted, because of these, new perception are being formed or re-evaluated on issues like environmentally product, recycle ability , waste reduction, the cost associated with pollution and price value relationship of environmentalism. Pressure from various stakeholders, govt. environmentalists, NGO's consumer is placed on businesses, which in turn keep them under constant and relentless watch in their daily operations. A direct result can be seen in developing as well as in developed countries where government become more strict in imposing regulations to protect environment at the same time, the consumers of these countries are being more and more out spoken regarding their needs for environmentally friendly products, even though question remain on their willingness to pay higher premium for these products.

So in this era where consumer determine the fate of a company, green marketing imparts a proactive strategies to these companies to cater the market by imparting natural

friendly product/ services which otherwise reduce or minimize detrimental impact on environment.

A green marketing approach in productive area promotes the integration of environmental issues on all corporate activities; from strategy formulation, planning re-engineering in production process and dealing with consumers. So to remain competitive within the challenge thrown by environment protectionists, the companies will have to find out the answer through their marketing strategies, product or services redesign, customer handling.

In this endeavor, the companies go for new technologies for handling waste, sewage and air pollution; it can go for product standardization to ensure environmentally safe product; by providing truly natural product. In this regard companies should be concerned with what happens to a product during and after its useful life. Companies may manifest these concerns through experimentation with ways to reassess the product life stages.

Moreover, man has limited resources on the earth, with which she/he must attempt to provide for the worlds' unlimited wants. There is extensive debate as to whether the earth is a resource at man's disposal.. In market societies where there is "freedom of choice", it has generally been accepted that individuals and organizations have the right to attempt to have their wants satisfied. As firms face limited natural resources, they must develop new or alternative ways of satisfying these unlimited wants. Ultimately green marketing looks at how marketing activities utilize these limited resources, while satisfying consumers wants, both of individuals and industry, as well as achieving the selling organization's objectives.

III. ADOPTION OF GREEN MARKETING

Firms can 'green' themselves in three ways: value-addition processes (firm level), management systems (firm level) and/or products(product level). Greening the value-addition processes could entail redesigning them, eliminating some of them, modifying technology and/or inducting new technology – all with the objective of reducing the environmental impact aggregated for all stages. A steel firm may install a state-of-the-art furnace (new technology), thereby using less energy to produce steel.

Firms could adopt management systems that create conditions for reducing the environmental impact of value-addition processes. A good example is the Responsible Care program of the chemical industry, which establishes systems to promote environmental, health and safety objectives. However, management systems' efficacy for greening value-addition processes is difficult to quantify if they are not accompanied by performance measures. Thus, by having measurable (therefore, easily monitored and understood) performance indicators, firms can make verifiable claims about the environmental impact of their management systems. Conceivably, consumers may reward such firms, if they can easily access and interpret such information

There are three keys to successful green marketing:

1) Being original means that
   a) you are actually doing what you claim to be doing in your green marketing campaign

   b) the rest of your business policies are consistent with whatever you are doing that's environmentally friendly.

2) Educating your customers isn't just a matter of letting people know you're doing whatever you're doing to protect the environment, but also a matter of letting them know why it matters.

3) Giving your customers an opportunity to participate means personalizing the benefits of your environmental friendly actions, normally through letting the customer take part in positive environmental action.

There are basically five reasons for which a marketer should go for the adoption of green marketing. They are -

- Opportunities or competitive advantage
- Corporate social responsibilities (CSR)
- Government pressure
- Competitive pressure
- Cost or profit issues

Green Code

G eneralise with care. Consumer behavior will not necessarily be consistent across different product types, and particular market segment may respond to certain issues on green agenda but not others.

R emember the validity of piece of market research is not related to degree to which it support your preferred option.

E xplore the context from which the market research data comes. Be clear on the nature of sample used , the question asked the way in which the responses were recorded and time and place from where the responses come.

E nsure that where the market research is crossing international boundaries, that the terminology and interpretations remain consistent.

N eurality is important. Ensure that when you pose questions to consumers that they can made any responses without being made guilty or uncomfortable and ensure that your own preconceptions about green agenda are not encoded within the questions.

IV. WHY ARE FIRMS USING GREEN MARKETING?

When looking through the literature there are several suggested reasons for firms increased use of Green Marketing. Five possible reasons cited are:

1. Organizations perceive environmental marketing to be an opportunity that can be used to achieve its objectives [Keller 1987, Shearer 1990];

2. Organizations believe they have a moral obligation to be more socially responsible [Davis 1992, Freeman and

Liedtka 1991, Keller 1987, McIntosh 1990, Shearer 1990];

3. Governmental bodies are forcing firms to become more responsible [NAAG 1990];

4. Competitors' environmental activities pressure firms to change their environmental marketing activities. [NAAG 1990]; and

5. Cost factors associated with waste disposal, or reductions in material usage forces firms to modify their behavior [Azzone and Manzini 1994].

V. SOME PROBLEMS WITH GOING GREEN

No matter why a firm uses green marketing there are a number of potential problems that they must overcome. One of the main problems is that firms using green marketing must ensure that their activities are not misleading to consumers or industry, and do not breach any of the regulations or laws dealing with environmental marketing. For example marketers in the US must ensure their green marketing claims can meet the following set of criteria, in order to comply with the FTC's guidelines. Green marketing claims must;

•Clearly state environmental benefits;

•Explain environmental characteristics;

•Explain how benefits are achieved;

•Ensure comparative differences are justified;

•Ensure negative factors are taken into consideration; and

•Only use meaningful terms and pictures. Another problem firms face is that those who modify their products due to increased consumer concern must contend with the fact that consumers' perceptions are sometimes not correct. Take for example the McDonald's case where it has replaced its clam shells with plastic coated paper. There is ongoing scientific debate which is more environmentally friendly. Somescientific evidence suggests that when taking a cradle-to-grave approach, polystyrene is less environmentally harmful. If this is the case McDonald's bowed to consumer pressure, yet has chosen the more environmentally harmful option. When firms attempt to become socially responsible, they may face the risk that the environmentally responsible action of today will be found to be harmful in the future. Take for example the aerosol industry which has switched from CFCs (chlorofluorocarbons) to HFCs (hydrofluorocarbons) only to be told HFCs are also a greenhouse gas. Some firms now use DME (dimethyl ether) as an aerosol propellant, which may also harm the ozone layer [Debets 1989]. Given the limited scientific knowledge at any point in time, it may be impossible for a firm to be certain they have made the correct environmental decision. This may explain why some firms, like Coca-Cola and Walt Disney World, are becoming socially responsible without publicizing the point. They may be protecting themselves from potential future negative backlash, if it is determined they made the wrong decision in the past.

While governmental regulation is designed to give consumers the opportunity to make better decisions or to motivate them to be more environmentally responsible, there is difficulty in establishing policies that will address all environmental issues. For example, guidelines developed to control environmental marketing address only a very narrow set of issues, i.e., the truthfulness of environmental marketing claims [Schlossberg 1993]. If governments want to modify consumer behavior they need to establish a different set of regulations. Thus governmental attempts to protect the environment may result in a proliferation of regulations and guidelines, with no one central controlling body.

Reacting to competitive pressures can cause all "followers" to make the same mistake as the "leader."

A costly example of this was the Mobil Corporation who followed the competition and introduced "biodegradable" plastic garbage bags. While technically these bags were biodegradable, the conditions under which they were disposed did not allow biodegradation to occur. Mobil was sued by several US states for using misleading advertising claims [Lawrence 1991]. Thus blindly following the competition can have costly ramifications.

VI. CONCLUSION

Green marketing covers more than a firm's marketing claims. While firms must bear much of the responsibility for environmental degradation, ultimately it is consumers who demand goods, and thus create environmental problems. One example of this is where McDonald's is often blamed for polluting the environment because much of their packaging finishes up as roadside waste. It must be remembered that it is the uncaring consumer who chooses to disposes of their waste in an inappropriate fashion. While firms can have a great impact on the natural environment, the responsibility should not be theirs alone.

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Track 4
Technical Session: 4
Mathematics

A New Approach for the Solution of Two Phase Parabolic Diffusion Equation

Bharti Gupta
Research Scholar, Department of Mathematics,
SLIET, Longowal 148106, Punjab, INDIA
goyal_bharti@rediffmail.com

V.K. Kukreja
Associate Professor, Department of Mathematics,
SLIET, Longowal 148106, Punjab, INDIA
vkkukreja@gmail.com

Abstract— A new numerical approach and methodology to solve two phase parabolic equation for Neumann and Robin boundary conditions, by using cubic B-spline collocation method is proposed. The advantage of the given scheme is that it can be conveniently applied to solve the complex problems and also reduces the size of computational work. The results are analyzed with respect to relative error by using the actual plant data available in literature. Also a uniform convergence of order at least two is obtained.

Keywords— Cubic B-spline; Neumann; Robin; shifted Legendre; shifted Chebyshev.

I. INTRODUCTION

In this article, versatile cubic B-spline collocation method (CSCM) is applied on an unsteady state transient mathematical model, used to study fluid flow through packed bed of porous, compressible and cylindrical shaped particles. This type of model is prominent among diffusion-dispersion and reaction in catalysts and porous solids, adsorption-desorption processes in bidisperse particles, and reaction or adsorption processes in packed columns.

In literature, research has focused on external mass transfer and macropore diffusion models [1-8]. Majority of the investigators have ignored the micro diffusion due to complex particle geometry of fibers and steep gradients near boundary. A very few [9-11] have focused on physical features of particle such as consistency, swollen radius, porosity etc.

The given two phase parabolic equation is considered to be one of the challenging problems for diffusion-dispersion equations, i.e.,

(a) Phase I: Model for the particle phase

$$\frac{\partial^2 Q}{\partial \eta^2} + \frac{1}{\eta}\frac{\partial Q}{\partial \eta} = \frac{\partial Q}{\partial \tau} + N_1\frac{(1-\omega)}{\omega}\frac{\partial N}{\partial \tau}, \tag{1}$$

with boundary conditions

$$\left.\frac{\partial Q}{\partial \eta}\right|_{\eta=0} = 0 ; \quad \left.\frac{\partial Q}{\partial \eta}\right|_{\eta=1} = -Bi(Q-C). \tag{2}$$

(b) Adsorption isotherm

$$\frac{\partial N}{\partial \tau} = \frac{R^2 k_1}{D_F}\left(C_1 Q(1-N) - \frac{N}{k}\right). \tag{3}$$

(c) Phase II: Model for bulk fluid

$$\frac{\partial C}{\partial \tau} = \frac{\psi}{Pe}\frac{\partial^2 C}{\partial \xi^2} - \psi\frac{\partial C}{\partial \xi} - \theta Bi\ \left. C - Q\right|_{\eta=1} , \tag{4}$$

with boundary conditions

$$\left(C - \frac{1}{Pe}\frac{\partial C}{\partial \xi}\right)_{\xi=0} = 0 ; \quad \left.\frac{\partial C}{\partial \xi}\right|_{\xi=1} = 0 , \tag{5}$$

and initial conditions

$$C = Q = N = 1 , \qquad \text{at } \tau = 0. \tag{6}$$

The formation of problem (1) to (6) is given in [11]. The model is discretized by radial domain for Phase I and axial domain for Phase II and both phases are related via Langmuir isotherm. Due to non linearity, model is quite complex, thus its exact solution is not possible. The results obtained from CSCM are proved cost effective, smooth, stable and fast as compare to other methods like orthogonal collocation method (OCM) and orthogonal collocation on finite elements (OCFE). It is also demonstrated convergence of CSCM of order $O(h^2)$.

II. CUBIC B-SPLINE COLLOCATION METHOD

A. Cubic B-spline Basis Functions

The cubic B-spline functions $B_m(x)$ are used as trial functions [12], i.e.,

$$B_m(x) = \frac{1}{h^3}\begin{cases}(x - x_{m-2})^3 & ,[x_{m-2}, x_{m-1}] \\ h^3 + 3h^2(x - x_{m-1}) + 3h(x - x_{m-1})^2 - 3(x - x_{m-1})^3 & ,[x_{m-1}, x_m] \\ h^3 + 3h^2(x_{m+1} - x) + 3h(x_{m+1} - x)^2 - 3(x_{m+1} - x)^3 & ,[x_m, x_{m+1}] \\ (x_{m+2} - x)^3 & ,[x_{m+1}, x_{m+2}] \\ 0 & ,\text{otherwise}\end{cases}$$

The B-spline basis functions in 2-D are defined by: $B_i^j(u,v) = B_i(u)B_j(v)$; $i, j = 1,2,3,4$, involving four control points. The basis functions are defined by:

$$B_1(u) = 1 - 3u + 3u^2 - u^3; \quad B_2(u) = 4 - 6u^2 + 3u^3;$$
$$B_3(u) = 1 + 3u + 3u^2 - 3u^3; \quad B_4(u) = u^3.$$

Similarly, $B_j(v)$'s are defined.

B. Selection of Collocation Points

The radial domain $0 \leq \eta \leq 1$ is divided into α small elements, i.e., η_α, $\alpha = 1, 2, ..., l+1$ with $\eta_1 = 0$ and $\eta_{l+1} = 1$. Each subdomain is mapped to $[0,1]$ by transformation,

$$u = \frac{\eta - \eta_\alpha}{\eta_{\alpha+1} - \eta_\alpha} = \frac{\eta - \eta_\alpha}{h_\alpha}, \quad \alpha = 1, 2, ..., l, \quad \text{where} \quad h_\alpha = \eta_{\alpha+1} - \eta_\alpha$$

is the length of the αth element in the radial direction. Within each element, zeros $u_2 = (1/2)(1 - 1/\sqrt{3})$ and $u_3 = (1/2)(1 + 1/\sqrt{3})$ of the shifted Legendre polynomial $P_2(x) = (2x-1)^2 - 1/3$ are used as collocation points. The end points of the elements are denoted by $u_1 = 0$ and $u_4 = 1$.

Similarly the axial domain $0 \leq \xi \leq 1$ is divided into β small elements i.e., ξ_β, $\beta = 1, 2, ..., m+1$ with $\xi_1 = 0$ and $\xi_{m+1} = 1$. Each subdomain is mapped to $[0,1]$ by transformation $v = \frac{\xi - \xi_\beta}{\xi_{\beta+1} - \xi_\beta} = \frac{\xi - \xi_\beta}{h_\beta}$, $\beta = 1, 2, ..., m$. The zeros $v_2 = (1/2)(1 - 1/\sqrt{2})$ and $v_3 = (1/2)(1 + 1/\sqrt{2})$ of the shifted Chebyshev polynomial $T_2(x) = 2(2x-1)^2 - 1$ are used as collocation points. The end points of the elements are denoted by $v_1 = 0$ and $v_4 = 1$.

C. Discretization of Model

Let $Q_\alpha^\beta(u, v, \tau)$ be approximation solution of $Q(u, v, \tau)$ in element (α, β), then $Q_\alpha^\beta(u, v, \tau)$ can be expressed in the B-splines basis by:

$$Q_\alpha^\beta(u, v, \tau) = \sum_{i,j=1}^{4} q_{i+\alpha-1}^{j+\beta-1}(\tau) B_i^j(u, v). \tag{7}$$

Similarly $N(u, v, \tau)$ can be approximated by:

$$N_\alpha^\beta(u, v, \tau) = \sum_{i,j=1}^{4} n_{i+\alpha-1}^{j+\beta-1}(\tau) B_i^j(u, v). \tag{8}$$

$C(v, \tau)$ in the element (α, β) is represented by:

$$C^\beta(v, \tau) = \sum_{j=1}^{4} c^{j+\beta-1}(\tau) B_j(v). \tag{9}$$

Using right hand side of (7) to (9) in (1), (3) and (4), residual equations becomes:

$$R_Q(u, v, \tau) = \sum_{i,j=1}^{4} \frac{dq_{i+\alpha-1}^{j+\beta-1}(\tau)}{d\tau} B_i^j(u, v) - \frac{1}{h_\alpha^2} \sum_{i,j=1}^{4} q_{i+\alpha-1}^{j+\beta-1}(\tau) \frac{\partial^2 B_i^j}{\partial u^2}(u, v)$$

$$- \frac{1}{(uh_\alpha + \eta_\alpha)h_\alpha} \sum_{i,j=1}^{4} q_{i+\alpha-1}^{j+\beta-1}(\tau) \frac{\partial B_i^j}{\partial u}(u, v) + N_t \frac{1-\omega}{\omega} \sum_{i,j=1}^{4} \frac{dn_{i+\alpha-1}^{j+\beta-1}(\tau)}{d\tau} B_i^j(u, v), \tag{10}$$

$$R_N(u, v, \tau) = \sum_{i,j=1}^{4} \frac{d\tau}{d\tau} n_{i+\alpha-1}^{j+\beta-1}(\tau) B_i^j(u, v) - \frac{R^2 k_t}{D_P} \left[C_t \sum_{i,j=1}^{4} q_{i+\alpha-1}^{j+\beta-1}(\tau) B_i^j(u, v) \left(1 - \sum_{i,j=1}^{4} n_{i+\alpha-1}^{j+\beta-1}(\tau) B_i^j(u, v) \right) \right]$$

$$- \frac{R^2 k_t}{D_P} \cdot \frac{1}{k} \sum_{i,j=1}^{4} n_{i+\alpha-1}^{j+\beta-1}(\tau) B_i^j(u, v), \tag{11}$$

$$R_C(v, \tau) = \sum_{j=1}^{4} \frac{d\tau}{d\tau} c^{j+\beta-1}(\tau) B^j(v) - \frac{\psi}{Peh_\beta^2} \sum_{j=1}^{4} c^{j+\beta-1} B_j''(v) + \frac{\psi}{h_\beta} \sum_{j=1}^{4} c^{j+\beta-1} B_j'(v)$$

$$+ \theta Bi \left(\sum_{j=1}^{4} c^{j+\beta-1} B_j(v) - \sum_{i,j=1}^{4} q_{i+1-1}^{j+\beta-1}(\tau) B_i^j(1, v) \right). \tag{12}$$

After discretization the boundary conditions (2) and (5), can be written as:

$$q_1^{j+\beta-1}(\tau) = q_3^{j+\beta-1}(\tau), \ j = 1, 2, 3, 4; \ \beta = 1, 2, ..., m,$$

$$\frac{q_{l+3}^{j+\beta-1}(\tau)}{2} - \frac{q_{l+1}^{j+\beta-1}(\tau)}{2} = -h_\alpha Bi \left(\frac{q_{l+1}^{j+\beta-1}(\tau)}{6} + \frac{2q_{l+2}^{j+\beta-1}(\tau)}{3} + \frac{q_{l+3}^{j+\beta-1}(\tau)}{6} - c^{j+\beta-1}(\tau) \right) \tag{13}$$

$$c^1(\tau) + 4c^2(\tau) + c^3(\tau) - \frac{1}{Peh_\beta} \left(3c^3(\tau) - 3c^1(\tau) \right) = 0; \ c^{m+1}(\tau) = c^{m+3}(\tau). \tag{14}$$

And initial condition (1.6) becomes:

$$c^{j+\beta-1}(0) = 1; \quad q_{i+\alpha-1}^{j+\beta-1}(0) = 1; \quad n_{i+\alpha-1}^{j+\beta-1}(0) = 1. \tag{15}$$

The above discretization leads to a system of $(m+3)(2l+7)$ differential algebraic equations (DAEs) and same number of unknowns.

III. RESULTS AND DISCUSSION

The stiff system of DAEs (10) to (14) is solved by CSCM on two collocation points within each element using MATLAB ode15s solver. The initial approximation is taken from (15). Two types of estimates, average solute concentration (c_{av}) and exit solute concentration (c_e), are obtained. The experimental data of [11] collected form a paper mill is used to compute average solute concentration (c_{av}). In Table I, the relative error clearly demonstrates the superiority in numerical results obtained by CSCM over OCFE [11].

The computational cost of CSCM is found by calculating the total time elapsed (in seconds) for execution of MATLAB program for evaluation of c_e at different Peclet numbers (Pe). For better comparison purpose same number of partitions were used as in [11] through OCFE. Results in Table II, indicate a 10 fold decline in the computational time, thereby establishing that the technique of CSCM is cost effective.

In Fig. 1, the exit solute concentration profiles for different Biot numbers (Bi) are plotted, for same partition points, by three different numerical techniques viz: OCM, OCFE and CSCM. Clearly, the break through curves of CSCM show that results obtained for different values of Bi are smooth, stable and fast as compared to other methods like OCM and OCFE.

In [1], it has been found that $Pe = 40$, $Bi = 10$ and $\varepsilon = 0.968$ are ideal parameters for pulp washing operation.

Using this as the reference point, rate of convergence of the l = m = 100 were considered as exact solution. A uniform convergence of order at least two is obtained as shown in Table III.

IV. CONCLUSIONS

The technique of cubic B-spline collocation method is applied to solve a system of two phase parabolic equations for Neumann and Robin boundary conditions. The outputs show superiority of CSCM over OCM and OCFE. CSCM is found to be conceptually simple, easy in implementation, computationally economical and reliable with order of convergence minimum two, therefore it can be extended to solve a wide variety of engineering problems.

TABLE I.   RELATIVE ERROR OF EXPERIMENTAL VALUES WITH OCFE [11] AND CSCM.

Time (s)	c_{av} (Exp.)	c_{av} (OCFE)	c_{av} (CSCM)	Error (OCFE)	Error (CSCM)
20	0.6475	0.6337	0.6411	2.13E-02	9.88E-03
30	0.4507	0.4445	0.4453	1.38E-02	1.20E-02
35	0.3758	0.3682	0.3786	2.02E-02	7.45E-03
40	0.2806	0.2829	0.2792	8.20E-03	4.99E-03
45	0.2394	0.2319	0.2367	3.13E-02	1.13E-02
50	0.1514	0.1577	0.1531	4.16E-02	1.12E-02

TABLE II.   ELAPSED TIME (IN SEC) FOR $Bi = 0.67, \varepsilon = 0.968$.

Parameters	OCFE	CSCM
Pe = 2	332.077670	36.158440
Pe = 10	458.553704	40.090552
Pe = 26.4	505.901121	42.048752

method is estimated. In this computation, results at

TABLE III.   RATE OF CONVERGENCE OF CSCM FOR $Bi = 10, \varepsilon = 0.968$.

Parameter (Pe)	l = m	Rate of convergence
10	5	-
	10	2.4319E+00
	20	2.3300E+00
20	7	-
	14	2.2776E+00
	28	2.1395E+00
40	10	-
	20	2.1637E+00
	40	2.1204E+00
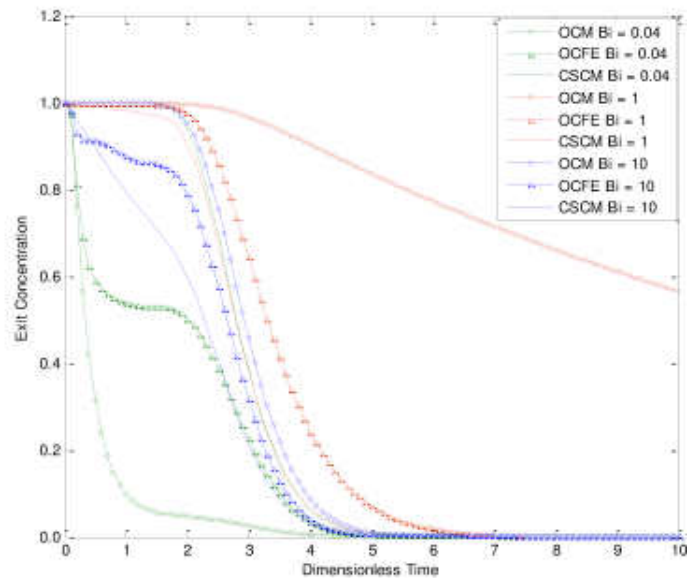
Fig. 1.   Exit concentration profile for OCM, OCFE and CSCM
Pe = 40, $\varepsilon = 0.965$ and Bi = 0.04, 1, 10.

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Level Cut of Fuzzy Graph

P.K. Sharma
P.G. Deptt. of Mathematics,
D.A.V. College, Jalandhar, Punjab
e-mail : pksharma@davjalandhar.com

Vandana Bansal
PTU, Jalandhar, Punjab
e-mai:bansalvandana@yahoo.com

Abstract: The concept of Graph Theory was introduced by Euler in 1741. The notion of fuzzy sets was discussed by L.A. Zadeh in 1965[1]. Using the concept of fuzzy subsets, the notion of fuzzy graph was introduced by A. Rosenfeld in 1975(cf.[3]). The motivation of this paper is the same as that of level subsets in fuzzy sets. In this paper some interesting properties of level cut of fuzzy graphs will be discussed which will help in the development of fuzzy graph theory.

Keywords: Subgraph, fuzzy graph, t-level cut of fuzzy graph.

I. INTRODUCTION

The subject Graph Theory is considered to have its origin in the famous Königsberg bridge problem settled by Euler in 1741. The first theorem of Graph Theory is due to Euler [2]. The notion of fuzzy sets was introduced by L.A. Zadeh in 1965[1]. It involves the concept of a membership function defined on a universal set. The value of the membership function lies in [0,1]. Using the concept of fuzzy subsets, the idea of fuzzy graph was introduced by A. Rosenfeld in 1975(cf.[3]). In this paper some interesting properties of t-level cut of fuzzy graphs are discussed.

II. PRELIMINARIES

Definition (2.1) [4] (Fuzzy Graph): Let V be a non-empty set. A fuzzy graph is a pair of functions G: (σ, μ) where σ is a fuzzy subset of V and μ is a symmetric fuzzy relation on σ. i.e. $\sigma: V \rightarrow [0,1]$ and $\mu: V \times V \rightarrow [0,1]$ such that $\mu(u, v) \leq \sigma(u) \wedge \sigma(v)$ for all u, v in V.

The crisp graph of a fuzzy graph G: (σ, μ) is denoted by $G^*: (\sigma^*, \mu^*)$, where σ^* is referred to as the (non-empty) set V of nodes (or vertices) and $\mu^* = E \subseteq V \times V$. The crisp graph (V, E) is a special case of a fuzzy graph with each vertex and edge of (V, E) having degree of membership 1.

Definition(2.2)[4] (Partial Fuzzy Subgraph) The fuzzy graph H: (τ, ν) is called a partial fuzzy subgraph of G:(σ, μ) if $\tau \subseteq \sigma$ and $\nu \subseteq \mu$. In particular, H:(τ, ν) is called a fuzzy subgraph of G:(σ, μ) if $\tau(u) = \sigma(u)$ for all $u \in \tau^*$ and $\nu(u, v) = \mu(u, v)$ for all $(u, v) \in \nu^*$

Definition (2.3) [4] A fuzzy graph G: (σ, μ) is strong if $\mu(u, v) = \sigma(u) \wedge \sigma(v)$ for all u, v in μ^* and is complete if $\mu(u, v) = \sigma(u) \wedge \sigma(v)$ for all u, v in σ^*.

Definition(2.4)[4] (Path in a fuzzy graph) A path P in a fuzzy graph G: (σ, μ) is a sequence of distinct nodes $u_0, u_1 \ldots u_n$ such that $\mu(u_{i-1}, u_i) > 0$, $1 \leq i \leq n$.

Here $n \geq 1$ is called the length of the path P. A single node u may also be considered as a path. In this case the path is of length o. The consecutive pairs (u_{i-1}, u_i) are called arcs of the path. We call P a cycle if $u_0 = u_n$ and $n \geq 3$.

Definition(2.5)[4] (Strength of a path) The strength of a path P is defined as $\wedge \mu(u_{i-1}, u_i) > 0$, $1 \leq i \leq n$ or, the strength of a path is defined to be the degree of membership of a weakest arc of the path.

Definition(2.6)[4] (Strength of connectedness) A strongest path joining any two nodes u and v is that path which has strength $\mu^\infty(u, v)$ and $\mu^\infty(u, v)$ is called the strength of connectedness between u and v.

Definition(2.7)[4] A fuzzy graph is connected if any two nodes are joined by a path.

Note. A fuzzy graph is connected if and only if $\mu^\infty(u, v) > 0$ for all u, v $\in$ V.

III. LEVEL CUT OF FUZZY GRAPHS AND THEIR PROPERTIES

Definition (3.1) Let $G = (\sigma, \mu)$ be a fuzzy graph on the set V, where σ is a fuzzy set on V and μ is a symmetric relation on σ. (i.e. $\mu \subseteq \sigma \times \sigma$). The crisp graph of the fuzzy graph G is denoted by $G^* = (V, E)$, where $E \subseteq V \times V$. For any real number $t \in [0,1]$, the t-level cut of the fuzzy graph G denoted by $^tG = (\sigma^t, \mu^t)$ is a subgraph of the crisp graph G^*, where $\sigma^t = \{ v \in V: \sigma(v) \geq t \}$ and $\mu^t = \{(u, v) \in E: \mu(u, v) \geq t \}$

Remarks (3.2) From the definition of t-level cut of fuzzy graph, we note the following:

a) $\sigma^t \subseteq V$

b) $\mu^t \subseteq E$

c) Since $\mu(u, v) \leq \sigma(u) \wedge \sigma(v)$ for all u, v in V which implies that $\mu^t \subseteq \sigma^t \times \sigma^t$ so we have (σ^t, μ^t) is a graph with vertex set σ^t and edge set μ^t for $t \in [0,1]$.

d) If $t_1 < t_2$ be any two real numbers, then $\sigma^t_2 \subseteq \sigma^t_1$ and $\mu^t_2 \subseteq \mu^t_1$.

e) If $t_1 < t_2$ be any two real numbers, then ^{t_2}G is subgraph of ^{t_1}G.

f) If G is a fuzzy graph, then $^tG = (\sigma^t, \mu^t)$ is a subgraph of the crisp graph G^*

g) Clearly, $\sigma^0 = V$ and $\mu^0 = E$

Proposition (3.3) Let $G = (\sigma, \mu)$ be a fuzzy graph and $t \in [0,1]$ be any real number, then $\sigma^1 \subseteq \sigma^t$ and $\mu^1 \subseteq \mu^t$

Proof. Since $t \leq 1$, then by remark (3.2)(d), we get

$\sigma^1 \subseteq \sigma^t$ and $\mu^1 \subseteq \mu^t$.

Theorem (3.4) G: (σ, μ) is a fuzzy graph of G^* :(σ^*, μ^*) if and only if ^tG: (σ^t, μ^t) is a subgraph for all $t \in [0,1]$

Proof : Firstly, let G: (σ, μ) be a fuzzy graph of G^*: (σ^*, μ^*). Let $t \in [0,1]$. Then $^tG = (\sigma^t, \mu^t)$ where $\sigma^t = \{ v \in V : \sigma(v) \geq t\}$ and $\mu^t = \{(u, v) \in E : \mu(u, v) \geq t\}$.

Since $\sigma^t \subseteq V$ and $\mu^t \subseteq E$.

Therefore ^tG is a sub graph of the crisp graph G^*.

Conversly, let ^tG: (σ^t, μ^t) is subgraph of G^*, for all $t \in [0,1]$.

To Prove G : (σ, μ) is a fuzzy graph. For this we show that μ is a symmetric fuzzy relation on σ and $\mu(u, v) \leq \sigma(u) \wedge \sigma(v)$ for all u, v $\in$ V.

Now, $\sigma^t \subseteq V$ and $\mu^t \subseteq E$. Also $\sigma \subseteq V$ and $\mu \subseteq E$.

Clearly, μ is a symmetric fuzzy relation on σ.

If possible, let $\mu(u, v) > \sigma(u) \wedge \sigma(v)$ (1)
for some u, v $\in$ V

let $\sigma(u) = t_1$ and $\sigma(v) = t_2$

Let $t_3 = Min \{ t_1, t_2\} = \sigma(u) \wedge \sigma(v)$ (2)

i.e $t_1 \geq t_3$ and $t_2 \geq t_3$

Suppose $\mu(u, v) = t$ where $t > t_3$ (from (1))

$\Rightarrow (u, v) \in \mu^t \subseteq \sigma^t \times \sigma^t$

But $u \in \sigma^t$ and $v \in \sigma^t$ $\Rightarrow$ $\sigma(u) \geq t$ and $\sigma(v) \geq t$ and so $\sigma(u) \wedge \sigma(v) \geq t$

i.e. $t_3 > t$ (using (2)) , which is a contradiction to our supposition

Thus $\mu(u, v) \leq \sigma(u) \wedge \sigma(v)$

Hence G is a Fuzzy graph.

Definition (3.5) (Level cut of intersection of Fuzzy Graphs)

Let G_1: (σ_1, μ_1) and G_2: (σ_2, μ_2) be two fuzzy graphs, where μ_1 and μ_2 are fuzzy relations on V_1 and V_2 respectively. The intersection of two fuzzy graphs is a fuzzy graph $G_1 \cap G_2$: (σ, μ) : $(\sigma_1 \cap \sigma_2, \mu_1 \cap \mu_2)$ where $\sigma = \sigma_1 \cap \sigma_2$, $\mu = \mu_1 \cap \mu_2$ and μ is a fuzzy relation on $V_1 \cap V_2$, then level cut of intersection of fuzzy graphs is $^t(G_1 \cap G_2)$: (σ^t, μ^t) where

$\sigma^t = \{ u \in V_1 \cap V_2 : \sigma(u) \geq t \}$ and

$\mu^t = \{ (u, v) \in E_1 \cap E_2 : \mu(u, v) \geq t \}$

Proposition (3.6) Let G_1: (σ_1, μ_1) and G_2: (σ_2, μ_2) be two fuzzy graphs. Then

(i) $(\sigma_1 \cap \sigma_2)^t = \sigma_1^t \cap \sigma_2^t$

(ii) $(\mu_1 \cap \mu_2)^t = \mu_1^t \cap \mu_2^t$

Proof (i) Now,

$(\sigma_1 \cap \sigma_2)^t = \{ u \in V_1 \cap V_2 : \sigma(u) \geq t \}$

$= \{ u \in V_1 \cap V_2 : (\sigma_1 \cap \sigma_2)(u) \geq t\}$

$= \{ u \in V_1: \sigma_1(u) \geq t \} \cap \{ u \in V_2 : \sigma_2(u) \geq t\}$

$= \sigma_1^t \cap \sigma_2^t$

(ii) Also,

$(\mu_1 \cap \mu_2)^t = \{ (u, v) \in E_1 \cap E_2 : \mu(u, v) \geq t \}$

$= \{(u, v) \in E_1 \cap E_2 : (\mu_1 \cap \mu_2)(u, v) \geq t\}$

$= \{(u, v) \in E_1: \mu_1(u, v) \geq t \} \cap \{(u, v) \in E_2 : \mu_2(u, v) \geq t\}$

$= \mu_1^t \cap \mu_2^t$

Theorem (3.7) Let G_1: (σ_1, μ_1) and G_2: (σ_2, μ_2) be two fuzzy graphs and $t \in [0,1]$ be any real number, then
$${}^t(G_1 \cap G_2) = {}^t G_1 \cap {}^t G_2$$

Proof : This follows immediately by Proposition (3.6) and definition (3.1)

Example 1. Consider the graphs G_1 and G_2.

G_1

G_2
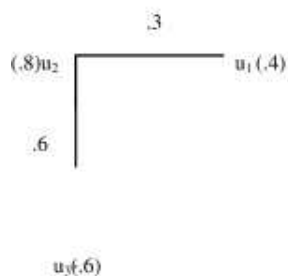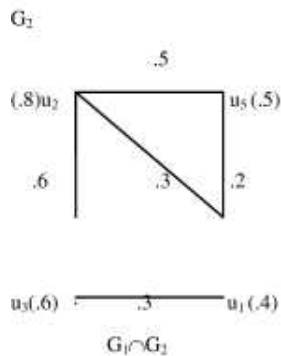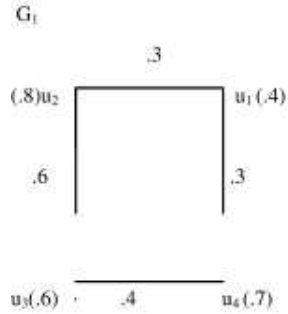
$G_1 \cap G_2$

Let $t = 0.4$, then ${}^t G_1 = {}^{0.4} G_1$
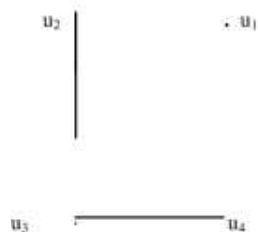
${}^t G_2 = {}^{0.4} G_2$
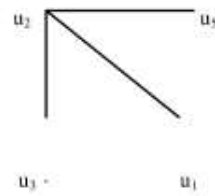
${}^t(G_1 \cap G_2) = {}^{0.4}(G_1 \cap G_2)$

${}^t G_1 \cap {}^t G_2 = {}^{0.4} G_1 \cap {}^{0.4} G_2$

Definition (3.8) (Level cut of union of Fuzzy Graphs)

Let G_1: (σ_1, μ_1) and G_2: (σ_2, μ_2) be two fuzzy graphs where μ_1 and μ_2 are fuzzy relations on V_1 and V_2 respectively. The union of two fuzzy graphs is a fuzzy graph $G = G_1 \cup G_2$: (σ, μ): $(\sigma_1 \cup \sigma_2, \mu_1 \cup \mu_2)$ where $\sigma = \sigma_1 \cup \sigma_2$, $\mu = \mu_1 \cup \mu_2$ and μ is a fuzzy relation on $V_1 \cup V_2$, then level cut of union of fuzzy graphs is defined as ${}^t(G_1 \cup G_2)$: (σ^t, μ^t) where

$$\sigma^t = \{ u \in V_1 \cup V_2 : \sigma(u) \geq t \} \text{ and}$$

$$\mu^t = \{ (u, v) \in E_1 \cup E_2 : \mu(u, v) \geq t \}$$

Proposition (3.9) Let G_1: (σ_1, μ_1) and G_2: (σ_2, μ_2) be two fuzzy graphs. Then

(i) $(\sigma_1 \cup \sigma_2)^t = \sigma_1^t \cup \sigma_2^t$

(ii) $(\mu_1 \cup \mu_2)^t = \mu_1^t \cup \mu_2^t$

Proof: (i) Now,

$$(\sigma_1 \cup \sigma_2)^t = \{ \, u \in V_1 \cup V_2 \; : \sigma(u) \geq t \, \}$$

$$= \{ \, u \in V_1 \cup V_2 \; : (\sigma_1 \cup \sigma_2)(u) \geq t \, \}$$

$$= \{ \, u \in V_1 : \sigma_1(u) \geq t \, \} \cup \{ \, u \in V_2 : \sigma_2(u) \geq t \, \}$$

$$= \sigma_1^t \cup \sigma_2^t$$

(ii) Also,

$$(\mu_1 \cup \mu_2)^t = \{ \, (u, v) \in E_1 \cup E_2 \; : \mu(u, v) \geq t \, \}$$

$$= \{ (u, v) \in E_1 \cup E_2 \; : (\mu_1 \cup \mu_2)(u,v) \geq t \, \}$$

$$= \{ (u, v) \in E_1 : \mu_1(u,v) \geq t \, \} \cup \{ (u, v) \in E_2 : \mu_2(u,v) \geq t \}$$

$$= \mu_1^t \cup \mu_2^t$$

Theorem (3.10) Let $G_1 : (\sigma_1, \mu_1)$ and $G_2 : (\sigma_2, \mu_2)$ be two fuzzy graphs and $t \in [0,1]$ be any real number, then $^t(G_1 \cup G_2) = {}^t G_1 \cup {}^t G_2$

Proof : This follows immediately by Proposition (3.9) and definition (3.1)

Example 2. Consider the graphs G_1 and G_2

G_1

$u_2(.5) \quad \cdot \quad .5 \quad u_3(.6)$

G_2

$u_5(.8)$
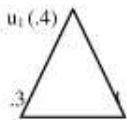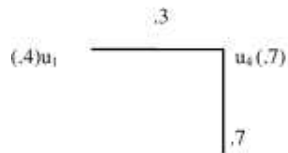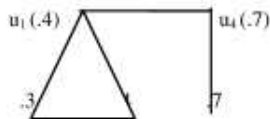
$G_1 \cup G_2$

$u_2(.5) \quad \cdot \quad .5 \quad u_3(.6) \qquad u_5(.8)$

Let $t = 0.5$, then $^t G_1 = {}^{0.5} G_1$

$^t G_2 = {}^{0.5} G_2$

$^t(G_1 \cup G_2) = {}^{0.5}(G_1 \cup G_2)$

$^t G_1 \cup {}^t G_2 = {}^{0.5} G_1 \cup {}^{0.5} G_2$
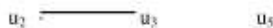
Theorem (3.11) If $G_1 : (\sigma_1, \mu_1)$ and $G_2 : (\sigma_2, \mu_2)$ be two fuzzy graphs, then $G_1 \cap G_2$ is also a fuzzy graph.

Proof: By Theorem (3.4), $G_1 \cap G_2$ is a fuzzy graph if and only if $^t(G_1 \cap G_2)$ is subgraph for all $t \in [0,1]$.

But $\quad {}^t(G_1 \cap G_2) = {}^t G_1 \cap {}^t G_2$ [by Theorem (3.7)]

And both $^t G_1$ and $^t G_2$ are subgraphs. As intersection of two subgraphs is a subgraph.

Also intersection of two subgraphs is a subgraph

i.e. $\quad {}^t G_1 \cap {}^t G_2$ is a subgraph

$\Rightarrow {}^t(G_1 \cap G_2)$ is a subgraph

$\Rightarrow G_1 \cap G_2$ is a fuzzy graph (By Theorem (3.4))

Theorem (3.12) If G_1: (σ_1, μ_1) and G_2: (σ_2, μ_2) be two fuzzy graphs, then $G_1 \cup G_2$ is also a fuzzy graph.

Proof: By Theorem (3.4), $G_1 \cup G_2$ is a fuzzy graphs if and only if ${}^t(G_1 \cup G_2)$ is subgraph

But ${}^t(G_1 \cup G_2) = {}^t G_1 \cup {}^t G_2$ [By Theorem (3.10)]

And both ${}^t G$ and ${}^t G_2$ are subgraphs. As know that intersection of two subgraphs is a subgraph.

Therefore, ${}^t G_1 \cup {}^t G_2$ is a subgraph

$\Rightarrow {}^t(G_1 \cup G_2)$ is a subgraph

$\Rightarrow G_1 \cup G_2$ is a fuzzy graph.

Theorem(3.13): Let $\bar{G}$:$(\bar{\sigma}, \bar{\mu})$ denote the complement of the fuzzy graph $G = (\sigma, \mu)$ and $t \in [0,1]$ be any real number ${}^t\bar{G} = \overline{{}^tG}$.

Proof: Let G: (σ, μ) be a fuzzy graph of G^*: (σ^*, μ^*). Its complement $\bar{G}$: $(\bar{\sigma}, \bar{\mu})$ is a fuzzy graph, where $\bar{\sigma} = \sigma$, $\bar{\mu}(u, v) = \sigma(u) \wedge \sigma(v) - \mu(u, v)$

Let ${}^tG = (\sigma^t, \mu^t)$ be the t- level cut subgraph, where

$\sigma^t = \{v \in V : \sigma(v) \geq t\}$ and $\mu^t = \{(u, v) \in E : \mu(u, v) \geq t\}$

Also ${}^t\bar{G} = (\bar{\sigma}^t, \bar{\mu}^t)$, where $\overline{(\sigma^t)} = \sigma^t$ and

$\bar{\mu}^t(u, v) = \bar{\sigma}^t(u) \wedge \bar{\sigma}^t(v) - \mu^t(u, v)$

Since $\overline{(\sigma^t)} = \sigma^t$, ----(1) and $\bar{\sigma} = \sigma$ ----(2)

Also $\bar{\sigma}^t = \sigma^t$ -----(3),

From (1) and (3), we have $\overline{(\sigma^t)} = \bar{\sigma}^t$. Also,

$\overline{(\mu^t)}(u, v) = \overline{(\sigma^t(u) \wedge \sigma^t(v) - \mu^t(u, v))}$

$\qquad = \bar{\sigma}^t(u) \wedge \bar{\sigma}^t(v) - \mu^t(u, v)$

$\qquad = \bar{\sigma}^t(u) \wedge \bar{\sigma}^t(v) - \mu^t(u, v)$

$\bar{\mu}^t(u, v) = (\sigma(u) \wedge \sigma(v) - \mu(u, v))^t$

$\qquad = (\sigma^t(u) \wedge \sigma^t(v) - \mu^t(u, v)$

Therefore $\overline{(\mu^t)}(u, v) = \bar{\mu}^t(u, v)$

Thus $\overline{(\sigma^t)} = \bar{\sigma}^t$

And $\overline{(\mu^t)}(u, v) = \bar{\mu}^t(u, v)$

Hence $\overline{{}^tG} = {}^t\bar{G}$.

Types of arcs and their level cut in fuzzy graphs

The strength of connectedness plays an important role in the structure of levelcut of fuzzy graph. The three types of arcs can be defined on the basis of the CONN ${}^tG(x, y)$ of an arc (x, y) in a level cut ${}^tG$ of fuzzy graph G.

Note:- CONN ${}^t_{G-(x,y)}(x, y)$ = the strength of connectedness between the nodes x and y in the fuzzy graph obtained from G by deleting the arc(x,y).

Definition(3.14) An arc (x, y) of ${}^tG$ is called α-strong if $\mu(xy) > $ CONN${}^t_{G-(x,y)}(x, y)$

Definition(3.15) An arc (x, y) of ${}^tG$ is called β-strong if $\mu(xy) = $ CONN${}^t_{G-(x,y)}(x, y)$

Definition(3. 16) An arc (x, y) of ${}^tG$ is called δ-strong if $\mu(xy) < $ CONN${}^t_{G-(x,y)}(x, y)$

Definition(3.17) An arc (x, y) of ${}^tG$ is called δ^*-strong if $\mu(xy) > \mu(uv)$, where (u, v) is the weakest arc in fuzzy graph

Definition (3.18) A graph ${}^tG$ is called an α-strong path if all its arcs are α-strong and is called a β-strong path if all its arcs are β-strong.

Remark (3.19) Arc of a fuzzy graph preserves its nature in level cuts provided arc exists in the level cuts.

Example(3.20) Let G:(V, E, σ, μ) be V=(u, v, w, x) E={uv, vw, uw, wx, xu}, where, $\mu(u,v)=1= \mu(w,v)$, $\mu(u,w)=0.4$, $\mu(u,x)=.1$ and $\sigma = \{1,1,1,.5\}$ so (u,v), (v,w) and (w,x) are α strong arc and (x,u) and (u,w) are δ-strong arc.

If t= .4 then $^tG = {}^{.4}G$ is as shown below
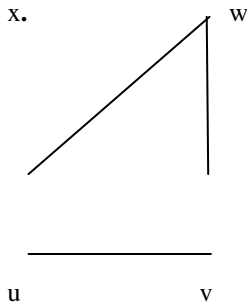
Here (u,v) and (v,w) are α strong arc and (u,w) is δ-strong arc.

Types of vertices and their level cut in fuzzy graph:

Definition(3.21)   Let $^tG = (V,E)$ be a crisp graph of fuzzy graph $G = (V, E, \sigma, \mu)$ and $x \in V$ be any vertex. Then x is called a super strong vertex if CONNG $(x,y) = p$, for every $y (\neq x) \in V$ and for some $p \in (0,1]$

Remark (3.22) Vertices of a fuzzy graph preserves its type in level cuts provided vertices exist in the level cuts.

Example (3.23) Consider the following fuzzy graph
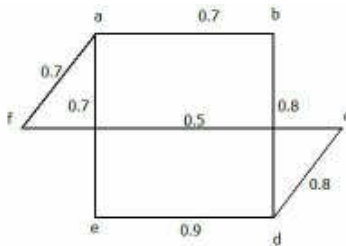
Here a and f are the only super strong vertices

If t= .8 , then $^tG = {}^{.8}G$

Here also a and f are the only super strong vertices.

Theorem (3.24) If a fuzzy graph G: (σ, μ) is connected, then its level cut ^tG: (σ^t, μ^t) may or may not be connected.

For example:--

$u_1(.3)$

$.2$ $.3$

(1)u_2 $.7$ $u_3 (.8)$

$.8$ $.5$ $.5$

(1) u_4 $.9$ $u_5 (.9)$
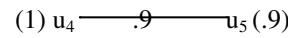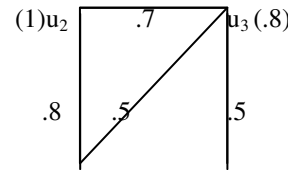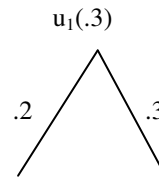
If t = .6 then $^tG = {}^{.6}G$ as shown below

u_2 u_3

u_4 u_5
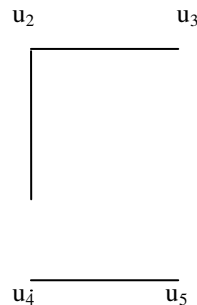
then $^tG = {}^{.6}G$ is also connected. As any two nodes are joined by a path but when we take t= .4 then $^tG = {}^{.4}G$ (as shown below) it is not connected as node u_1 cannot be joined to other nodes by any path
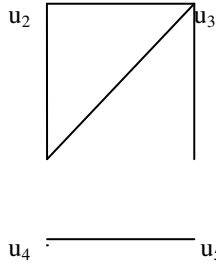
IV. CONCLUSION

In the theory of fuzzy sets, level sets are extremely important tools for the development of the theory, Similarly Level cut of fuzzy graph theory play an important role in the development of the theory of fuzzy graphs.

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Z-Connected Spaces

Shallu Gupta
Dept. of Mathematics, S.D. College
Ambala Cantt, India
sha31582@Yahoo.Com

Gurjeet kaur
Dept. of Mathematics, S.D. College
Ambala Cantt, India
chawla_gurjeet@yahoo.com

Abstract- All of us known that a space is connected if and only if any continuous map from it to the discrete space {0, 1} is constant. It would be interesting to see what concept arises if the discrete space of two points is replaced by some other spaces. Let Z be a T_1 space which has more than one point, then a space X is said to be Z-connected if and only if any continuous map from X to Z is constant. It can be shown that this idea generates some stronger notion of connectedness

Keywords:- Connectedness; discrete topology; homeomorphic

I. INTRODUCTION

The notion of connectedness is very important in higher analysis, geometry and topology -- indeed, in almost any subject for which the notion of topological space is relevant. When discussing the concept of connectedness, we often come across the equivalent criterion that a space is connected if and only if any continuous map from it to the discrete space {0,1} is constant. It would be interesting to

see what concept arises if the discrete space of two points is replaced by some other spaces. Let Z be a T_1 space which has more than one point, then a space X is said to be Z-connected if and only if any continuous map from X to Z is constant. It can be shown that this idea generates some stronger

notion of connectedness and this stronger notion has many similarities with the usual concept of connectedness. The first nontrivial example of Z-connected space can be constructed by taking Z to be the space **Z** of integers equipped with the complement finite topology. In this paper we review the concept of connected spaces and we define the concept of Z-connected spaces and shown that how the definition is obtained, and how it is similar to the connectedness. It will also be shown that the Z-connectedness is a stronger notion of connectedness.

II. MAIN RESULTS

A connected space is the one that cannot be separated into two or more parts. It is easy to see that the subspace [0, 1] in the real line is connected, whereas the subspace $[0, 1] \cup [2, 3]$ is not connected. A space X is connected if and only if any continuous map f from X to the discrete space {0, 1} is constant. There is another equivalent criterion, which is often taken as the definition.

It makes use of the concept of separation. A separation of a space X means a pair of nonempty open sets U and V, such that $U \cup V = X$ and $U \cap V = \phi$

In symbols, $X = U | V$.

A topological space X is connected if and only if it has no separation.

Examples of Connected Spaces

(1)Every indiscrete space is connected

(2)Co-finite topological space is connected

(3)Every real line is connected space

Examples of Not connected Spaces

(1)Every discrete space containing two or more points is not connected space

(2)Subspace Q of R is not connected space.

Concept of Z-Connectedness Recall the definition of connectedness, a space X is connected if and only if any continuous map from X to two-point space with the discrete topology is constant. The concept of Z-connectedness is obtained by replacing the discrete space {0, 1} by some other space Z.

Definition 3.1 Let Z be a topological space with more than one point. A space X is Z- connected if and only if any continuous map from X to Z is constant.

Note that in the above definition, Z is restricted to be a space with more than one point. Otherwise, the image of X is always constant and the definition makes no sense. As an immediate consequence, the following proposition can be proved.

PROPOSITION 3.2 Z-connected space is connected.

Proof: Since Z has at least two points, there exists a continuous injection i such that $i : \{0, 1\} \rightarrow Z$. Then for any continuous map $f : X \rightarrow \{0, 1\}$, iof is also a continuous function.

Now X is Z-connected, by definition, iof is constant, thus f is constant. Therefore, X is connected.

This proposition ensures that the new Z-connectedness is stronger than original connectedness, and the definition of Z-connected spaces is suitable for the purpose of finding a stronger notion of connectedness.

EXAMPLES OF Z-CONNECTED SPACES

To get a better understanding of Z-connected spaces, we need some examples. If a space X is Z-connected, the property of X

depends greatly on the space Z. So we start our discussion with various spaces Z. There are two approaches: the connectedness of Z and the topological property of Z. First let's begin with the connectedness of Z. Roughly speaking, there are three possibilities:

(1) Z is totally disconnected

(2) Z is a collection of connected components, i.e. $Z = \{Z_\lambda \mid \lambda \in \Lambda\}$

(3) Z is connected

The following proposition shows that if Z is totally disconnected, the definition of Z- connectedness has the same meaning as the usual connectedness.

PROPOSITION 3.3: If Z is totally disconnected, Z-connectedness is equivalent to connectedness.

Proof: By Def., if X is Z-connected, it is connected.

Conversely, if X is connected and Z is totally disconnected, then for any Continuous map $f : X \to Z$, f [X] is connected. However, the only connected subset of Z is one point space, so f is constant. Therefore, X is Z-connected.

The next proposition shows that Z may be assumed to be connected.

PROPOSITION 3.4: Let Z be a space that is not totally disconnected and let $Z = \{Z_\lambda \mid \lambda \in \Lambda\}$ be the collection of all connected components of Z. Then for any space X, X is Z-connected if and only if X is Z_λ-connected for all $\lambda \in \Lambda$.

Proof: Suppose X is Z-connected. By definition, any continuous map from X to Z is constant. For all $\lambda \in \Lambda$, The inclusion $i_\lambda: \lambda \to Z$ is an injective continuous map. For any continuous map

$f : X \to Z_\lambda$, $i_\lambda \circ f : X \to Z$ is continuous and constant. Therefore f is constant, i.e. X is Z_λ- connected.

Conversely, suppose X is Z_λ-connected for all $\lambda \in \Lambda$. Since Z is not totally is connected, there exists at least a Z_α having more than one point. X is Z_α-connected, so X is connected. For any continuous map g: $X \to Z$, g[X] is connected and belongs to some Z_β. X is Z_β-connected, so g is constant, X is Z-connected. Next, we shall see how the space X varies when different topologies are added to a two point set $\{0, 1\}$. Then there are only three types of topologies on Z, namely, indiscrete topology, order topology, and discrete topology.

For simplicity, we write

2i: the space $\{0, 1\}$ with indiscrete topology, whose open sets are $\varnothing, \{0, 1\}$;

2o: the space $\{0,1\}$ with order topology, whose open sets are $\varnothing, \{0\}, \{0, 1\}$;

2d: the space $\{0, 1\}$ with discrete topology, whose open sets are $\varnothing, \{0\}, \{1\}, \{0, 1\}$;

Claim: X is 2i-connected, if and only if X is a one-point space.

Proof: If X is a one-point space, for any continuous map $f : X \to Z$, f (X) is constant.

Conversely, if X has more than one point, $X = U \cup V$, where U and V nonempty and disjoint.

Define $f : X \to Z$ by f [U] = 0 , f [V] = 1.

This function is continuous but not constant.

Thus X is not 2i-connected. Therefore X is not Z connected except that X is one-point.

Claim: X is 2o-connected if and only if X is indiscrete.

Proof: If X is indiscrete, for any continuous map f from X to the space 2o, $\{0\}$ is open in the space 2o, so $f^{-1}(0)$ is open in X, thus

$f^{-1}(0) = X$ or $\varnothing$.

If $f^{-1}(0) = X$, f (X) = 0 ; if $f^{-1}(0) = \varnothing$,

$f^{-1}(X) = 1$.

In either case, f is constant.

Conversely, if X is not indiscrete, there exists a proper open set S of X.

Define $f : X \to \{0, 1\}$ by f [S] = 0, and

f [X-S] = 1.

Then $f^{-1}(0) = S$, $f^{-1}(\{0, 1\}) = X$, thus f is continuous but not constant, and hence not 2o-connected.Therefore, X is 2o-connected if and only if X is indiscrete.

Claim: X is 2d-connected if and only if X is connected.

Proof: It is exactly the definition of a connected space.

The following proposition is a summary of the above cases.

PROPOSITION 3.5 Let Z be a two-point space. Then

(I) X is 2i-connected if and only if X is a one-point space.

(II) X is 2o-connected if and only if X is indiscrete.

(III) X is 2d-connected if and only if X is connected.

This proposition can be generalized to finite case. For a finite space Z, it turns out that these are the only types of connectedness that arise. Recall separation axioms of a topological space, X is T_1 if for any distinct

x, y $\in$ X, there exists open neighborhoods U of x and V of y such that y is not in U and x is not in V. It is easy to see that X is T1 if and only if every singleton set in X is closed. In the following studies, this property will be used very often.

PROPOSITION 3.6 Let Z be a space that is not T_1. If X is Z-connected, then X is either indiscrete or is a one-point space.

Proof: Let Z be a space that is not T_1, i.e. there exists a connected component Z_λ that contains more than one point. Suppose X is neither one point nor indiscrete, then X has a proper open set. It is sufficient to prove that there exists a continuous map $f : X \to Z$ that is not constant. Define $f : X \to Z$ by $f[U] = x$, $f[X - U] = y$, where x and y are elements of Z_λ.

Note that the subspace $\{x, y\}$ is either 2i or 2o but never 2d, thus f is continuous and not constant. Therefore, X is either indiscrete or is a one-point space. This proposition tells us that whether Z is T_1 is crucial in generating

non-trivial Z- connectedness. Note that a finite T_1 space is discrete. The first nontrivial example of Z-connectedness can be constructed by taking Z to be the space Z of integers equipped with the complement finite topology. In fact, Z is the coarsest space which is infinite and T_1.

PROPOSITION 3.7: A continuous image of Z-connected space is Z-connected.

Proof: Let X be any Z-connected space.

By definition, any continuous map from X to Z is constant.

Let $f : X \to Y$ be a continuous surjective map and $g : Y \to Z$ be continuous. Then gof is continuous and constant, so g[Y] is constant. Therefore, Y is Z-connected, i.e. the continuous image of X is Z-connected.

If a collection of connected subspaces has a common point, then their union is connected. A similar statement can be proved for Z-connected spaces.

PROPOSITION 3.8: If $\{ X_\alpha \}$ is a collection of Z-connected subspaces of a space X such that $\bigcap_\alpha X_\alpha \neq \varnothing$, then $\bigcup_\alpha X_\alpha$ is Z-connected.

Proof: For any continuous map $f : \bigcup_\alpha X_\alpha \to Z$, let map $i: X_\alpha \to \bigcup_\alpha X_\alpha$ be the inclusion map and let $f : \bigcup_\alpha X_\alpha \to Z$ be any continuous map. Since X_α is Z-connected, $f \circ i : X_\alpha \to Z$ is continuous and thus constant.

And since $\bigcap_\alpha X_\alpha \neq \varnothing$, so there exist a p such that $p \in \bigcap_\alpha X_\alpha$, i.e. $p \in X_\alpha$ for all α. Then $f \circ i$ is constant and equals to $f(p)$.

Therefore, f is constant and $\bigcup_\alpha X_\alpha$ is Z-connected. if A is a connected subset of a space X, and $A \subseteq B \subseteq \bar{A}$, then B is connected. In Z- connected spaces, this proposition can be written as follows:

PROPOSITION 3.9: Let A and B be subsets in a space X such that $A \subseteq B \subseteq \bar{A}$. If A is Z-connected, then B is Z-connected.

Proof: Let $f : B \to Z$ be any continuous map where $A \subseteq B \subseteq \bar{A}$ and let $f_A = f |A : A \to Z$ be the restriction of f. Since A is Z-connected, and f_A is continuous,

$f_A (A) = f (A)$ is constant. Z is a T_1 space, thus f (A) is closed.

Note that $\bar{A}^{-B} = \bar{A} \cap B = B$, therefore,

$$f (B) = f (\bar{A}^{-B}) \subseteq \overline{f(A)} = f (A).$$

Thus f (B) is constant and B is Z-connected.

A Z-connected component containing p is defined as the largest Z-connected set in X which contains the point p. For such a Z-connected component, the following property can be proved.

COROLLARY 3.10: Each Z-connected component of a space is closed.

Proof: Let A be any Z-connected component, i.e. A is the largest Z- connected set in X containing p. By proposition 3.9, $\bar{A}$ is Z-connected and closed. Also, $\bar{A}$ is larger than A. Thus $\bar{A}$ = A, and a Z-connected component is closed.

Just like the product of an arbitrary family of connected spaces is connected, the product of Z-connected spaces is Z-connected. A Z-connected component is closed.

Just like the product of an arbitrary family of connected spaces is connected, the product of Z-connected spaces is Z-connected.

PROPOSITION 3.11: The topological product of an arbitrary family of Z- connected spaces is Z-connected.

Proof: First, let's prove the product $X \times Y$ of Z-connected spaces X and Y is Z-connected. Let (a, b) and (c, d) be any two points of

$X \times Y$. Then $X \times \{b\}$ and $\{c\} \times Y$ are Z-connected and have the intersection (c, b).

By proposition 3.8, $X \times \{b\} \cup \{c\} \times Y$ is Z-connected. Then the T-shaped space $T = (X \times \{ b \}) \cup (\{c\} \times Y)$ is Z-connected.
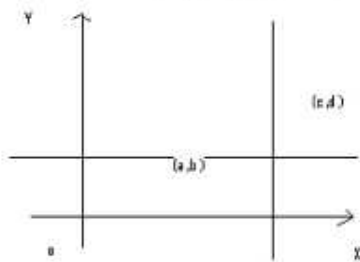
fig 2. A T-shaped space in XY plane.

The space $X \times Y$ is the union of all T-shaped spaces, and those spaces are Z-Connected and have a common point (a,b). Thus $X \times Y$ is Z-connected. Next, for any finite product of Z-connected spaces, $X_1 \times X_2 \times \ldots \times X_n$ is

homeomorphic to $(X_1 \times X_2 \times \ldots \times X_{n-1}) \times X_n$, and by induction, it is Z-connected. Finally, let's consider an arbitrary family $\{X_\alpha\}$ of Z-connected spaces.

Let $X = \prod X_\alpha$ and b be a given point in X.

Define a subspace $X(_{1, \ldots, n})$ of X. It consists of all points (x) such that $x = b$ for all $\neq _{1, \ldots, n}$. $X(_{1, \ldots, n})$ isomomorphic with the finite product $X_1 \times X_2 \times \ldots \times X_n$, and hence is Z- connected. Then we define a subspace Y be the union of the above subspaces, i.e.

$Y = \cup X(_{1, \ldots, n})$, and Y is Z-connected since all of $X(_{1, \ldots, n})$ has a common point b.

III. ACKNOWLEDGMENT

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Topology and Knot theory in Engineering

Meera Aggarwal
Apeejay College of Fine Arts
Jalandhar, India
Meeraaggarwal17@yahoo.in

Ranjita Kapur
Apeejay College of Fine Arts
Jalandhar, India
ranjitakapur@gmail.com

Abstract— Topology is the mathematical study of shapes like mobius strips. Topological sculptures are those which are constructed using such topological surfaces. In this paper I laid emphasis on topological sculpture that are constructed on the theory based on topology and how such sculpture can be constructed including 3, 4, 5… entangled rings. Here the concepts of mobius strips and Klein bottle are also discussed.

Knot logic is logic nonetheless (suck on that, logicians!). This is seriously alien math that takes the frustration of tangled string, and kicks it up a notch. Knot theory also borrows some of the machinery from polynomials (despite having nothing to do with polynomials themselves) to form the various forms of knot polynomials. I discussed about Knot Theory and its applications in Engineering like subway maps etc

I. Topology

Topology (from the Greek τόπος, "place", and λόγος, "study") is the mathematical study of shapes and topological spaces. It is an area of mathematics concerned with the properties of space that are preserved under continuous deformations including stretching and bending, but not tearing or gluing. This includes such properties as connectedness, continuity and boundary.

Topology developed as a field of study out of geometry and set theory, through analysis of such concepts as space, dimension, and transformation. Such ideas go back to Leibniz, who in the 17th century envisioned the geometria situs (Latin for "geometry of place") and analysis situs (Greek-Latin for "picking apart of place"). The term topology was introduced by Johann Benedict Listing in the 19th century, although it was not until the first decades of the 20th century that the idea of a topological space was developed. By the middle of the 20th century, topology had become a major branch of mathematics.

Topology has many subfields:

- General topology [1]establishes the foundational aspects of topology and investigates properties of topological spaces and investigates concepts inherent to topological spaces. It includes point-set topology, which is the foundational topology used in all other branches (including topics like compactness and connectedness).

- Algebraic topology [2]tries to measure degrees of connectivity using algebraic constructs such as homology and homotopy groups.

- Differential topology [3]is the field dealing with differentiable functions on differentiable manifolds. It is closely related to differential geometry and together they make up the geometric theory of differentiable manifolds.

- Geometric topology [4,5] primarily studies manifolds and their embeddings (placements) in other manifolds. A particularly active area is low dimensional topology, which studies manifolds of four or fewer dimensions. This includes knot theory, the study of mathematical knots.

A. Mobius strip

Mobius or Moebius, is a surface with only one side and only one boundary component. The Möbius strip has the mathematical property of being non-orientable. It can be realized as a ruled surface. It was discovered independently by the German mathematicians August Ferdinand Möbius and Johann Benedict Listing in 1858 [6,7,8]

Topologically, the Möbius strip can be defined as the square $[0,1] \times [0,1]$ with its top and bottom sides identified by the relation $(x, 0) \sim (1 - x, 1)$ for $0 \le x \le 1$, as in the diagram shown right[9][10].
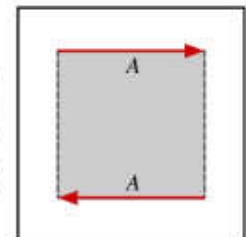
The Möbius strip is a two-dimensional compact manifold (i.e. a surface) with boundary. It is a standard example of a surface which is not orientable. In fact, the Möbius strip is the epitome of the topological phenomenon of non orientability. This is because 1) two-dimensional shapes (surfaces) are the lowest-dimensional shapes for which non
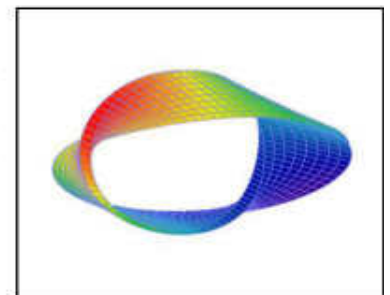
orientability is possible, and 2) the Möbius strip is the only surface that is topologically a subspace of every non-orientable surface. As a result, any surface is non-orientable if and only if it contains a Möbius band as a subspace.
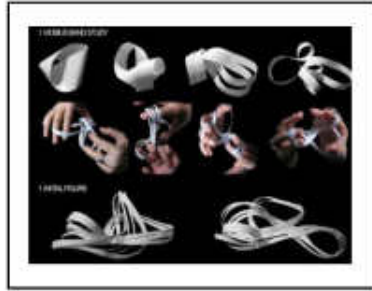
Mobius strip cuttings twice, thrice and so on. In first figure it is a mobius band with two turns, like wise we twist them three times and more, the cut them from centre and can generate new forms as shown in second figure. This concept is useful in designing of jewellery, mathematical sculptures, attractive show pieces, etc.

B. Klein Bottle
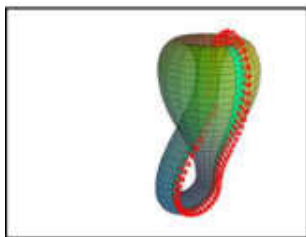
In mathematics, the Klein bottle is an example of a non-orientable surface; informally, it is a surface (a two-dimensional manifold) in which notions of left and right cannot be consistently defined [11]

Start with a square, and then glue together corresponding coloured edges, in the following diagram, so that the arrows match. More formally, the Klein bottle is the quotient space described as the square [0,1] × [0,1] with

sides identified by the relations (0, y) ~ (1, y) for $0 \leq y \leq 1$ and (x, 0) ~ (1 − x, 1) for $0 \leq x \leq 1$ [12]
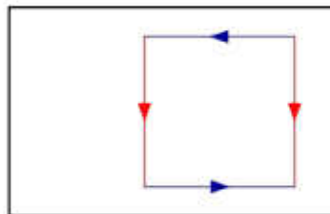
This square is a fundamental polygon of the Klein bottle (shown in adjacent figure). "If you glue the two edges of mobius strip, you will get klein bottle, but it is impossible to glue them.
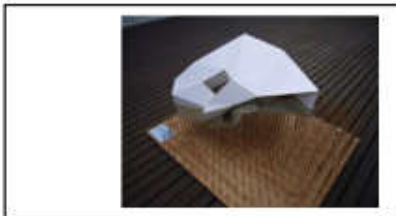
Klein bottle house is a wondrous job of architecture

II. Knot theory

Knot logic is logic nonetheless (suck on that, logicians!). This is seriously alien math that takes the frustration of tangled string, and kicks it up a notch. Knot theory also borrows some of the machinery from polynomials (despite having various forms of knot polynomials [13, 14]
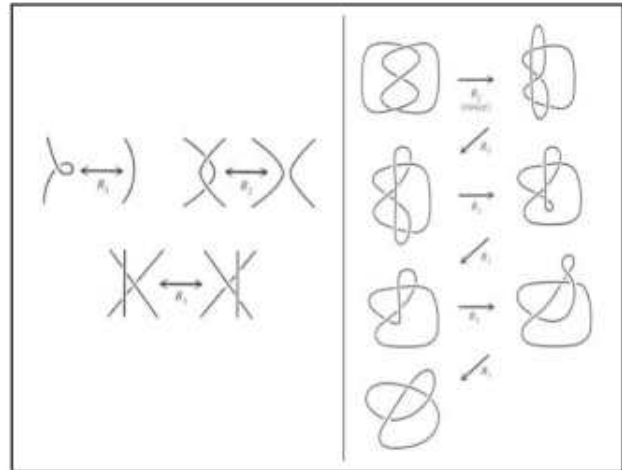
A. Subway Maps
  1) Knots are different embedding of a circle, a one-dimensional torus
  2) The same object can be embedded in different ways. Some of these embeddings, such as a trefoil knot, cannot be smoothly deformed into the others.
  3) Reidemeister moves are a set of techniques with which one can tell which knots are isomorphic to each other.

Let's take another look at the subway loop from our earlier example.
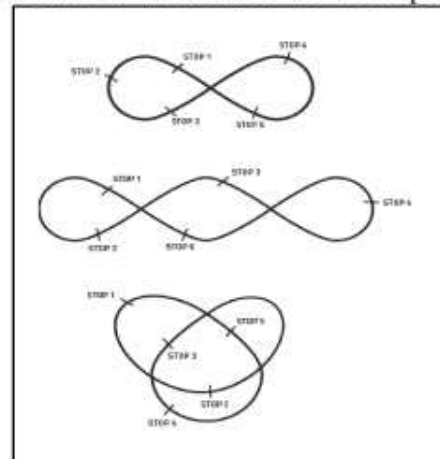
We are treating our subway as a one-dimensional manifold [15] Remember, this

means that when we ride the train, we perceive only forward or backward motion, even though we know that our subway is a loop because we keep coming back to the same stop. From our intrinsic perspective, the actual subway map could be any of the embeddings shown above.

The subway map represents an embedding of our 1-manifold in a two-dimensional plane. By looking at the map, we view the manifold extrinsically. The designer of the map has many choices as to how to draw it, provided that the order of the stops remains the same. Intrinsically, all of these possibilities are the same, but each version of the map is different extrinsically. Some of these maps can be turned into one another by bending and stretching, but some of them can't.

This version of the map is unlike the others. It is plain to see

that no matter how much we manipulate it, we cannot transform it into a circle without making a cut and re-gluing the ends. However, recall that,
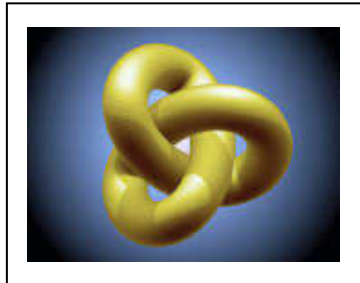
experienced intrinsically, this configuration is no different than a circle. Obviously, from an extrinsic view, this equivalence no longer holds.
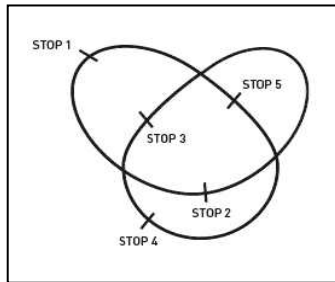
This configuration is an example of a knot. A knot, to a topologist, is simply a particular embedding of a circle in 3 dimensional space—also known as 3-space. It may appear that these knots are embedded in the plane, but recall that in the plane there is no such notion as "above" or "below." Clearly, we need these directional concepts in order to have knots. All knots, when viewed intrinsically, are the same; they become interesting, really, only when we look at them extrinsically.
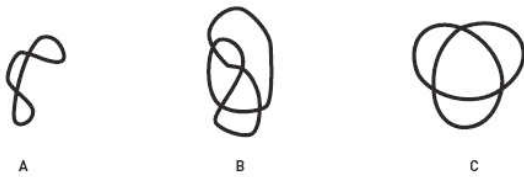
Some knots are easily undone, such as the one shown in image A. Sliding the overlying side to either the right or the left creates what can, topologically, be considered a circle. Other knots, such as that shown in image B, are a bit more difficult, though not impossible, to undo. In this case, sliding the bottom overlying half-loop down a bit, then sliding the middle overlying part to the right creates what looks like a circle within a circle. Finally, a mere twist of the remaining overlying part again creates a topological circle.

Unfortunately, if we try to perform the same types of manipulations, called "Reidemeister moves," on knot C, we will be out of luck. A little mental projection should convince you that clearing up one part of the knot will only make things
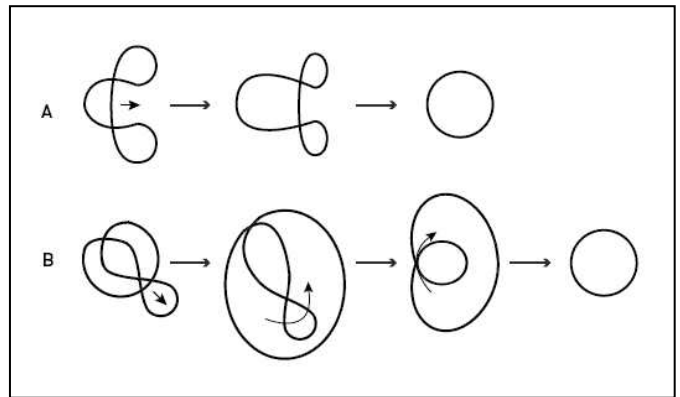
worse in other parts. This type of knot, known as a "trefoil knot," cannot be undone in the extrinsic view of topology. However, as we saw before, in the intrinsic view, this is really no different topologically than a circle. The only way to undo this knot would be to un-embed it, that is, take it out of our space, untangle it, and then re-embed it in our space. A four-dimensional being would have little trouble doing this, but we'll save our examination of the exploits of four-dimensional beings for a later unit. For now, all that is important is that we cannot undo it in 3-space.

Central to this study of knots is the concept of isotopy. Isotopy is a form of equivalence in which one topological object can be transformed into another while maintaining the property of being an embedding. Although one needs to be careful in defining it, it is a precise way to capture the notion of deforming without crossing. This is what we are doing when we use our Reidemeister moves to undo knots. Hence, we would say that knot A is isotopic to knot B and that both are isotopic to a circle. Knot C, however, is isotopic to none of these things, because we would have to un-embed it to undo it.
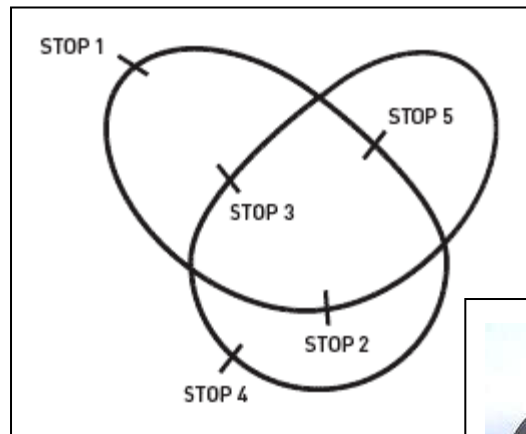
III. TOPOLOGICAL SCULPTURE

Mathematicians have studied "knots" for many centuries. This interesting and fascinating category of topological objects presents a wide range of possibilities to be used in sculpture. Most mathematical sculptors have made use of this concept.

Here in following figures you noticed that a torus is cut in such a manner that the resulting two rings are entangled without separating. The similar concept is used to form 3, 4, 5, 6, 7 … rings entangled

together without separating. You only need to cut the torus using such a blade that having 3 sides, 4 sides, 5 sides … , like shown below
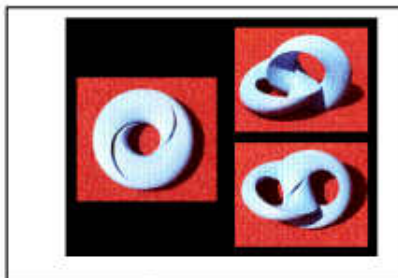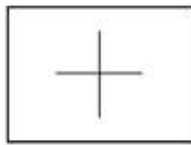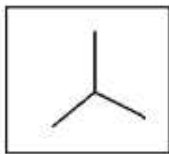
Oushi zokey 1999, San sabestian, spain, by Keizo Ushio

Massive mobius strip library, kazakhstan

A. OTHER APPLICATIONS OF TOPOLOGY IN ENGINEERING

1) Topology is also used in computer graphics. Topological graphics lays out the framework of to represent digital contents in a few orders of magnitude efficient.

2) Topology is also beneficial for physics- topological insulators

3) In cosmology, topology can be used to describe the overall shape of the universe

B. OTHER APPLICATIONS OF KNOT THEORY IN ENGINEERING

1) Knots and links have been conjectured to play a fundamental role in a wide range of physical fields, including plasmas and fluids, both quantum and classical. In fluids, the fundamental knottedness-carrying excitations occur in the form of linked and knotted vortex loops, which have been conjectured to exist for over a century.

2) Knot theory is intimately related to quantum physics

3) Knot theory is also helpful in studying structure of DNA.

4) This theory is also used to construct roller coasters

IV. ACKNOWLEDGEMENT

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Application of Finite Element Method for Partial Differential Equations in Engineering

Nitika Chugh

Department of Mathematics,
Apeejay College of Fine Arts,
Jalandhar, India.
niti.chugh85@gmail.com

Abstract— The present article approaches to the numerical solution for partial differential equations by Galerkin Finite Element Method. The finite element method is a computer based technology for designing of mechanical elements. Every designed made has to fulfil certain specifications, and among them is working under a variety of condition, temperature, humidity, vibrations, etc. The application of finite element method for Design analysis and civil engineering are presented, and discussed in order to test the efficiency of the method.

Keywords— Finite element; Galerkin; Poisson equation; Design analysis; Civil engineering.

I. INTRODUCTION

Finite element methods (FEM) represent a powerful and general class of techniques for the approximate solution of PDEs. They were proposed in a seminal work of [1], unfortunately, the relevance of this article was not recognised at the time and the idea was forgotten. In the early 1950's the method was rediscovered by engineers, but the mathematical analysis of finite element approximations began much later, in the 1960's, the first important results being due to [2]. Since then FEMs have been developed into one of the most general and powerful class of techniques for the numerical solution of PDEs and are widely used in engineering design and analysis. Some decades later Chung [3] and Baker [4], among other publications, treated the heat transfer and fluid flow problems solutions.

Recently, several authors have presented applications of the finite element method for two and tridimensional problems [5-7].

In FEM, solution is obtained at all points in the domain than discrete nodes. In it firstly the region is divided into a finite number of non-overlapping sub regions, called elements. The advantage of dividing a big element into small ones is that it allows that every small element has a simpler shape, which leads to a good approximation for the analysis. In each of the elements, the solution is approximated by a linear combination of basis function which is continuous and defined in terms of the nodal values belonging to that element. There may be mainly two approaches for the formulation of finite element method- one based on weighted residual method, particularly Galerkin's method and the other based on Variational principle, particularly Rayleigh-Ritz method. Both Galerkin's method and Rayleigh-Ritz method gives equivalent result in regard to 1-Dimensional and 2-Dimensional boundary value problems. Therefore, in present study, the FEM adopting the Galerkin's criterion is described.

II. FEM STEPS

A. Discretization/ Subdivision of solution domain

Generally, straight-line segments are used in 1-Dimensional case, triangles or rectangles are used in 2-Dimensional case and tetrahedron is used for 3-Dimensional case, as shown in Fig. 1.
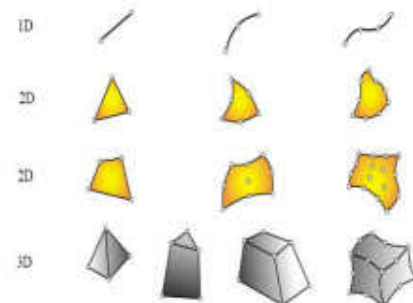
Fig. 1. Discretization/ Subdivision of solution domain

B. Selection of interpolation schemes

Linear or higher order polynomials
For Example:-
(i) Construction of 1D Linear Finite element:
Consider the barycentric coordinates:

$\lambda_1(x) = \dfrac{x_1 - x}{x_2 - x_1}, \lambda_2(x) = \dfrac{x - x_2}{x_2 - x_1}$, defined on the element

$e = [x_1, x_2]$, where $\lambda_i(x_j) = \delta_{ij}$ (for $i = 1, 2$)

Then Basis function:

$$\varphi_1 |_e = \lambda_1 \ , \ \varphi_2 |_e = \lambda_2$$
$$u_h(x) = u_1\varphi_1(x) + u_2\varphi_2(x) \ , \ x \in e$$

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(ii) Construction of 1D Quadratic Finite element:
$\{\lambda_1(x), \lambda_2(x)\}$ are barycentric coordinates

$x_1 = (1,0), x_2 = (0,1)$ are endpoints and $x_{12} = \left(\dfrac{1}{2}, \dfrac{1}{2}\right)$ is a mid point, then basis functions:

$\varphi_1, \varphi_2, \varphi_{12} \in P_1(e)$

$\varphi_1(x) = \lambda_1(x)(2\lambda_1(x) - 1)$

$\varphi_2(x) = \lambda_2(x)(2\lambda_2(x) - 1)$

$\varphi_{12}(x) = 4\lambda_1(x)\lambda_2(x)$

and $u_h(x) = u_1(x)\varphi_1(x) + u_2(x)\varphi_2(x) + u_{12}(x)\varphi_{12}(x)$

(iii) <u>Construction of triangular finite elements:</u>
Consider Nodal barycentric coordinates

$x_{123} = \left\{\dfrac{1}{3}, \dfrac{1}{3}, \dfrac{1}{3}\right\}, x_1 = 1,0,0 , x_2 = 0,1,0 , x_3 = 0,0,1 ,$

$x_{12} = \left\{\dfrac{1}{2}, \dfrac{1}{2}, 0\right\}, x_{13} = \left\{\dfrac{1}{2}, 0, \dfrac{1}{2}\right\}, x_{23} = \left\{0, \dfrac{1}{2}, \dfrac{1}{2}\right\}.$

Linear elements $u_h(x) = c_1 + c_2 x + c_3 y \in P_1(e)$,

where $\varphi_1 = \lambda_1$, $\varphi_2 = \lambda_2$, $\varphi_3 = \lambda_3$, vertex-oriented (standard) and $\varphi_{12} = 1 - 2\lambda_3$, $\varphi_{13} = 1 - 2\lambda_2$, $\varphi_{23} = 1 - 2\lambda_1$, midpoint-oriented.

C. Formulation of system of equations

Galerkin's finite element method is used for formulation of system of equations. The steps involved in formulation are given as under:

1) Multiply the residual of the PDE by a weighting function w vanishing on the Dirichlet boundary and set the integral over the given region equal to zero.
2) Integrate by parts using the Neumann and Robin boundary conditions.
3) Represent the approximate solution $u_h \approx u$ as a linear combination of polynomial basis functions φ_i defined on a given mesh (triangulation).
4) Substitute the functions u_h and φ_i for u and w in the weak formulation.
5) Solve the resulting algebraic system for the vector of nodal values u_i.

D. Solution of the System of Equations

Using either a direct or Iterative Method for a boundary value problem:

$Lu = g$, defined in region R bounded by S.

We seek for a solution u_h which satisfies it in a weaker form. Let $\varphi = \{\varphi_1, \varphi_2, \ldots\}$ be a set of linearly independent functions satisfying the boundary condition u=0 on S.

Let $u_h = a_i\varphi_i$, where a_i 's are unknown parameters and are to be determined. Then the 'Residual' Re is given by Re $= Lu_h - g$. The residual Re is minimised such that it is orthogonal to all the basis function φ_i over the region R, i.e

$\iint Re\, \varphi_j dx = 0$, over the region R.

Here we find a set of linear equations in a_i 's . After solving these equations and putting the values of a_i 's in the approximate solution u_h can be obtained.

Example
Differential Equation:

$\dfrac{d^2\varphi}{dx^2} = x + 1 \quad , 0 \le x \le 1$

Boundary Condition:

$\varphi | (x = 0) = 0$

$\varphi | (x = 1) = 1$

Solution by Galerkin's Method
Weighted Residuals:

$\displaystyle\int_0^1 w_i \left(\dfrac{d^2\varphi}{dx^2} - x - 1\right)dx = 0$

Expansion: $u_h(x) = x + c_3(x^2 - x) + c_4(x^3 - x)$

Weighting: $w_1 = x^2 - x$, $w_2 = x^3 - x$

Solution:

$\dfrac{1}{3}c_3 + \dfrac{1}{2}c_4 - \dfrac{1}{4} = 0$, $\dfrac{1}{2}c_3 + \dfrac{4}{5}c_4 - \dfrac{23}{60} = 0$

By solving $c_3 = \dfrac{1}{2}, c_4 = \dfrac{1}{6}$

III. APPLICATIONS OF FINITE ELEMENT METHODS IN ENGINEERING

In this section, the applications of finite element method for design analysis and civil engineering are discussed in order to show the efficiency of the method.

A. FEM for design analysis

One important area where this method is used is in design of mechanical elements. Every designed made has to fulfill certain specifications, and among them is working under a variety of conditions: temperature, humidity, vibrations, etc. The job of the designer is to achieve this, and to assure that the product will work effectively, taking care of the user and of the element. An engineer has to follow certain steps in order to create a good product with high quality. First, the steps of the design flow chart must be followed:

1) recognize a need
2) specifications and requirements
3) feasibility sturdy
4) creative design and development
5) detailed drawings
6) prototype building and testing
7) design for manufacture
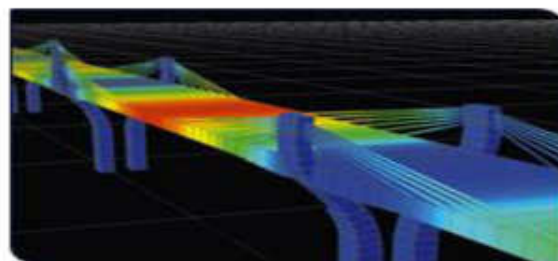
After the designer has the calculations of the dimensions, tolerances, manufacturing parameters, etc, some other tests should be done. For example, an engineer has to know whether the product is going to support certain loads, or how it is going to behave with temperature variations, or what could happen if vibrations are present. This is where the finite element method enters inaction in engineering.

The automotive industry uses this method to see how the cars behave under some conditions of load, and for crash tests. For this industry, it has a lot of advantages. After the car is modeled in a CAD software, it is exported to a finite element analysis software, and after all the conditions are set, the test begins. The method has the advantage of giving very accurate information. For example, the deformation suffered point by point(node by node) at a specific time. The fact of they doing these type of analyses represents a great advantage for them, because they save money, they save time, and they also save material, and yet they have very reliable information of the behavior of the car.
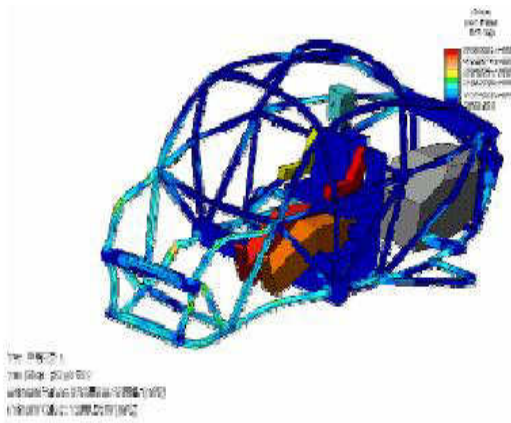
B. FEM for Civil Engineering

FEM formulations will be elaborated for various fields of Civil Engineering such as structural engineering, Building industry etc. Traditionally, engineers have used laboratory testing to investigate the structural behaviour of steel building products and systems subject to the expected wind and earthquake loads and to develop appropriate design rules. Laboratory testing was also used to develop new building products and systems. However, such reliance on time consuming and expensive laboratory testing has hindered progress in this area. The product manufacturers and designers often decided on conservative designs in order to avoid expensive and time consuming laboratory testing. However, advances in the field of computer aided engineering during the last two decades have changed this situation significantly in many engineering industries. In the building industry, the use of advanced finite element tools has not only allowed the introduction of innovative and efficient building products, but also the development of accurate design methods.

IV. CONCLUSION

In the proposed applications, the Galerkin Finite Element Method shown good results, mainly when quadratic elements were used.It is a very important tool for stress and strain analysis, not only because it provides accurate information but because it also saves lot of money and time by simulating the events in computer and not in real life. For every engineer it is a very reliable tool because it is very specific for each occasion and it is able to perform different analysis of same model under different circumstances with simple changes in boundary conditions, in the loads, in the material or whatever the problem demands.

The method can help to modify each design in order to increase the service line of it as much as possible.

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Stability Analysis by using Lyapunov Theory

Palwinder Singh
C.T. Institute of Engineering Management and Techonology,
Jalandhar, Punjab, India.

Kanwalpreet Kaur
C.T. Institute of Techonology,
Jalandhar, Punjab, India

Abstract- In this paper the stability behavior of differential systems is discussed by using the concept of Lyapunov Theory.The two approaches of Lyapunov theory for autonomous system known as Lyapunov's indirect method which uses the concept of system linearization and Lyapunov's direct method which uses the concept of total energy function are explained alongwith their advantages and disadvantages .Some techniques for the construction of Lyapunov functions are also suggested. These methods can also be used and generalized for the non-autonomous systems.

Keywords - Stability , Lyapunov direct method ,Lyapunov indirect method

I. INTRODUCTION

The most of the physical phenomena are described as ordinary differential equations of the form $x' = f(t, x)$ (i) with initial condition $x(t_0) = x_0$ .The small disturbances in initial data can affect the behaviour of corresponding solutions . The branch of mathematics which deals with such problems is known as Stability theory .For any dynamical system it is expected to have a stable solution because unstable systems are of no use. In 1892 the Russian Mathematician A.M. Lyapunov introduced a theory referred as Lyapunov theory for stability analysis. The major advantage of this theory is that stability can be discussed without any prior knowledge about the solutions. Now days this theory is extensively used to study control systems , dynamical systems ,systems with time lag , power systems analysis and so on . Lyapunov theory includes two approaches Lyapunov's indirect method and Lyapunov 's direct method. First method uses the concept of system linearization around a point to achieve local stability whereas second method used to achieve global stability. The basic idea behind Lyapunov 's direct method is that if the total energy of a system is continuously dissipating then the system must settle down to an equilibrium point . The main characteristic is to construct a suitable scalar function called Lyapunov function and then to find its first order derivative

along with the given trajectory . This method is described in Ahmad [1] Antosiewicz [4], Hahn [6], ,Lakshmikantham and Leela [2] and Yoshiwara [3] .

This paper is organized as follows. In section 2 some basic definitions and theorems without proof are summarized . In section 3 and 4 Lyapunov indirect method and direct method with some related theorems and examples are explained . Advantages and disadvantages of Lyapunov theory are discussed in section 5 . Finally conclusion of all the results is given.

II. PRELIMINARIES

Let $x(t) = x(t_0, x_0)$ be a solution of (i) through (t_0, x_0) .The various concepts of stability for the solution of (i) are given on interval $[t_0, \infty)$ as follows ;

Definition 2.1 :- The solution x (t) of (i) is said to be stable if , for every $\varepsilon > 0$, there exists a $\delta = \delta(\varepsilon) > 0$ such that for any solution $\bar{x}(t) = x(t_0, \bar{x_0})$ of (i) the inequality $\left\| \bar{x_0} - x_0 \right\| \leq \delta$ implies $\left\| \bar{x}(t) - x \right\| < \varepsilon$ for all $t \geq t_0$.

Definition 2.2 :- The solution x (t) of (i) is said to be asymptotically stable if it is stable and if , there exists a $\delta_0 > 0$ such that $\left\| \bar{x_0} - x_0 \right\| \leq \delta_0$ implies $\left\| \bar{x}(t) - x \right\| \rightarrow 0$ as $t \rightarrow \infty$.

Definition 2.3 :- Any dynamical system of the form $x' = f(x)$ where f is a function of only dependent and free from t and such that it ensure existence and uniqueness of solution is called autonomous system otherwise it is called non-autonomous.

III. LYAPUNOV INDIRECT METHOD

This method is concerned with the local stability of some equilibrium point of a non- linear system .It uses the concept of system linearization to check the stability .The next theorem states the conditions for local stability as

Theorem 3.1 :- If x=0 be the equilibrium point of the non-linear autonomous system $x' = f(x)$ (ii). Where f is continuously differential in neighborhood of origin. Let A be Jacobian matrix at x=0 and λ_i , i=1,2,3,……….,n be eigen values of A , then

1. The origin is stable if Re (λ_i) ≤ 0 for all i

2. The origin is asymptotically stable if Re(λ_i) < 0 for all i

Example :- Consider the equations

$$x_1' = -x_2 \text{ and } x_2' = x_1 + (x_1^2 - 1)x_2$$

Then Jacobian matrix at x=0 is

$$A = \begin{bmatrix} 0 & -1 \\ 1 & -1 \end{bmatrix}$$,Then eigen values of are $\lambda = -1 + \sqrt{3}/2$

whose real parts are < 0 ,hence origin is asymptotically stable .

IV.   LYAPUNOV DIRECT METHOD

It is well known that if the total energy of a physical system has a local minimum at an equilibrium point ,then that point will be stable . this is the concept that is used widely in this theory to study stability . if we are able to find a function say V which is continuous and has continuous first order derivatives and V' be its rate of change , then we can check stability of equilibrium point by Lyapunov direct method .

Any dynamical system of the form $x' = f(x)$ where f is such that it ensure existence and uniqueness of solution is called autonomous system .Lypunov stability theorems for stability are stated as below.

Let $S_r = \{x \in R^n : \|x\| < r$ be   a   set   and $x(t) = x(t, t_0, x_0)$ is any solution of (ii) passing through initial value ,then

Theorem :- If there exists a positive definite function V(x) such that

(i) $V'(x)$ is negative semidefinite   on S_r then zero solution of (ii) is stable.

(ii) $V'(x)$ is negative definite on S_r then zero solution of (ii) is asymptotically stable.

Remark 4.1:- The definitions of positive definite , negative definite , negative semi definite etc. can be taken from Ahmad [1] and Khalil [5]

These theorems describe the criteria for stability of autonomous systems which can also be generalized to many forms of differential systems without finding the solution or knowing much about solution.

This method does not provide any general criteria for construction of Lyapunov function .Many techniques like Krasovskii method ,energy function as a Lyapunov function ,quadratic forms etc. can be applied to find suitable function

Example : Consider the system

$$x_1' = -6x_2 - x_1 x_2^2 / 4 \qquad \text{and} \quad x_2' = 4x_1 - x_2 / 6$$

now if we choose a positive definite function as $V(x_1, x_2) = 2x_1^2 + 3x_2^2$,then $V' = -x_2^2(1 + x_1^2)$. which is a negative semidefinite then by above theorem zero solution is stable .

V.   ADVANTAGES AND DISADVANTAGES OF LYAPUNOV THEORY

Lyapunov theory have been widely used in stability analysis for last few decades and proved as a very crucial tool for control systems and many more physical problems. The main advantage is that it gives results without solving the differential equations . As it is very difficult to solve typical equations that realizes the importance of Lyapunov theory .This theory is also necessary for the problems with time varying parameters involved in uncertain systems . Also it works on a simple theory of total energy which can be easily acceptable. This technique is very effective and insightful. This theory is also supported by efficient numerical tools . It is very easy to test positive or negative definiteness of a function as compared to test stability by typical mathematical definitions which are already given in this paper .

Lyapunov theory also have several pitfalls which decreases the usefulness of the theory . The main drawback of this theory is that it does not suggest any proper method for the selection of Lyapunov function . Some methods have been suggested by many authors after having literature review but still they are not sufficient in typical and practical problems . This theory works on state feedback controls but output feedback is very complicated . At last , this theory is very unprogressive for time varying parameters or for problems concerning uncertain parameters .

VI.   CONCLUSIONS

In this paper two approaches of Lyapunov theory are discussed which are very useful in stability analysis. Some basic definitions and theorems relating to stability of equilibrium point are given .It is discussed that how the Lyapunov function which represents total energy of a system can be used to test the stability as if the rate of change of total energy goes on decreasing then the equilibrium point will remain stable or very close to that point . Asymptotic stability can also be tested by the same theory. Some examples for the autonomous system are also given to illustrate the concept

and to explain how these theorems can be applied .At last some advantages and disadvantages are discussed which may affect the use of Lyapunov theory for stability analysis .

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Mathematical Model for Optimization of Municipal Waste Management

Vinay Arora
PUSSGRC, Hoshiarpur,
vinay2037@gmail.com

Anupma Arora
Govt. Degree College, Kathua
anupma12@rediffmail.com

Abstract- **It is critical to adopt a broad approach in developing a working framework for waste management. This covers the social, economic, technology, political and administrative dimensions. Therefore it is important that the right action be carried out at the right level. Waste management is one of the important & biggest problems from time to time. It covers collection, transportation, processing, recycling or disposal of waste materials. The proper management of the municipal waste solves the dual purpose as it helps to protect the environment from polluting and use the untapped potential of the municipal waste to make the eco-friendly future fuel. A review of the municipal waste management and planning literature reveals the growing number & complexity of the available mathematical models, but lack of practical applications of mathematical modeling techniques. So our purpose is to form some integrated techno-economic programming models, which can not only determine the most appropriate cost of waste disposal but also to explain the inter-parametric linkages and even to compare the potentiality and suitability of a particular methodology for a set of conditions. The aim of the study is to form models, which provide a tool to engineers, planners, and constructor's to determine the best scenario for a waste management planning. In this paper, linear programming model for optimization of municipal waste management is discussed to integrate different options involved in such management. Various economic and environmental costs associated with such management are taken into consideration while developing this mathematical model**.

I. INTRODUCTION

The demand of fossil fuel is continuously rising. In contrast, fossil fuel resources are limited and decreasing due to over exploitation. The need of hour is renewable alternate energy resources like bio-fuels, solar energy, hydro energy etc. The bio-fuels include biomass, bio-diesel and biogas. These bio-fuels can be produced from biodegradable materials like animal waste, human excreta, municipal waste, crop waste etc. If this municipal waste is properly managed/processed this waste has potential to provide us the biogas which can replace approximately 10% of total energy requirement. This municipal waste can be segregated into biodegradable and non- biodegradable material. The non-biodegradable material consists of mineral water bottles, polythene and other metallic waste, this plastic waste can be used for road construction. The biodegradable waste along with sewerage water can be fed into the digester and biogas can be produced, compressed and filled into the cylinders

and dispatched to the end user like LPG. This biogas can be used to run any kind of automobile engine after some minor alternation and it is 100% safe. The waste slurry of the digester can be buried in the large pit with a layer of soil which forms very good organic manure. It can replace the chemical fertilizers to a large extent. The processing & management of the municipal waste solve the dual purpose as it helps to protect the environment from polluting and use the untapped potential of the municipal waste to make the eco-friendly future fuel. The term waste usually relates to materials produced by human activity and is generally undertaken to reduce their affect on health, aesthetics or amenity.

Municipal waste includes commercial and residential wastes generated in municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical waste. The management of waste is concerned; the human safety in terms of health and environmental burdens of waste like energy consumption, pollution of air, oil, water and loss of amenity must be taken under consideration.

Developing countries like India have a wide range of waste problems, including inadequate waste collection system, open dumping and other forms of improper final disposal and the resulting environmental pollution, scavenging at landfill sites by waste pickers, and illegal dumping. These problems are being aggravated by growing waste generation rates associated with economic growth, which increases the consumption levels, and the transition to mass consumption life style in developing countries. There is concern that these problems, if left unattended, will become a serious challenge for generations to overcome.

Management of waste is a problem that is more felt at the municipal level, where decision makers should plan an effective strategy, taking simultaneously into account conflicting objectives (e.g. economic, technical, normative, health, and environmental). In addition, the problem is characterized by an intrinsic uncertainty of the estimates of cost and environmental impacts.

Waste management is one of the important areas where the problems arise from time to time. It is therefore, the responsibility of municipal corporations to provide municipal waste management services. A review of the municipal waste (MW) management and planning

literature reveals the growing number and complexity of the available mathematical models. A technical survey of practicing waste management professionals indicated a general interest in, but lack of practical applications of mathematical modeling techniques.

A fundamental difficulty in planning a MW management system is the necessity of taking simultaneously into account conflicting objectives (This usually can't be dealt with by economical quantification only). In some cases the model is used for resource management and the mathematical program is designed to prescribe decisions for operation and planning to minimize cost subject to quality standard constraints.

Our MC's are failed to keep the city properly clean and thus giving rise to health and environmental problems. So our purpose is to form some integrated techno-economic models, which can be used not only to determine the most appropriate cost of waste disposal but also to explain the inter-parametric linkages and even to compare the potentiality and suitability of a particular methodology for a set of condition. Here our purpose is to formulate such programming models for integrated waste management planning. In this paper, linear programming model is discussed to integrate the following different options involved in MW management. Various economic and environmental costs associated with MW management are taken into consideration while developing the model.

1. Community compost plant: Composting pits in local area are used by community for converting biodegradable waste into compost.

2. Mechanical aerobic compost plant: Industries are used to converts the organic component of MW into manure through mechanical aerobic composting.

3. Sanitary landfill: The sanitary landfills are used to dispose of collected waste.

II. MATHEMATICAL MODEL

Considering both economic and environmental factors a mathematical model is discussed in this section.

Now cost and benefit depends on various factors as transportation, processing etc. So let us assume $X_{\alpha\beta}$ = Amount of waste transported from generation node 'α' to destination node 'β'

α, β = aerobic compost plant 'm', compost plant 'p' and sanitary landfill 'l'

C_m = total cost of waste processing at aerobic composting plant 'm'

B_m = total benefits of waste processing at aerobic composting plant 'm'

C_p = total cost of waste processing at community compost plant 'p'

B_p = total benefits of waste processing at community compost plant 'p'

C_l = total cost of waste disposal at sanitary landfill 'l'

B_l = total benefits of waste management under sanitary landfill 'l'

t = transportation cost per ton of waste per km

S_{jm} = distance from generation node 'j' to aerobic composting plant 'm'

S_{pl} = distance from compost plant 'p' to sanitary landfill 'l'

S_{jl} = distance from generation node 'j' to sanitary landfill 'l'

F_b = fraction of biodegradable material in total waste

O_m = operating cost per ton of waste for aerobic composting plant

O_p = operating cost per ton of waste for community compost plant

O_l = operating cost per ton of waste for sanitary landfill

L_p = land cost associated with community composting

L_m = land cost associated with aerobic composting

L_l = land cost associated with sanitary landfill

E_m = environmental cost per ton of waste for aerobic composting

E_p = environmental cost per ton of waste for community compost plant

E_l = environmental cost per ton of waste for sanitary landfill

F_k = fraction of recyclable material 'k' in total waste

P_{ac} = price of aerobic compost

P_{cc} = price of community compost

P_k = price of recyclable material 'k'

A. Constraints

1) Mass balance constraints

All waste generated at a source j, should be transported either to a community compost plant p or to an aerobic compost plant m, or to a sanitary landfill l. So if G_j is the amount of waste generated at generation node 'j' then

$$G_j = \sum_m X_{jm} + \sum_l X_{jl} + \sum_p X_{jp}$$

2) Capacity limitation constraints

Let V_m and V_p denotes the maximum capacity of aerobic compost plant 'm' and community compost plant 'p' respectively. Then capacity at each plant should be less than or equal to the maximum allowable capacity of the plant. Hence $\sum_j X_{jm} \leq V_m$ and $\sum_j X_{jp} \leq V_p$.

Then the total cost is given by,

$$TC = \sum_m C_m + \sum_l C_l + \sum_p C_p$$

Where,

$$\sum_m C_m = \sum_m \sum_j t * S_{jm} * X_{jm} + \sum_m \sum_j O_m * X_{jm}$$
$$+ \sum_m \sum_j L_m * X_{jm} + \sum_m \sum_j E_m * X_{jm} * F_b$$
$$+ \sum_m \sum_l O_l * X_{ml} + \sum_m \sum_l L_l * X_{ml}$$
$$+ \sum_m \sum_l E_l * X_{ml}$$

$$\sum_l C_l = \sum_l \sum_j t * S_{jl} * X_{jl} + \sum_l \sum_j O_l * X_{jl}$$
$$+ \sum_l \sum_j L_l * X_{jl} + \sum_l \sum_j E_l * X_{jl}$$

$$\sum_p C_p = \sum_p \sum_j F_b * O_p * X_{jp} + \sum_p \sum_j L_p * X_{jp}$$
$$+ \sum_p \sum_j E_p * F_b * X_{jp} + \sum_p \sum_l t * X_{pl} * S_{pl}$$
$$+ \sum_p \sum_l O_l * X_{pl} + \sum_p \sum_l L_l * X_{pl} + \sum_p \sum_l E_l * X_{pl}$$

And total benefits are given by,

$$TB = \sum_m B_m + \sum_l B_l + \sum_p B_p$$

Where,

$$\sum_m B_m = \sum_m \sum_j P_{ac} * F_b * X_{jm} + \sum_m \sum_j \sum_k F_k * P_k * X_{jm}$$

$$\sum_l B_l = \sum_l \sum_j \sum_k F_k * P_k * X_{jl}$$

$$\sum_p B_p = \sum_p \sum_j P_{cc} * F_b * X_{jp} + \sum_p \sum_j \sum_k F_k * P_k * X_{jp}$$

B. Objective function

If TC is total cost and TB is total benefit associated with waste management stream then the objective function will be to Minimize $(TC - TB)$.

Hence we have transformed the problem of waste management into above linear programming problem.

III. Conclusions

We get an optimization model for waste management system. To get optimal result it is better to process all waste at community compost plants and only inert material is transported to dump sites. Hence, community compost plant becomes the dominant option. Recyclable material is sold to wholesalers and organic material is composted and then sold in the market. All inert material goes to the municipal bins, which is later transported by the Municipal authorities to disposal sites. Thus the model proposed here can minimize the economic cost, the quantity of waste sent to sanitary landfill as well as the incinerator emissions to reduce the environmental pollution. Moreover, it takes care of loss of amenity along with the health parameter.

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Comparative Study of Rate of Convergence of Bisection and Newton-Raphson for Finding Roots of an Equation

Rimple Mahajan
CT Group of Institutions, India
rimplrmahajan20@gmail.com

Jyoti Mahajan

Abstract: The study is aimed at comparing the rate of performance, viz-aviz, the rate of convergence of Bisection method and Newton-Raphson method for finding roots of a transcendental equations. A computer program in C++ language has been developed to calculate roots of a given equation in the close interval [0,1] using bisection and Newton-Raphson's and the result are compared. It was observed that the Bisection method converges at a less rate and with the possibility of error, whereas Newton-Raphson method converges at a rapid rate and gives the exact value upto 6 decimal place in 5-6 iterations with a negligible error. It was then concluded that of the two methods considered, Newton-Raphson Method is the most effective scheme. This is in line with the result in our Ref.[4]

Keywords: - Convergence, Roots, Algorithm, Iterations, Equation, Bisection method, Newton-Raphson method, and function

I. INTRODUCTION

Root finding problem is a problem of finding a root of the equation f(x)= 0 , where f (x) is afunction of a single variable, x . Let f (x) be a function, we are interested in finding x=ξ such

that f (ξ)= 0 . The number ξ is called the root or zero of f (x) .f (x) may be algebraic, trigonometric ortranscendental function.

The root finding problem is one of the most relevant computational problems. It arises in a wide variety ofpractical applications in Physics, Chemistry, Biosciences, Engineering, etc. As a matter of fact, thedetermination of any unknown appearing implicitly in scientific or engineering formulas, gives rise to rootfinding problem [1]. Relevant situations in Physics where such problems are needed to be solvedinclude findingthe equilibrium position of an object, potential surface of a field and quantized energy level of confinedstructure [2]. The common root-finding methods include: Bisection, Newton-Raphson, False position, Secantmethods etc. Different methods converge to the root at different rates. That is, some methods are faster inconverging to the root

than others. The rate of convergence could be linear, quadratic or otherwise. The higherthe order, the faster the method converges [3]. The study is at comparing the rate of performance (convergence)of Bisection, Newton-Raphson and Secant as methods of root-finding.

Obviously, Newton-Raphson method may converge faster than any other method but when we compareperformance, it is needful to consider both cost and speed of convergence. An algorithm that converges quicklybut takes a few seconds per iteration may take more time overall than an algorithm that converges more slowly,but takes only a few milliseconds per iteration [4]. Secant method requires only one function evaluation periteration, since the value of $f(x_{n-1})$ can be stored from the previous iteration [1,4]. Newton's method, on theother hand, requires one function and the derivative evaluation per iteration. It is often difficult to estimate thecost of evaluating the derivative in general (if it is possible) [1, 4-5]. It seem safe, to assume that in most cases,evaluating the derivative is at least as costly as evaluating the function [4]. Thus, we can estimate that theNewton iteration takes about two functions evaluation per iteration. This disparity in cost means that we can runtwo iterations of the secant method in the same time it will take to run one iteration of Newton method.In comparing the rate of convergence of Bisection and Newton, [4] used C++programminglanguage to calculate the cube roots of numbers from 1 to 25, using the three methods. They observed that therate of convergence is in the following order: Bisection method< Newton method. Theyconcluded that Newton method is 7.678622465 times better than the Bisection method

A. Bisection Method

The Bisection Method [5] is the most primitive method for finding real roots of function f(x) = 0 where f is a continuous function. This method is also known as Binary-Search Method and Bolzano Method. Two initial guess is required to start the procedure. This method is based on the Intermediate value theorem:

if function f(x) = 0 is continuous between f(l) and f(u) and have opposite signs and less than zero, then

there is at least one root.We have to bracket the root. After that to calculate the midpoint $x_m = \frac{x_l + x_u}{2}$ the method divides the interval into two. Then we try to find $f(x_l)f(x_m)$It is illustrated in Figure 1.It is an advantageous of the Bisection Method [4] that it always converges. This method is very usefulfor computer based solvers. As iterations are conducted, interval gets halved. The error can be controlled.

Since the method brackets the root, convergence is guaranteed. In contrast, there are some pitfalls as well.That the Bisection Method is very slow because it converges linearly. It is not good for the Bisection Method to have initial guess close to the root, otherwise it will take more number of iterations to find theroot.
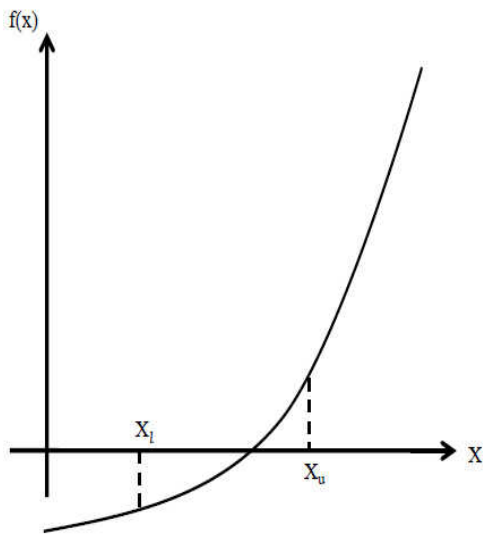
Bisection Method

1.1.1 Algorithm

Choose $\{x_{l}\}$ and $\{x_{u}\}$ as the initial guess such that

$f(x_{l})f(x_{u})<0$

Try the midpoint $x_{m}=\frac{x_{l}+x_{u}}{2}$

Find

$f(x_{l})f(x_{m})$

If

$f(x_{l})f(x_{m})<0$

Then1.1.1 Algorithm

Choose $\{x_{l}\}$ and $\{x_{u}\}$ as the initial guess such that

$f(x_{l})f(x_{u})<0$

Try the midpoint $x_{m}=\frac{x_{l}+x_{u}}{2}$

Find

$f(x_{l})f(x_{m})$

If

$f(x_{l})f(x_{m})<0$

Then

$x_{l}=x_{l};x_{u}=x_{m}$

If

$f(x_{l})f(x_{m})>0$

Then

$x_{l}=x_{m};x_{u}=x_{u}$

If

$f(x_{l})f(x_{m})=0$

Then the root is exact root.

$\epsilon_{x}^{i}|=|x_{i}-x_{i+1}|$

Check if

$|\epsilon_{x}^{i}|\leq\epsilon$

B. Newton-Raphson Method

Newton Raphson Method [5] is the most popular method for finding the roots of non-linear equations.Function can be approximated by its tangent line as shown in Figure 2. It starts with an initial guess that isclose to the root. The basic difference between Newton and other methods is that only one initial guess isrequired. Newton Method is efficient if the guess is close to the root. On the other hand, Newton Methodworks slowly or may diverge if initial guess is not very close to the root. One advantage of Newton Methodis that it converges fast, If it converges. The best thing for Newton Raphson Method is that it consumesless time and less iterations to find the root than the Bisection and False Position Method. It has drawbackof more complicated calculations. It resembles with the Bisection Method in approximating roots in aconsistent fashion. In this way user can easily predict exactly how many iterations it require to arrive at aroot.It is necessary for Newton Method [5] to use the function as well as the derivative of that functionto approximate the root. The process starts with an initial guess close to the root. After that one canapproximate the function by its tangent line to estimate the location of the root and x-intercept of itstangent line is also approximated. The better approximation will be x-

intercept than original guess, and theprocess is repeated until the desired root is found.

Error calculation is another interesting possible action with the Newton Method. Error calculations aresimply the difference between approximated value and the actual value. Newton-Raphson Method is fasterthan the Bisection Method. However as it requires derivative of the function which is sometime difficultand most laborious task. Sometimes there are some functions which are not solved by Newton-RaphsonMethod. So False Position Method is best method for such kind of functions. To meet the convergencecriteria, it should fulfill the condition off(x) f00(x) < [f(x)]2

However, there is no guarantee of convergence. If derivative is too small or zero then the method will diverge
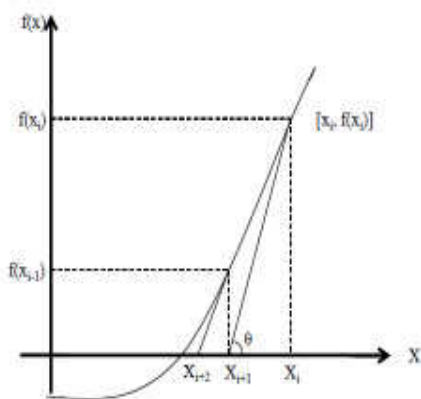
Newton-Raphson Method

1.2.1 Algorithm

Write out $\{f(x)\}$

Calculate $\{f'(x)\}$

Choose an initial guess

Find

$x_{i+1}=x_{i}-\frac{f(x_{i})}{f'(x_{i})}$

Continue iterating till

$|\epsilon_{x}^{i}|=|x_{i}-x_{i+1}|$

Check if

$|\epsilon_{x}^{i}|\leq\epsilon$

II. RESULT AND DISCUSSION

Lowest rate of convergence of bisection method has been observed in the calculation of cube root of 18 and isequal to 0.513604787. Highest rate of convergence of bisection method has been observed in the calculation of cuberoot of 9 and is equal to 16.05404433. Average rate of convergence of bisection method is 2.488206405.

Lowest rate of convergence of Newton-Raphson method has been observed in the calculation of cube root of23 and is equal to 0.71090450. Lowest rate of convergence of bisection method has also been observed in thecalculation of cube root of 18 and is equal to 0.513604787. Clearly, the numerical lowest rate of convergence ofNewton-Raphson method is higher than that of bisection method. Highest rate of convergence of bisection method hasbeen observed in the calculation of cube root of 1 and 8; and is equal to 100. Average rate of convergence of Newton-Raphson is 19.10599760 and in bisection method it was 2.488206405. It indicates that Newton-Raphson method isnumerically converges eight times faster than bisection method.

Lowest rate of convergence of secant method has been observed in the calculation of cube root of 2 and isequal to 2.067266281. Highest rate of convergence of bisection method has been observed in the calculation of cuberoot of 8 and is equal to 100. Average rate of convergence of bisection method is 26.547447346241. Numerical rateof convergence of bisection, Newton-Raphson and secant methods in the calculation of cube roots of natural numbersfrom 1 to 25 is shown in Table-1.

Table-1: Numerical rate of convergence of bisection, Newton-Raphson and secant methods in the calculation of cube roots of natural numbers from 1 to 25

S. No.	Function	Numerical rate of convergence of bisection method	Numerical rate of convergence of Newton-Raphson method
1	f(x)= x³-1	0.672162049000	100.000000000000
2	f(x)= x³-2	1.130409000000	10.472153810000
3	f(x)= x³-3	2.067266281386	31.613856000000

4	$f(x)= x^3-4$	4.905801738000	1.529660300000
5	$f(x)= x^3-5$	3.462918874000	63.650806600000
6	$f(x)= x^3-6$	0.534290882000	15.476043000000
7	$f(x)= x^3-7$	1.755222313000	2.194027900000
8	$f(x)= x^3-8$	1.839606985000	100.000000000000
9	$f(x)= x^3-9$	16.054044330000	18.887111000000
10	$f(x)= x^3-10$	0.869339151000	46.456744000000
11	$f(x)= x^3-11$	2.522446558000	4.053471300000
12	$f(x)= x^3-12$	2.011468427000	29.718609000000
13	$f(x)= x^3-13$	2.477496712000	0.982535100000
14	$f(x)= x^3-14$	0.855832748000	3.942084000000
15	$f(x)= x^3-15$	1.315970420000	7.591838000000
16	$f(x)= x^3-16$	5.464152428000	6.071280500000
17	$f(x)= x^3-17$	1.777792000000	3.463714500000
18	$f(x)= x^3-18$	0.513604787000	10.034817000000
19	$f(x)= x^3-19$	3.371910234000	3.746566900000
20	$f(x)= x^3-20$	1.354783292000	3.165259300000
21	$f(x)= x^3-21$	0.711212261000	3.502951900000
22	$f(x)= x^3-22$	1.097351638000	4.352778400000
23	$f(x)= x^3-23$	0.609346680000	0.710904500000
24	$f(x)= x^3-24$	2.694367495000	3.119794000000
25	$f(x)= x^3-25$	1.105228019000	2.912933000000
Average numerical rate of convergence		2.488206405000	19.105997600000

CONCLUSION

Cube roots of natural numbers from 1 to 25 have been calculated using bisection, Newton-Raphsonmethods with the help of computer programs. Average numerical rate of convergence of bisection and Newton-Raphsonhave been found to be 2.488206405000 and 19.105997600000 respectively. Itindicates that the numerical rate of convergence of bisectionand Newton-Raphson secant methods is in the followingorderBisection method < Newton-Raphson method. Above discussions indicate that Newton-Raphson method is 7.678622465 times better than bisection method.

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Effect of Wave Number on Fiber Reinforced Thermoelastic Medium at the Interface of Fluid Half Space

Praveen Ailawalia
Department of Applied Sciences
Baddi university of Emerging Science and Technology
Solan, India

Sunil Kumar Sachdeva
Dept. of Applied Sciences
D.A.V Institute of Engineering and Technology,
Jalandhar, India
sunilsachdeva.daviet@gmail.com

Abstract— The purpose of this paper is to study the effect of wave number in two dimensional deformation of fiber reinforced thermoelastic medium. A mechanical force is applied along the interface of fluid half space and fiber reinforced thermoelastic half space. The normal mode analysis has been applied to obtain the exact expressions for displacement component, force stress and temperature distribution. The effect of wave number on the displacement component, force stress and temperature distribution has been depicted graphically.

Keywords-Fiber-reinforced, Thermoelastic medium, Normal mode analysis, Wave number.

I. INTRODUCTION

The dynamical interaction between the thermal and mechanical has great practical applications in modern aeronautics, astronics, nuclear reactors, and high-energy particle accelerators. Classical elasticity is not adequate to model the behavior of materials possessing internal structure. Furthermore, the micropolar elastic model is more realistic than the purely elastic theory for studying the response of materials to external stimuli. Green AE and Lindsay KA developed the theory of thermoelasticity [1]. Eringen and Suhubi [2] and Suhubi and Eringen [3] developed a nonlinear theory of micro-elastic solids. Later Eringen [4-6] developed a theory for the special class of micro-elastic materials and called it the "linear theory of micropolar elasticity". Under this theory, solids can undergo macro-deformations and micro-rotations.

A reinforced structural component is designed for all conditions of stresses that may occur and in accordance with the principles of applied mechanics. Fiber-reinforced composites are used in a variety of structures due to their low weight and high strength. The characteristic property of a reinforced composite is that its components act together as single anisotropic units as long as they remain in the elastic condition. A reinforced medium plays a very interesting role in civil engineering and geophysics, as well as aerospace structural dynamics (wings, fuselage etc). The idea of introducing a continuous self-reinforcement at every point of an elastic solid was given by Belfied et al.[7]. The model was later applied to the rotation of a tube by Verma and Rana [8]. Sengupta and Nath [9] discussed the problem of the surface waves in fiber-reinforced anisotropic elastic media. The problem of wave propagation in thermally-conducting linear fiber-reinforced composite materials was analyzed by Singh [10]. Abbas and Othman [11] and Othman and co-workers [12-15] discussed some problems in fiber-reinforced thermoelastic medium.

The constitutive equation for a fiber-reinforced linearaly elastic medium with respect to reinforcement direction $\vec{a}$ (Belfied et al. [7]) are

$$\sigma_{ij} = \lambda e_{kk}\delta_{ij} + 2\mu_T e_{ij} + \alpha(a_k a_m e_{km}\delta_{ij} + e_{kk} a_i a_j) +$$

$$2(\mu_L - \mu_T)(a_i a_k e_{kj} + a_j a_k e_{ki}) +$$

$$\beta a_k a_m e_{km} a_i a_j - \upsilon(1 + \nu_0 \frac{\partial}{\partial t})\hat{T}\delta_{ij} \qquad (1)$$

where σ_{ij} is a force stress tensor, e_{ij} are component of strain, λ, μ_T are elastic constants ; α, β and $(\mu_L - \mu_T)$ are reinforcement parameter, $\upsilon = (3\lambda + 2\mu)\alpha_t$; α_t is thermal expansion coefficient, $\hat{T} = T - T_0$ where T is temperature above reference temperature T_0, ε_{ijr} is alternate tensor, δ_{ij} is kronecker's delta and $\vec{a} \equiv (a_1, a_2, a_3), a_1^2 + a_2^2 + a_3^2 = 1$,we choose the fiber direction as $\vec{a} \equiv (1,0,0)$. The strain can be expressed in terms of the displacement u_i as follows:

$$e_{ij} = \frac{1}{2}(u_{i,j} + u_{j,i})$$

if we restrict our analysis to the plane strain parallel to xy-plane with displacement vector $\vec{u} = (u, v, 0)$, then the constitutive relation for stress components can be written as,

$$\sigma_{xx} = A_1 u_{,x} + A_2 v_{,y} - \upsilon(1 + \nu_0 \frac{\partial}{\partial t})\hat{T} \qquad (2)$$

$$\sigma_{yy} = A_2 u_{,x} + A_{22} v_{,y} - \upsilon(1 + \nu_0 \frac{\partial}{\partial t})\hat{T} \qquad (3)$$

$$\sigma_{zz} = A_{12}u_{,x} + \lambda v_{,y} - \upsilon(1 + v_0\frac{\partial}{\partial t})\hat{T} \tag{4}$$

$$\sigma_{xy} = \mu_L(u_{,y} + v_{,x}), \ \sigma_{yx} = \mu_L(u_{,y} + v_{,x}),$$
$$\sigma_{zx} = \sigma_{zy} = 0 \tag{5}$$

Where,

$$A_{11} = \lambda + 2(\alpha + \mu_T) + 4(\mu_L - \mu_T) + \beta,$$
$$A_{12} = \alpha + \lambda, A_{22} = \lambda + 2\mu_T$$

The field equations and constitutive relations for generalized thermo-elastic medium in the absence of body forces, body couples and heat sources in the context of generalized thermo-elasticity can be expressed as:

Equation of Motion:

$$\rho\ddot{u}_j = \sigma_{ij,i}, (i, j = 1,2,3) \tag{6}$$

Heat conduction Equation:

$$K^*T_{,ii} = (n_1\frac{\partial}{\partial t} + \tau_0\frac{\partial^2}{\partial t^2})\rho C_E T + \upsilon T_0(n_1\frac{\partial}{\partial t} + n_0\tau_0\frac{\partial^2}{\partial t^2})u_{i,i} \tag{7}$$

where ρ denotes the density of thermoelastic solid, K^* is the thermal conductivity, C_E is the specific heat at constant strain, n_1, n_0 are parameters and τ_0, υ are thermal relaxation times.

The equations of motion and stress components in fluid are:

$$(\lambda^f)\nabla(\nabla.\vec{u}^f) = \rho^f\frac{\partial^2\vec{u}^f}{\partial t^2}, \tag{8}$$

$$\sigma_{ij}^f = \lambda^f u_{r,r}^f\delta_{ij} \tag{9}$$

where, $\vec{u}^f$ is displacement vector, λ^f is Lame's constant and ρ^f is density of fluid.

Using the summation convection from (2)-(5), we note that the third equation of motion in (6) identically satisfied and first two equation become,

$$\rho\frac{\partial^2 u}{\partial t^2} = A_{11}\frac{\partial^2 u}{\partial x^2} + B_2\frac{\partial^2 v}{\partial x\partial y} + B_1\frac{\partial^2 u}{\partial y^2} - \upsilon(1 + v_0\frac{\partial}{\partial t})\frac{\partial\hat{T}}{\partial x} \tag{10}$$

$$\rho\frac{\partial^2 v}{\partial t^2} = A_{11}\frac{\partial^2 v}{\partial y^2} + B_2\frac{\partial^2 u}{\partial x\partial y} + B_1\frac{\partial^2 v}{\partial x^2} - \upsilon(1 + v_0\frac{\partial}{\partial t})\frac{\partial\hat{T}}{\partial y} \tag{11}$$

Where $B_1 = \mu_L$, $B_2 = A_2 + B_1$

Equaton (7) becomes

$$K^*\nabla^2 T = (n_1\frac{\partial}{\partial t} + \tau_0\frac{\partial^2}{\partial t^2})\rho C_E T + \upsilon T_0(n_1\frac{\partial}{\partial t} + n_0\tau_0\frac{\partial^2}{\partial t^2})e \tag{12}$$

For convenience the following non-dimensional variables are used:

$$x' = c_1\eta x, \ y' = c_1\eta y, \ u' = c_1\eta u, \ v' = c_1\eta v, \ t' = c_1^2\eta t,$$

$$\tau_0' = c_1^2\eta\tau_0 \quad v_0' = c_1^2\eta v_0, \quad \theta = \frac{\upsilon\hat{T}}{\rho c_1^2}, \quad \sigma_{ij}' = \frac{\sigma_{ij}}{\rho c_1^2},$$

$$\sigma_{ij}^{f'} = \frac{\sigma_{ij}^f}{\rho^f c_1^2}, \ P_1' = \frac{P_1}{\rho c_1^2},$$

Where, $\eta = \frac{\rho C_E}{K^*}$, $c_1^2 = \frac{\lambda + 2\mu_T}{\rho}$

Using above non dimensional variables, the equations (10)-(12) reduces to (after dropping superscripts)

$$\frac{\partial^2 u}{\partial t^2} = h_{11}\frac{\partial^2 u}{\partial x^2} + h_2\frac{\partial^2 v}{\partial x\partial y} + h_1\frac{\partial^2 u}{\partial y^2} - \upsilon(1 + v_0\frac{\partial}{\partial t})\frac{\partial\theta}{\partial x} \tag{13}$$

$$\frac{\partial^2 v}{\partial t^2} = h_{22}\frac{\partial^2 v}{\partial y^2} + h_2\frac{\partial^2 u}{\partial x\partial y} + h_1\frac{\partial^2 v}{\partial x^2} - \upsilon(1 + v_0\frac{\partial}{\partial t})\frac{\partial\theta}{\partial y} \tag{14}$$

$$\frac{\partial^2\theta}{\partial x^2} + \frac{\partial^2\theta}{\partial y^2} = (n_1\frac{\partial}{\partial t} + \tau_0\frac{\partial^2}{\partial t^2})\theta + \varepsilon(n_1\frac{\partial}{\partial t} + n_0\tau_0\frac{\partial^2}{\partial t^2})(\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y}) \tag{15}$$

where, $(h_{11}, h_{22}, h_1, h_2) = \dfrac{(A_{11}, A_{22}, B_1, B_2)}{\rho c_1^2}$,

$$\varepsilon = \frac{\vartheta^2 T_0}{K^*\eta\rho c_1^2}$$

Equation (2)-(5) in dimensionless form reduces to

$$\rho c_1^2\sigma_{xx} = A_{11}u_{,x} + A_2v_{,y} - \rho c_1^2(1 + v_0\frac{\partial}{\partial t})\theta \tag{16}$$

$$\rho c_1^2\sigma_{yy} = A_2u_{,x} + A_{22}v_{,y} - \rho c_1^2(1 + v_0\frac{\partial}{\partial t})\theta \tag{17}$$

$$\rho c_1^2\sigma_{zz} = A_2u_{,x} + \lambda v_{,y} - \rho c_1^2(1 + v_0\frac{\partial}{\partial t})\theta \tag{18}$$

$$\rho c_1^2 \sigma_{xy} = \mu_L (u_{,y} + v_{,x}) \quad (19)$$

$$\rho c_1^2 \sigma_{yx} = \mu_L (u_{,y} + v_{,x}) \quad (20)$$

$$\sigma_{zx} = \sigma_{zy} = 0 \quad (21)$$

II. Normal Mode Analysis

The solution of the considered physical variables can be decomposed in terms of normal mode and can be considered in the following form

$$(u, v, \theta, \sigma_{ij}, u^f, v^f, \sigma_{ij}^f)(x, y, t) = (u^*, v^*, \theta^*, \sigma_{ij}^*, u^{f^*}, v^{f^*}, \sigma_{ij}^{f^*})(x)e^{\omega t + iby}$$

where ω is complex frequency, b is wave number in y-direction and $u^*(x), v^*(x), \theta^*(x), \sigma_{ij}^*(x), u^{f^*}(x), v^{f^*}(x), \sigma_{ij}^{f^*}(x)$ are the amplitudes of field quantities.

Using Normal mode in equation (13)-(21), we get

$$(h_{11}D^2 - A_1)u^* + ibh_2 Dv^* - A_3 D\theta^* = 0 \quad (22)$$

$$ibh_2 Du^* + (h_1 D^2 - A_2)v^* - ibA_3\theta^* = 0 \quad (23)$$

$$A_5 Du^* + ibA_5 v^* - (D^2 - A_4)\theta^* = 0 \quad (24)$$

$$\rho c_1^2 \sigma_{xx}^* = A_{11}Du^* + ibA_{12}v^* - \rho c_1^2 A_4\theta^* \quad (25)$$

$$\rho c_1^2 \sigma_{yy}^* = A_{12}Du^* + ibA_{22}v^* - \rho c_1^2 A_4\theta^* \quad (26)$$

$$\rho c_1^2 \sigma_{zz}^* = A_{11}Du^* + \lambda ibv^* - \rho c_1^2 A_4\theta^* \quad (27)$$

$$\rho c_1^2 \sigma_{xy}^* = \mu_L (ibu^* + Dv^*) \quad (28)$$

$$\rho c_1^2 \sigma_{yx}^* = \mu_L (ibu^* + Dv^*) \quad (29)$$

where, $A_1 = \omega^2 + h_1 b^2$, $A_2 = \omega^2 + h_{22}b^2$, $A_3 = 1 + \nu_0\omega$, $A_4 = b^2 + \tau_0\omega^2 + n_1\omega$, $A_5 = \varepsilon\omega(n_1 + n_0\tau_0\omega)$, $D = \dfrac{d}{dx}$

Eliminating $v^*(x), \theta^*(x)$ between equations (22)-(24), we get the following eight order differential equation for $u^*(x)$ as $(D^6 + AD^4 + BD^2 + C)u^*(x) = 0 \quad (30)$

where,

$$A = \frac{-1}{h_{11}h_1}(h_{11}h_1 A_4 + h_{11}A_2 + h_1 A_1 - b^2 h_2^2 + h_1 A_3 A_5)$$

$$B = \frac{-1}{h_{11}h_1}(-h_{11}A_2 A_4 - b^2 h_{11}A_3 A_5 - h_1 A_1 A_4 - A_1 A_2 +$$

$$b^2 h_2^2 A_4 + 2b^2 h_2 A_3 A_5 - A_2 A_3 A_5)$$

$$C = \frac{-1}{h_{11}h_1}(A_1 A_2 A_4 + b^2 A_1 A_3 A_5)$$

In a similar manner we can show that $v^*(x)$, $\theta^*(x)$ satisfies the equation

$$(D^6 + AD^4 + BD^2 + C)(v^*(x), \theta^*(x)) = 0 \quad (31)$$

which can be factorized as follows

$$(D^2 - k_1^2)(D^2 - k_2^2)(D^2 - k_3^2)u^*(x) = 0 \quad (32)$$

The Series solution of equation (31) has the form

$$u^*(x) = \sum_{n=1}^{3}[M_n(b,\omega)e^{-k_n(x)}] \quad (33)$$

$$v^*(x) = \sum_{n=1}^{3}[M_n'(b,\omega)e^{-k_n(x)}] \quad (34)$$

$$\theta^*(x) = \sum_{n=1}^{3}[M_n''(b,\omega)e^{-k_n(x)}] \quad (35)$$

Where $M_n(b,\omega), M_n'(b,\omega), M_n''(b,\omega)$ are specific function depending upon b, ω and k_n^2; $n = 1,2,3$ are the roots of characteristic equation (32).

using equation (33)-(35) in equation (22)-(24), we get the following relations

$$M_n'(b,\omega) = H_{1n}M_n(b,\omega) \quad (36)$$

$$M_n''(b,\omega) = H_{2n}M_n(b,\omega) \quad (37)$$

Thus we have,

$$v^*(x) = \sum_{n=1}^{3}[H_{1n}M_n(b,\omega)e^{-k_n(x)}] \quad (38)$$

$$\theta^*(x) = \sum_{n=1}^{3}[H_{2n}M_n(b,\omega)e^{-k_n(x)}] \quad (39)$$

$$\sigma_{xx}^* = \sum_{n=1}^{3}[H_{3n}M_n(b,\omega)e^{-k_n(x)}] \quad (40)$$

$$\sigma_{yy}^* = \sum_{n=1}^{3}[H_{4n}M_n(b,\omega)e^{-k_n(x)}] \quad (41)$$

$$\sigma_{zz}^* = \sum_{n=1}^{3} [H_{5n} M_n(b,\omega) e^{-k_n(x)}] \qquad (42)$$

$$\sigma_{xy}^* = \sum_{n=1}^{3} [H_{6n} M_n(b,\omega) e^{-k_n(x)}] \qquad (43)$$

$$\sigma_{yx}^* = \sum_{n=1}^{3} [H_{7n} M_n(b,\omega) e^{-k_n(x)}] \qquad (44)$$

where,

$$H_{1n} = \frac{ib[(h_{11} - h_2)k_n^2 - A_1]}{[(b^2 h_2 - A_2) + k_n h_1 k_n^3]}$$

$$H_{2n} = \frac{A_5(-k_n + ibH_{1n})}{(k_n^2 - A_4)}$$

$$H_{3n} = \frac{[-A_1 k_n + ibA_{12}H_{1n} - \rho c_1^2 A_5 H_{3n}]}{\rho c_1^2}$$

$$H_{4n} = \frac{[-A_{12} k_n + ibA_{22}H_{1n} - \rho c_1^2 A_3 H_{3n}]}{\rho c_1^2}$$

$$H_{5n} = \frac{[-A_{12} k_n + ib\lambda H_{1n} - \rho c_1^2 A_3 H_{3n}]}{\rho c_1^2}$$

$$H_{6n} = \frac{[ib\mu_L - k_n \mu_L H_{1n} - kH_{2n}]}{\rho c_1^2}$$

$$H_{7n} = \frac{[ib\mu_L - k_n \mu_L H_{1n} + kH_{2n}]}{\rho c_1^2}$$

Similarly for medium II (i.e fluid half space), the solutions are of the form

$$u^{f^*}(x) = M_4(b,\omega) e^{-k_4(x)} \qquad (45)$$

$$v^{f^*}(x) = M_4'(b,\omega) e^{-k_4(x)} \qquad (46)$$

where $M_4(b,\omega)$ and $M_4'(b,\omega)$ are specific function depending upon b and ω and k_4 is root of characteristic equation,

$$(D^2 - b^2 + 1\omega^2)u^{f^*}(x) = 0 \qquad (47)$$

Where, $1 = \dfrac{\rho^f c_1^2}{\lambda^f}$

From (47), $k_4 = \sqrt{b^2 - 1\omega^2}$

Thus we have,

$$v^{f^*}(x) = QM_4(b,\omega) e^{-k_4(x)} \qquad (48)$$

$$\sigma_{xx}^{f^*} = LM_4(b,\omega) e^{-k_4(x)} \qquad (49)$$

$$\sigma_{xy}^{f^*} = 0 \qquad (50)$$

where, $Q = \dfrac{k_4^2 - 1\omega^2}{ibk_4}$ and $L = \dfrac{(\lambda^f)(ibQ - k_4)}{\rho c_1^2}$

III. APPLICATIONS

In this section we determine the parameter M_n; ($n = 1,2,3,4$). In the Physical problem, we should suppress the positive exponential that are unbounded at infinity. Constants M_1, M_2, M_3 and M_4 have to be selected such that boundary condition at the surface $x = 0$ takes the form,

$$\sigma_{xx} = \sigma_{xx}^f - P_1 e^{\omega t + iby}; \ \sigma_{xy} = \sigma_{xy}^f; \ v = v^f; \ \frac{\partial \theta}{\partial x} = 0$$

where P_1 is the magnitude of mechanical force.

Using the expressions of σ_{xx}, σ_{xx}^f, σ_{xy}, σ_{xy}^f, v, v^f, θ into above boundary conditions, gives the following equations satisfied by the parameters.

$$\sum_{n=1}^{3} [H_{3n} M_n] - LM_4 = -P_1$$

$$\sum_{n=1}^{3} [H_{6n} M_n] = 0$$

$$\sum_{n=1}^{3} [H_{1n} M_n] - QM_4 = 0$$

$$\sum_{n=1}^{3} [H_{2n} k_n M_n] = 0$$

After applying Cramer rule to above system of four equations, we get the values of constant M_1, M_2, M_3, M_4 and hence obtain the component of normal displacement, normal force

stress and temperature distribution at the interface of fiber reinforced thermoelastic half space and fluid half space.

IV. NUMERICAL RESULTS AND DISCUSSIONS

In order to illustrate the theoretical results obtained in the preceding section and to compare various theories of thermoelasticity formulated earlier, we present some numerical results for the physical constants (Othman et al. [15]):

$$\lambda = 9.4 \times 10^9 \, \text{N/m}^2, \mu_T = 1.89 \times 10^9 \, \text{N/m}^2,$$

$$\mu_L = 2.45 \times 10^9 \, \text{N/m}^2, \alpha = -1.28 \times 10^9 \, \text{N/m}^2,$$

$$\beta = 0.32 \times 10^9 \, \text{N/m}^2, C_E = 5 \text{J/(kgK)}, k = 10^{11} \text{N/m}^2,$$

$$\gamma = 0.779 \times 10^{-1} \text{N}, K^* = 0.3 \text{W/(mk)}, T_0 = 274.5 \text{K},$$

$$\rho = 1.7 \times 10^3 \text{kg/m}^3, \alpha_t = 7.4033 \times 10^{-7} \text{k}^{-1},$$

$$\lambda^f = 2.14 \times 10^9 \, \text{N/m}^2, \rho^f = 10^3 \text{kg/m}^3.$$

The computations are carried out for the value of non-dimensional time $t = 0.4$ in the range $0 \leq x \leq 10$ and on the surface $y = 1.3$. The numerical values for normal

displacement v, temperature distribution θ and normal force stress σ_{yy} are shown in figures (1)-(3) for mechanical force with magnitude,

$$P_1 = 1.0, \, \omega = \omega_0 + \iota\xi, \, \omega_0 = -0.3, \, \xi = 0.1$$

These graphical results represent the solutions obtained by using the generalized theory with two relaxation times (G-L theory) by taking $\tau_0 = 0.4$, $\upsilon_0 = 0.6$

The variations of all the quantities are similar in nature which decrease with increase in horizontal distance. Value of normal displacement, normal force stress and temperature distribution for fibre reinforced thermoelastic medium is more near the point of application of source for all the values of b, whereas the temperature distribution has higher value for b = 0.7 and when the value of b is b = 0.8 and b = 0.9, the value of temperature distribution has less value to start with and ultimately approaches to zero. In figures (1)-(3), it has been observed that as x increases in range $0 \leq x \leq 10$ all the three quantities start decreasing and approaches to zero.
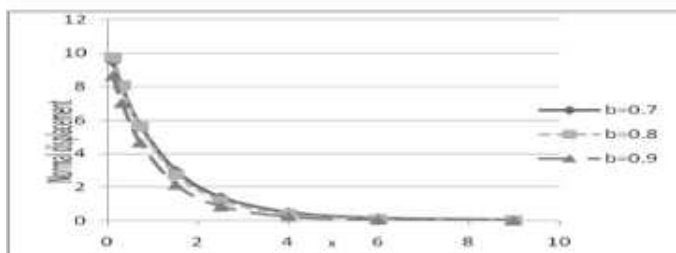
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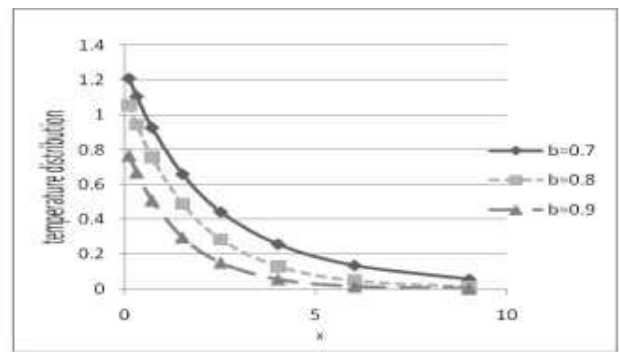
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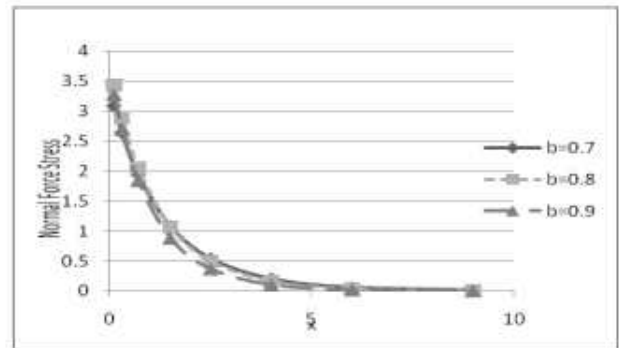
Figure 3

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Need and Applications of Numerical Analysis

Kanwalpreet Kaur
Department of Applied Sciences, C.T.Institute of
Technology
Jalandhar,India
kanwal.bal@rediffmail.com

Palwinder Singh
Department of Applied Sciences, C.T.I.E.M.T.
Jalandhar,India
palwinder_bolina@yahoo.co.in

Abstract— **In this paper we will study about the need and applications of numerical analysis.Numerical analysis is considered as a new approach to scientific discovery. Numerical analysis is the area of mathematics and computer science that is used for solving numerically the problems of continuous mathematics. A brief description of the basic techniques that are applied in the field of numerical analysis are included in the paper.**

Keywords— **Rounding errors, matrix operation, continuous mathematics, numerical linear algebra, numerical optimization, numerical ordinary differential equations.**

I. INRODUCTION

Numerical analysis is the study of algorithms that use numerical approximation for the problems of mathematical analysis i.e. numerical analysis is the area of mathematics and computer science that creates, analyzes, and implements algorithms for solving numerically the problems of continuous mathematics. Such problems originate generally from real-world applications of algebra, geometry, and calculus, and they involve variables which vary continuously. These problems occur throughout the natural sciences, social sciences, medicine, engineering, and business. It does not seek exact answers, because exact answers are often impossible to obtain in practice [1]. Instead, much of numerical analysis is concerned with obtaining approximate solutions while maintaining reasonable bounds on errors. The overall goal of the field of numerical analysis is the design and analysis of techniques to give approximate but accurate solutions to hard problems

II. APPLICATIONS OF NUMERICAL ANALYSIS

A. History

Numerical algorithms are almost as old as human civilization. The Rhind Papyrus (~1650 BC) of ancient Egypt describes a root finding method for solving a simple equation Archimedes of Syracuse (287- 212 BC) created much new mathematics, including the "method of exhaustion" for calculating lengths, areas, and volumes of geometric figures [5]. When used as a method to find approximations, it is in much the spirit of modern numerical integration; and it was an important precursor to the development of the calculus by Isaac Newton and Gottfried Leibnitz. Throughout history, leading mathematicians have been involved with scientific applications, and in many cases this has led to the discovery of numerical algorithms still in use today .Gauss, as usual, is an outstanding example. Among many other contributions, he made crucial advances in least-squares data fitting (1795), systems of linear equations (1809), and numerical quadrature (1814), as well as inventing the fast fourier transform (1805), though the last did not become widely known until its rediscovery by Cooley and Tukey in 1965[4]. Around 1900, the numerical side of mathematics started to become less conspicuous in the activities of research mathematicians. This was a consequence of the growth of mathematics generally and of great advances in fields in which, for technical reasons, mathematical rigor had to be the heart of the matter. A generation passed, and in the 1940s the computer was invented. From this moment numerical mathematics began to explode, but now mainly in the hands of specialists. The revolution was sparked by hardware, but it included mathematical and algorithmic developments that had nothing to do with hardware. In the half century from the 1950s, machines sped up by a factor of around 109, but so did the best algorithms known for some problems, generating a combined increase in speed of almost incomprehensible scale [3]. Half a century on, numerical analysis has grown into one of the largest branches of mathematics, the specialty of thousands of researchers who publish in dozens of mathematical journals as well as applications journals across the sciences and engineering. Thanks to the efforts of these people going back many decades, and thanks to ever more powerful computers, we have reached a point where most of the classical mathematical problems of the physical sciences can be solved numerically to high accuracy. Most of the algorithms that make this possible were invented since 1950. Numerical analysis is built on a strong foundation: the mathematical subject of approximation theory.

B. Machine Arithmetic and Rounding Errors

It is well-known that computers cannot represent real or complex numbers exactly. A quotient like 1/7 evaluated on a computer, for example, will normally yield an inexact result. (It would be different if we designed machines to work in base 7!) Computers approximate real numbers by a system of floating-point arithmetic, in which each number is represented in a digital equivalent of scientific notation, so that the scale does not matter unless the number is so huge or tiny as to cause overflow or underflow. Floating-point arithmetic was invented by Konrad Zuse in Berlin in the 1930s, and by the end of the 1950s it was standard across the computer industry. Until the 1980s, different computers had widely different arithmetic

properties. Then, in 1985, after years of discussion, the IEEE (Institute of Electrical and Electronics Engineers) standard for binary floating-point arithmetic was adopted, or IEEE arithmetic for short. This standard has subsequently become nearly universal on processors of many kinds. The main business of numerical analysis is coping with rounding errors. In fact, the main business of numerical analysis is designing algorithms that converge quickly; rounding-error analysis.

C. Numerical Linear Algebra

Many problems in applied mathematics involve solving systems of linear equations, with the linear system occurring naturally in some cases and as a part of the solution process in other case. Linear algebra becomes a standard topic and there are several reasons for this. The importance of linear algebra has exploded since the arrival of computers. The starting point of this subject is Gaussian elimination, a procedure that can solve n linear equations in n unknowns using on the order of n3 arithmetic operations. Equivalently, it solves equations of the form $Ax = b$, where A is an $n \times n$ matrix and x and b are column vectors of size n. Gaussian elimination is invoked on computers around the world almost every time a system of linear equations is solved. Even if n is as large as 1000. The idea of elimination was first discovered by Chinese scholars about 2000 years ago, and more recent contributors include Lagrange, Gauss, and Jacobi. Gaussian elimination is a process of lower-triangular uppertriangularization. Many other algorithms of numerical linear algebra are also based on writing a matrix as a product of matrices that have special properties. To borrow a phrase from biology, we may say that this field has a central dogma:

algorithms $\longleftrightarrow$ matrix factorizations.

Soon after computers came into use it was observed that even for matrices that do have LU factorizations, the pure form of Gaussian elimination is unstable, amplifying rounding errors by potentially large amounts. Stability can be achieved by interchanging rows during the elimination in order to bring maximal entries to the diagonal, a process known as pivoting The matrix factorization corresponding to Gaussian elimination with pivoting is

$PA = LU$,

where U is upper-triangular, L is unit lower-triangular, and P is a permutation matrix,

The discovery of pivoting came quickly, but its theoretical analysis has proved astonishingly hard. In practice, pivoting makes Gaussian elimination almost perfectly stable, and it is routinely done by almost all computer programs that need to solve linear systems of equations. Yet it was realized in around 1960 by Wilkinson and others that for certain exceptional matrices, Gaussian elimination is still unstable, even with pivoting. The lack of an explanation of this discrepancy represents an embarrassing gap at the heart of numerical analysis Meanwhile, beginning in the late 1950s, the field of numerical linear algebra expanded in another direction: the use of algorithms based on orthogonal or unitary

matrices, that is, real matrices with $Q^{-1} = Q^T$ or complex ones with $Q^{-1} = Q^*$, where Q^* denotes the conjugate transpose. The starting point of such developments is the idea of QR factorization. If A is an $m \times n$ matrix with $m \geq n$, a QR factorization of A is a product $A = QR$, where Q has orthonormal columns and R is upper-triangular. One can interpret this formula as a matrix expression of the familiar idea of Gram–Schmidt orthogonalization. A big event was when Householder showed in 1958 that a dual strategy of orthogonal triangularization is more effective for many purposes. The Householder method turns out to be more stable numerically, because orthogonal operations preserve norms and thus do not amplify the rounding errors introduced at each step. From the QR factorization sprang a rich collection of linear algebra algorithms in the 1960s. The QR factorization can be used by itself to solve leastsquares problems and construct orthonormal bases. More remarkable is its use as a step in other algorithms. In particular, one of the central problems of numerical linear algebra is the determination of the eigenvalues and eigenvectors of a square matrix A. If A has a complete set of eigenvectors, then by forming a matrix X whose columns are these eigenvectors and a diagonal matrix D whose diagonal entries are the corresponding eigenvalues, we obtain

$AX = XD$,

and hence, since X is nonsingular,

$A = XDX^{-1}$,

the eigenvalue decomposition. In the special case in which A is hermitian, a complete set of orthonormal eigenvectors always exists, giving

$A = QDQ^*$,

where Q is unitary. The standard algorithm for computing these factorizations was developed in the early 1960s by Francis, Kublanovskaya, and Wilkinson: the QR algorithm. Because polynomials of degree 5 or more cannot be solved by a formula, we know that eigenvalues cannot generally be computed in closed form. The QR algorithm is therefore necessarily an iterative one, involving a sequence of QR factorizations that is in principle infinite. Nevertheless, its convergence is extraordinarily rapid. In the symmetric case, for a typical matrix A, the QR algorithm converges cubically, in the sense that at each step the number of correct digits in one of the eigenvalue–eigenvector pairs approximately triples. The QR algorithm is one of the great triumphs of numerical analysis, and its impact through widely used software products has been enormous. Algorithms and analysis based on it led in the 1960s to computer codes in Algol and Fortran and later to the software library EISPACK ("Eigensystem Package") and its descendant LAPACK. The same methods in general-purpose numerical libraries such as the NAG, IMSL, and Numerical Recipes collections, and in problem-solving environments such as MATLAB, Maple, and Mathematica. These developments have been so successful that the computation of matrix eigenvalues long ago became a "black

box" operation for virtually every scientist, with nobody but a few specialists knowing the details of how it is done. A curious related story is that EISPACK's relative LINPACK for solving linear systems of equations took on an unexpected function: it became the original basis for the benchmarks that all computer manufacturers run to test the speed of their computers. If a supercomputer is lucky enough to make the TOP500 list, updated twice a year since 1993, it is because of its prowess in solving certain matrix problems Ax = b of dimensions ranging from 100 into the millions.The eigenvalue decomposition is familiar to all mathematicians, but the development of numerical linear algebra has also brought its younger cousin onto the scene: the singular value decomposition (SVD). It is also a step in an extraordinary variety of further computational problems including rank-deficient least-squares, computation of ranges and null spaces, determination of ranks, "total least-squares," low-rank approximation, and determination of angles between subspaces. All the discussion above concerns "classical" numerical linear algebra, born in the period 1950–75. The ensuing quarter-century brought in a whole new set of tools: methods for large-scale problems based on Krylov subspace iterations.

D. Numerical Solution of Differential Equations

Long before much attention was paid to linear algebra, mathematicians developed numerical methods to solve problems of analysis. The problem of numerical integration or quadrature goes back to Gauss and newton , and even to archimedes . The classic quadrature formulas are derived from the idea of interpolating data at n + 1 points by a polynomial of degree n, then integrating the polynomial exactly. Equally spaced interpolation points give the Newton– Cotes formulas, which are useful for small degrees but diverge at a rate as high as 2n as n → ∞: the Runge phenomenon. If the points are chosen optimally, then the result is Gauss quadrature, which converges rapidly and is numerically stable. It turns out that these optimal points are roots of Legendre polynomials, which are clustered near the endpoints. This quadrature method is also stable and rapidly convergent, and unlike Gauss quadrature can be executed in O(nlog n) operations by the fast Fourier transform. The explanation of why clustered points are necessary for effective quadrature rules is related to the subject of potential theory. Around 1850 another problem of analysis began to get attention: the solution of ODEs. Both the ODE itself and its numerical approximation may involve one equation or many, in which case u(t,x) and vn become vectors of an appropriate dimension. The Adams formulas are higher-order generalizations of Euler's formula that are much more efficient at generating accurate solutions. Most unfortunately, the habit in the numerical analysis literature is to speak not of the convergence of these magnificently efficient methods, but of their error, or more precisely their discretization or truncation error as distinct from rounding error. This ubiquitous language of error analysis is dismal in tone, but seems ineradicable. At the turn of the twentieth century, the second great class of ODE algorithms, known as Runge–Kutta or one-step methods, was developed by Runge, Heun, and

Kutta. For example, here are the formulas of the famous fourth-order Runge–Kutta method, which advance a numerical solution (again scalar or system) from time step tn to tn+1 with the aid of four evaluations of the function f : Runge–Kutta methods tend to be easier to implement but sometimes harder to analyze than multistep formulas.

When computers began to be used to solve differential equations after World War II, a phenomenon of the greatest practical importance appeared: once again, numerical instability.One mathematician concerned with this effect was Germund Dahlquist. Dahlquist saw that the phenomenon

could be analyzed with great power and generality, and some people regard the appearance of his 1956 paper as one of the events marking the birth of modern numerical analysis. This landmark paper introduced what might be called the fundamental theorem of numerical analysis:

consistency + stability = convergence.

Before Dahlquist's paper, the idea of an equivalence of stability and convergence was perhaps in the air in the sense that practitioners realized that if a numerical scheme was not unstable, then it would probably give a good approximation to the right answer. His theory gave rigorous form to that idea for a wide class of numerical methods. As computer methods for ODEs were being developed, the same was happening for the much bigger subject of PDEs. Discrete numerical methods for solving PDEs had been invented around 1910 by Richardson for applications in stress analysis and meteorology, and further developed by Southwell; in 1928 there was also a theoretical paper on finite-difference methods by courant , Friedrichs, and Lewy. But although the Courant–Friedrichs–Lewy work later became famous, the impact of these ideas before computers came along was limited. After that point the subject developed quickly. Particularly influential in the early years was the group of researchers around von Neumann at the Los Alamos laboratory, including

the young Peter Lax. Just as for ODEs, von Neumann and his colleagues discovered that some numerical methods for PDEs were subject to catastrophic instabilities. Early treatments of linear and nonlinear equations in one space dimension soon moved to two dimensions and eventually to three. It is now a routine matter to solve problems involving millions of variables on computational grids with hundreds of points in each of three directions. The equations are linear or nonlinear; the grids are uniform or nonuniform, often adaptively refined to give special attention to boundary layers and other fast-changing features; the applications are everywhere. Numerical methods were used first to model airfoils, then whole wings, then whole aircraft. Engineers still use wind tunnels, but they rely more on computations. Many of these successes have been facilitated by another numerical technology for solving PDEs that emerged in the 1960s from diverse roots in engineering and mathematics: finite elements. Instead of approximating a differential operator by a difference quotient, finite-element methods approximate the solution itself by functions f that can be broken up into simple pieces. Here are

some examples that illustrate the successful reliance of today's science and engineering on the numerical solution of PDEs: chemistry (the schrodinger equation),structural mechanics (the equations of elasticity),weather prediction (the geostrophic equations), turbine design (the navier– stokes equations,acoustics (the Helmholtz equation),telecommunications (maxwell's equations cosmology (the Einstein equations); oil discovery (the migration equations),groundwater remediation (Darcy's law),integrated circuit design (the drift diffusion equations); tsunami modeling (the shallowwater equations),optical fibers (the nonlinear wave equations ,image enhancement (the Perona– Malik equation); metallurgy (the Cahn–Hilliard equation), pricing financial options (the black–schools equation.

E. Numerical Optimization

Numerical Optimization presents a comprehensive and up-to-date description of the most effective methods in continuous optimization. The development of optimization has been somewhat independent of that of the rest of numerical analysis, carried forward in part by a community of scholars with close links to operations research and economics. Calculus students learn that a smooth function may achieve an extremum at a point of zero derivative, or at a boundary. The same two possibilities characterize the two big strands of the field of optimization. At one end there are problems of finding interior zeros and minima of unconstrained nonlinear functions by methods related to multivariate calculus. At the other are problems of linear programming, where the function to be minimized is linear and therefore easy to understand, and all the challenge is in the boundary constraints. Unconstrained nonlinear optimization is an old subject. Newton introduced the idea of approximating functions by the first few terms of what we now call their Taylor series. Newton (1669) and Raphson (1690) applied this idea to polynomials, and Simpson (1740) generalized it to other functions F and to systems of two equations. In today's language, for a system of n equations in n unknowns. The problem of constraints brings us to the other strand of numerical optimization, linear programming. This subject was born in the 1930s and 1940s with Kantorovich in the Soviet Union and Dantzig in the United States. As an outgrowth of his work for the U.S. Air Force in the war, Dantzig invented in 1947 the famous simplex algorithm for solving linear programs. A linear program is nothing more than a problem of minimizing a linear function of n variables subject to m linear equality and/or inequality constraints.

III.CONCLUSION

Numerical analysis has numerous applications in all fields of science and some fields of engineering, and essentially any type of work that requires calculations to give very precise solutions. The point of numerical analysis is to analyze methods that are used to give approximate number solutions to situations where it is unlikely to find the real solution quickly, and to try and improve upon these methods so as to reduce the amount of error generated by computer calculation. It is essential in work that requires precise numbers to get very good approximations with very little error in them, if approximations with just even 1 or 2% error are used in another calculation, and the answer of that calculation used in another, and so on, the errors will build up and you end up with very unreliable numbers. This is why it is a good idea to study numerical analyze if you intend to go into any area of work requiring precise calculations, so as to be able to identify if there are areas you can improve so as to better your methods in finding solutions and reducing error.

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Stability of Plankton-Nutrient Interaction in the Presence of Delay

Amit Sharma
Dept. of Applied Sciences
D.A.V.Institute of Engineering and Technology
Jalandhar, India.
e-mail: amit.daviet@gmail.com

Anuj K. Sharma
Department of Mathematics
DAV College
Jagraon, India
Email:anujsumati@gmail.com

Abstract— In this paper a plankton-nutrient interaction is considered with a discrete time delay in the growth term of phytoplankton regarded as delay due to gestation. The system is analysed for local asymptotic stability with and without delay. Further, considering this time delay as a bifurcation parameter, it is shown that the system undergoes a Hopf-bifurcation as delay passes through a some critical value. Finally, outcomes of the system are validated through numerical simulations.

Keywords—Plankton, Gestation delay, Stability, Hopf-bifurcation.

I. INTRODUCTION

Differential equations with delay in various interaction terms have already been extensively used by many researchers to model population dynamics which also includes plankton-nutrient interactions. Many delayed biological models are the monographs of cushing [1], gopalsamy[10] and kuang [2]. They observed that the delayed differential equation models exhibit more complicated dynamics than ordinary differential equations as time delay may transfer a stable equilibrium to unstable and can induce bifurcations.Moreover, the mathematical analysis of Plankton-Nutrient systems has been studied by many authors[3-9]. Lot of work has also been done which deals with physical and chemical aspects of phytoplankton growth[10]. Beretta et al.[11] and Ruan [12] studied chemostat models to stimulate the growth of plankton with limited nutrient supply at a constant rate and also studied the effect of delay on the stability of the system by taking delay as bifurcation parameter. Das and Ray [13] has studied a detritus based plankton model with delay in nutrient recycling and showed that this delay does not effect the stability of the system under certain conditions.In this paper we will investigate a Nutrient-Plankton system with limited nutrient supply at a constant rate N_0 and a discrete delay in the growth term of phytoplankton for nutrient uptake due to gestation [12]. The deriving equations of the system considered are as follows:

$$\frac{dN}{dt} = \gamma(N_0 - N) - \alpha_1 NP + k_1\delta_1 P + k_2\delta_2 Z$$

$$\frac{dP}{dt} = -\delta_1 P - \beta\frac{P}{a+P}Z + rN(t-\tau)P \qquad (1)$$

$$\frac{dZ}{dt} = \varepsilon\beta\frac{P}{a+P}Z - \delta_2 Z$$

$$N(0) > 0, P(0) > 0, Z(0) > 0.$$

The following assumptions of the above model are made:

1.The variable $N(t)$, $P(t)$ and $Z(t)$ are the concentration of nutrient, population densities of the phytoplankton and zooplankton species respectively at any time 't'.

2. r is the growth rate of phytoplankton and γ the rate of replenishment of nutrient. Let β be the grazing rate of the zooplankton and ε is the fraction of biomass converted to zooplankton growth. It is also assumed that the some proportion of the dead mass of phytoplankton and zooplankton converted into nutrient and recycled back at the rate k_1, k_2 respestively.

3. N_0 is the constant rate of nutrient supply, a is the half saturation constant and α_1 is uptaking rate of nutrients by the phytoplankton. Further δ_1, δ_2 are the natural death rate of phytoplankton and zooplankton species respectively. The discrete delay τ is the delay due to gestation.

The initial conditions of the system
Error! Reference source not found. has the form
$N(\theta) = \phi_1(\theta)$, $P(\theta) = \phi_2(\theta)$, $Z(\theta) = \phi_3(\theta)$,
$\phi_1(\theta) \geq 0$, $\phi_2(\theta) \geq 0$, $\phi_3(\theta) \geq 0$, $\theta \in [-\tau, 0]$,
$\phi_1(0) \geq 0$, $\phi_2(0) \geq 0$ where
$\phi_1(\theta), \phi_2(\theta), \phi_3(\theta) \in C([-\tau, 0], R_+^3)$, the banach space of continuous functions mapping the interval $[-\tau, 0]$ into R_+^3
where $R_+^3 = \{(x_1, x_2, x_3) : x_i \geq 0, i = 1,2,3\}$

Further from the fundamental theorem of differential equations the existence,uniqueness and continuous dependence on initial conditions of the system **Error! Reference source not found.** are evidently satisfied .

Local Stability Analysis and Hopf bifurcation

The boundary and planar equilibria of the system are $E_0 = (N_0, 0, 0)$ which is always trivial,

$$E_1 = \left(\frac{\delta_1}{r}, \frac{\gamma(rN_0 - \delta_1)}{\delta_1(\alpha_1 - rk_1)}, 0 \right)$$ exists if $\frac{\delta_1}{N_0} < r < \frac{\alpha_1}{k_1}$ or

$\frac{\alpha_1}{k_1} < r < \frac{\delta_1}{N_0}$ and an interior equilibrium

$$E_* = \left(\frac{\dfrac{a\delta_1\delta_2(\varepsilon k_2 - k_1)}{(\varepsilon\beta - \delta_2)} - \gamma N_0}{\dfrac{ar\varepsilon k_2\delta_2 - a\alpha_1\delta_2}{(\varepsilon\beta - \delta_2)} - \gamma}, \frac{a\delta_2}{\varepsilon\beta - \delta_2}, \frac{a\varepsilon(rN_* - \delta_1)}{(\varepsilon\beta - \delta_2)} \right)$$

exist if $\beta > \dfrac{\delta_2}{\varepsilon}$, $rN_* > \delta_1$ and

$\gamma < \min\left(\dfrac{a\delta_1\delta_2(\varepsilon k_2 - k_1)}{N_0(\varepsilon\beta - \delta_2)}, \dfrac{a\delta_2(r\varepsilon k_2 - \alpha_1)}{(\varepsilon\beta - \delta_2)} \right)$ holds

provided $k_2 > \max\left(\dfrac{k_1}{\varepsilon}, \dfrac{\alpha_1}{r\varepsilon} \right)$.

In this section we mainly focus on the investigation of the local asymptotical stability and Hopf-bifurcation only around the interior equilibrium point E_* which is considered to the most ecological one.

$$\begin{vmatrix} -\gamma - \alpha_1 P^* - \lambda & -\alpha_1 N^* + k_1\delta_1 & k_2\delta_2 \\ rP^* e^{-\lambda\tau} & rN^* - \delta_1 - \dfrac{a\beta Z^*}{(a+P^*)^2} - \lambda & -\dfrac{\varepsilon\beta P^*}{a+P^*} \\ 0 & \dfrac{a\varepsilon\beta Z^*}{(a+P^*)^2} & \dfrac{\varepsilon\beta P^*}{a+P^*} - \delta_2 - \lambda \end{vmatrix} = 0$$

$$\Delta(\lambda, \tau) = \lambda^3 + a_1\lambda^2 + a_2\lambda + a_3 + e^{-\lambda\tau}(b_2\lambda + b_3) = 0 \quad (2)$$

where

$a_1 = \gamma + \alpha_1 P^* + \delta_1 + \dfrac{a\beta Z^*}{(a+P^*)^2} - rN^*$

$a_2 = \dfrac{a\varepsilon\beta^2 P_*Z^*}{(a+P^*)^3} - (\gamma + \alpha_1 P^*)\left(rN_* - \delta_1 - \dfrac{a\beta Z^*}{(a+P^*)^2}\right)$

$a_3 = (\gamma + \alpha_1 P_*)\dfrac{a\varepsilon\beta^2 P_*Z^*}{(a+P^*)^3}$

$b_2 = rP_*(a_1 N_* + k_1\delta_1)$

$b_3 = \dfrac{ar\varepsilon\beta k_2\delta_2 P_*Z^*}{(a+P^*)^2}$

For $\tau = 0$, the transcendental equation (2) reduces to following form

$$\Delta(\lambda, 0) = \lambda^3 + a_1\lambda^2 + (a_2 + b_2)\lambda + a_3 + b_3 = 0. \quad (3)$$

Where

$a_1 = \gamma + \alpha_1 P^* + \delta_1 + \dfrac{a\beta Z^*}{(a+P^*)^2} - rN^* > 0$

$a_2 + b_2 = \dfrac{a\varepsilon\beta^2 P_*Z^*}{(a+P^*)^3} - (\gamma + \alpha_1 P^*)$

$\left(rN_* - \delta_1 - \dfrac{a\beta Z^*}{(a+P^*)^2}\right) + rP_*(a_1 N_* + k_1\delta_1) > 0$

$a_3 + b_3 = (\gamma + \alpha_1 P_*)\dfrac{a\varepsilon\beta^2 P_*Z^*}{(a+P^*)^3} + \dfrac{ar\varepsilon\beta k_2\delta_2 P_*Z^*}{(a+P^*)^2} > 0$

Now by using Routh-Hurwitz Criteria we know that all the roots of equation (3) have negative real parts i.e. the interior equilibrium E^* is locally asymptotically stable provided that the condition $H1: a_1(a_2 + b_2) - (a_3 + b_3) > 0$ holds.

Theorem 1: If $a_1 > 0$, $a_3 > 0$ and $H1$ holds then the system (3) will remain asymptotically stable around E^*.

Now, we will be interested to determine how delay effects the stability of the positive equilibrium by taking τ as the bifurcation parameter. Before this we shall introduce the following lemma's.

Lemma1.[16] For the polynomial equation
$z^3 + pz^2 + qz + r = 0$,

(1)If $r < 0$, the equation has at least one positive root;

(ii)If $r \geq 0$ and $\Delta = p^2 - 3q \leq 0$, then equation has no positive root;

(iii)If $r \geq 0$ and $\Delta = p^2 - 3q > 0$, then equation has

positive roots iff $z_1^* = \dfrac{-p + \sqrt{\Delta}}{3}$ and $h(z_1^*) \leq 0$, where

$h(z) = z^3 + pz^2 + qz + r$.

Lemma2. (i)The positive equilibrium E_* of the system (1) is absolutely stable if and only if the equilibrium E_* of the corresponding ODE system is asymptotically stable and the

characteristic equation (2) has no purely imaginary roots for any $\tau > 0$

(ii)The positive equilibrium E_* of the system (1) is conditionally stable if and only if all the roots of the characteristic equation (2) have negative real parts at $\tau = 0$ and there exist some positive values τ such that the characteristic equation (2) has pair of purely imaginary roots $\pm i\omega$.

In order to see the delay induced instability let $\iota\omega(\omega > 0)$ is a root of the characteristic equation (2), for some $\tau > 0$, we then have

$$-\iota\omega^3 - a_1\omega^2 + \iota a_2\omega + a_3 + (\iota b_2\omega + b_3)e^{-\iota\omega\tau} = 0$$

separating the real and imaginary parts,we have

$$a_1\omega^2 - a_3 = b_3\cos\omega\tau + b_2\omega\sin\omega\tau$$
$$-a_2\omega + \omega^3 = b_2\omega\cos\omega\tau - b_3\sin\omega\tau \qquad (4)$$

eliminating ω from above equations and setting $\omega^2 = z$, it can be obtained that

$$h(z) = z^3 + pz^2 + qz + r = 0 \qquad (5)$$

Where $p = a_1^2 - 2a_2$, $q = a_2^2 - 2a_1a_3 - b_2^2$, $r = a_3^2 - b_3^2$.

Since $a_3^2 - b_3^2 < 0$ therefore by lemma 1 there exist at least one positive root $\omega = \omega_0$ of (5) satisfying (4) which implies characteristic equation (2) has a pair of purely imaginary roots of the form $\pm\iota\omega_0$.

Substituting $\omega = \omega_0$ in (4), the corresponding critical value of delay is given by

$$\tau_k = \frac{1}{\omega_0}\arctan\frac{b_3(a_3 - a_1\omega_0^2) + b_2\omega_0^2(a_2 - \omega_0^2)}{\omega_0^3(b_3 - a_1b_2)}$$
$$+ \frac{k\pi}{\omega_0} \qquad (6)$$

Next to obtain the transversality condition for the Hopf-bifurcation, we will find the value of $\dfrac{d\xi}{d\tau}$ at $\xi = 0$.

Let $\lambda(\tau) = \xi(\tau) + i\omega(\tau)$ be a root of (2) s.t. $\xi(\tau_k) = 0$ and $\omega(\tau_k) = \omega_0$ and differentiating with respect to τ, we get

$$\left[\frac{d\lambda}{dt}\right]^{-1} = \frac{3\lambda^2 + 2a_1\lambda + a_2}{\lambda(b_2\lambda + b_3)e^{-\lambda\tau}} - \frac{\tau}{\lambda} + \frac{b_2}{\lambda(b_2\lambda + b_3)}$$

$$= \frac{3\lambda^2 + 2a_1\lambda + a_2}{-\lambda(\lambda^3 + a_1\lambda^2 + a_2\lambda + a_3)} - \frac{\tau}{\lambda}$$
$$+ \frac{b_2}{\lambda(b_2\lambda + b_3)}$$

$$\left(\frac{d\mathrm{Re}(\lambda)}{dt}\right)^{-1}_{\lambda = \iota\omega_0} = \frac{-3\omega_0^2 + \iota 2a_1\omega_0 + a_2}{-\iota\omega_0(-\iota\omega_0^3 - a_1\omega_0^2 + \iota a_2\omega_0 + a_3)}$$
$$+ \frac{b_2}{\iota\omega_0(\iota b_2\omega_0 + b_3)}$$

$$= \frac{-2\omega_0^2(a_3^2 - b_3^2)}{(a_2\omega_0 - \omega_0^3)^2 + (a_1\omega_0^2 - a_2)^2} > 0$$

as $(a_3^2 - b_3^2) < 0$. Thus root of the characteristic equation (2) crosses the imaginary axis as τ continuously varies from a number less than τ_k to one greater than τ_k. Therefore, the transversality condition holds and the conditions for Hopf bifurcation [17] are then satisfied at $\tau = \tau_*$ which is the least positive value of τ_k given by (6). Based on the above analysis we have the following theorem

Theorem3.Suppose that E_* exist and the condition H_1 satisfied for the model system (1),then

(i)if $\tau \in [0, \tau_*]$,the positive equilibrium point E_* is LAS;

(ii)if $\tau > \tau_0$,the positive equilibrium point E_* is unstable;

(iii)system undergoes Hopf-bifurcation at $\tau = \tau_*$ around E_*.

A. Numerical Simulations

In this subsection, we will provide a numerical example to dignify our theoretical findings. We have considered the given system by choosing a set of parameters $N_0 = 5$, $a = 10$, $\alpha_1 = 0.18$, $r = 0.15$, $\beta = 0.4$, $\varepsilon = 0.9$, $\gamma = 0.5$, $\delta_1 = 0.01$, $\delta_2 = 0.2$, $k_1 = 0.002$, $k_2 0.001$. i.e.

$$\begin{cases} \dfrac{dN}{dt} = 0.5(5 - N_0) - 0.18NP + 0.002(.01)P + 0.001(0.2)Z \\[2mm] \dfrac{dP}{dt} = 0.15N(t - \tau)P - 0.01P - 0.4\dfrac{PZ}{(10 + P)} \\[2mm] \dfrac{dZ}{dt} = 0.9(0.4)\dfrac{PZ}{(10 + P)} - 0.2Z \end{cases}$$
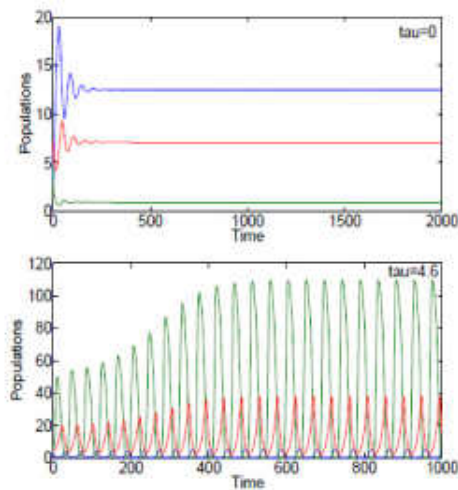
Figure 1: Time series solution at various values of delay parameter about interior equilibrium E_*.

Using the package of DDE 23 in Matlab, we have integrated the system (1) with initial data $N(t) = 3$, $x(t) = 7$, $y(t) = 9$ at $\tau = 0$ and observe that the local asymptotic stability condition (H_1) in the absence of time delay is evidently satisfied. The system trajectories approaches to positive interior equilibrium at $E_*(.9193, .2953, .8586)$ in the form of a stable focus as shown in fig 1. Numerical simulations shows that the system remain LAS in $[0, 4.5)$. Further we find a purely imaginary root $\iota\omega_0$ of equation (2) with $\omega_0 = 0.4613$ and after some algebraic calculations one can find the minimum value of the delay parameter $'\tau'$ for the model system (1) for which the stability behaviour changes and the this critical value is given by $\tau_0 = 4.5$ such that, the co-existence equilibrium E_* remain stable for $0 \leq \tau \leq 4.5$ (see fig 1) and is unstable for $\tau \geq 4.5$ (see. fig. 1).

II. DISCUSSION

In this paper, a plankton-nutrient model with a discrete delay in the growth term of phytoplankton have been proposed and analysed. First the dynamic of the system in terms of local asymptotic stability is studied both without and with delay about the interior equilibrium E_*. Next the criterion for Hopf-bifurcation was given and a critical value of the delay i.e. $\tau = \tau_*$ has also been calculated such that when τ crosses this critical value, system loses its stability and a Hopf-bifurcation occurred around E_*. Finally, numerical simulation were carried out and dynamical flow of the system is shown in fig.1 for some values of the delay parameter. Thus it has been shown that the given system depends upon the magnitude of time delay and it can drive a stable equilibrium

to unstable one. In other words there is a critical value of delay $'\tau_0'$ such that when the bifurcation parameter $\tau < \tau_0$, system remain stable and when $\tau > \mathrm{tau}_0$, it loses stability and a Hopf bifurcation occurred through this value of delay.

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Track 5

Technical Session: 1

Advertising, Quality & Social Media

Marketing of services- An essence for modern day living

Mr. Navdeep S. Thind
CT Institutions, Shahpur, Jalandhar.

Abstract-In the present scenario of cut throat competition customer are often found in a daze regarding choosing amongst one product or the other, where corporations are trying their best to magnetize customers towards their product. They have realized that in addition to manufacturing a quality product the quality and magnitude of service should be of epitome leading to the ultimate goal of customer satisfaction and customer delight. The challenge that the service industry faces basically is an outcome of lack of trust over the service industry due to intangibility and lack of standardization, which leads to the advent of and substance of physical evidence and service scape be it a five star hotel or waiting lounge where one get to service its like the aura and environment created by branded saloon and health spa's are the reasons, why people readily considered spending more than usual amount of money for such services. Taking a look at the current service providers in various industries one thing is for sure that the customer has Raised his level of satisfaction, and all the service provider will have to strive hard to meet the changing demand of the time. Strategies like extended service schemes, waiting line and pricing of services should hit the customer heart, so that one is not able to resist the offering of offered by the company. Market itself is very wide term which includes making and retaining the customers and all the companies are using goods after sale services as a part their retention strategies to enhance their sale sales and get a positive repute in the market thereby differentiating between the high & low customer satisfaction companies. More emphasis should be laid by certain industries like hotel & restaurants, bars & cafes on the aura and environment of such places to please & attract the customers for a better experience.

I. SERVICE MARKETING

A service is the action of doing something for someone or something. It is largely intangible. A product is tangible since u can touch it an own it. A service tends to be an experience that is consume at the point where it is purchased, and cannot be owned since is quickly perishes.

A person could go to a café one day and have excellent service, and then return the next day and have a poor experience. So often marketers talk about the

A. Nature of a Service as:

- Inseparable – From the point where it consumed, and from the provider of the service. For example, you cannot take a live theatre performance home to consume it (a DVD for the same performance would be product, not a service)
- Intangible – cannot have a real, physical presence as does a product. For example, motor insurance may have a certificate, but the financial service itself cannot be touched. i.e. it is intangible.
- Perishable – in that once it has occurred. It cannot be repeated in exactly the same way. For example, once a 100 meters Olympic final has been run, there will be not other for 4 more years, and even then it will be staged in a different place with many different finalists.
- Variability – since the human involvement of service provision means that no two services will completely identical. For example, returning to the same garage time and time again for a service on your car might see different level of customer satisfaction, or speediness of work.
- Right of ownership – is not taken to the service, since you merely experience it. For example, an engineer may service your air- conditioning, but you do not own the service, the engineer or his equipment. You cannot sell it on once it has been consumed, and do not take ownership of it.

II. IMPORTANCE OF SERVICE MARKETING

The U.S. economy has evolved into a service economy with services like health care, education and consulting dominating the market. Marketing services is an important skill--and a tough one--for businesses to have. Without a tangible product to show and tell, service marketers must be adept at pulling together all of the pieces of the marketing mix to create value for their intended consumers.

A. Good Relationships

In service marketing, because there is no tangible product, relationships are key. Service marketers must understand the importance of listening to and understanding the needs of customers and prospective customers to build loyalty and trust. Ultimately, effective relationships in service marketing will lead to repeat sales and positive word-of-mouth.

B.   Multiple Touch Points:
Service marketing involves many touchpoints for the consumer. Interactions with multiple people and experiences that are less tangible than when buying an actual product all impact the consumer perspective of the purchase process. Each of these touchpoints work together to establish a perception in the consumer's mind.

C.   Service Proliferate
Consumers have many service options to choose from, and because the product is intangible, the challenge for the service marketer is to somehow make her services stand out from the crowd. Because service marketing is so prolific, marketers must think of ways to communicate the benefits of the service they offer in language that reflects consumer need and value.

D.   Service improved by feedback:
Unlike the marketing process for a tangible product, service marketing actually involves the consumer in the marketing process. He is engaged in the process and contributes to a positive outcome. For this reason, it is important to seek consumer feedback and use that feedback to improve service marketing effectiveness.

E.   Influenced by technology:
Technology is having a major impact on the service economy. You can use technology to streamline service activities and provide do-it-yourself options for consumers. Internet-based services, for instance, allow consumers to participate actively in the service marketing process, often never involving contact with another human being.

III.   MARKETING YOUR SERVICE BUSINESS

If your company is all about providing a great service, a marketing campaign that builds relationships is essential to your success.
A.   Let customers be aware.
Good relationships are built on trust. So it's natural that customers want to learn as much as they can about your company and the people that stand behind it. Women shoppers, in particular, look for deeper information when deciding on which company or service to choose, and the vast majority of both male and female shoppers do research on the web before making a purchase. Having a company website is a smart and affordable way to convey in-depth information about your service business. Use any of the major hosting companies to create your own site using the site building wizards. Showcase your service benefits on the main page,

just as you would in an effective company brochure. Include your company's story, photos, staff bios and affiliations. And show how well your company delivers on its promises by providing testimonials, case histories or work samples.
B.   Value based competition.
What will make customers or clients select your company vs. your competitor's? Most choose the service provider that offers the greatest value for their money. In many competitive markets, there's price parity among the principal players.So the best way to win business is not to cut your prices or rates, but instead add products or services that elevate your offer--making it too good to resist. This is called "bundling."
C.   Attract customers with incentives.
Customers who've had positive experiences with your company's services in the past will happily return. But tempting new customers requires making a special offer. Businesses that provide home services, such as rug cleaning, painting, home heating or air conditioning, can benefit by sending consumers coupons through a mail provider. For long-term results, create a special offer that will motivate new customers to make more than a single purchase.
D.   Keep in touch.
It costs considerably less to keep a customer than to win a new one, so it's smart to maintain a campaign to upsell or resell existing customers. In fact if you're not communicating with your customer database at least every four to six weeks, you're missing opportunities to grow your business. Use a combination of sales and marketing tactics to stay in touch, such as alternating sales calls with e-mail and postal mail. Even with the best of offers, you can burn out your list if you pitch customers too often.

IV.   WAYS TO OVERCOME MARKETING CHALLENGES FOREVER

For most small business owners, marketing is an overwhelming concept. They need marketing solutions that ensure a smooth-running, profitable business yet most don't know where to begin or how to focus their efforts. 90% of small businesses don't even have a marketing plan. It's difficult to reach your destination if you don't know where you're going. If you're a small business owner looking for ease, focus and marketing success, we recommend that you focus on just 4 tactics:
A.   Impeccable branding:
The secret to business success is determined by your ability to powerfully communicate your business with laser precision and your ability to deliver a clearly-defined and consistent experience. In a nutshell... it's called branding, and, when done right, it ensures a thriving business with all the customers and profits you need. The secret is to establish a powerful brand identity that sings distinction. And establish that identity before you

launch any marketing activities.

B. Connecting people with affection.

Who wants and needs what you have to offer? The only wrong answer is "everyone." If you're a pediatrician, you may see infants and children. Are they your target audience? No! They are your patients, but it's the parents you need to connect with to get the kids in your door. And it's not just any parents - it's a definite group of parents.

In marketing, you get a lot more "bang for your buck" if you focus your spending on a well-defined group of people that you enjoy working with. The better you define this group, the more effective your marketing can be.

C. Design compelling offerings, which attracts the customers.

80% of all purchase decisions are based on emotion. It's your job as a marketer to know how your customers want to feel and to get them to visualize how your services can meet their needs. People want to know, "What's in it for me?" Tap into the emotion and create offerings that touch your customers.

D. Craft a Personal, Workable Marketing Plan

Marketing is everything you do to make your product or service more visible, more desirable and more profitable. Your marketing plan will clearly define the big picture and provide focus and direction based on the 4 'P's of Marketing - product, price, place/distribution and promotion.

Since 90% of small business owners do not have a plan, you'll have a leg up on your competition by crafting your personal, workable marketing plan to ensure that you reach your business goals.

Following these 4 criteria will transform any small business into a money-making machine guaranteed to grow your client list, sales and profits. The upfront work is the secret to a million-dollar business, literally and figuratively.

E. Customer Loyalty

Customer loyalty is built over time. Both large and small companies need to develop a loyal customer base. One positive experience with a company will start a customer on this road. Long term loyal customers cost your company less than a new customer. They will tell their friends about you. Price is not as much an issue for them as for new customers. Don't forget your loyal customers when you have a new product or are offering a discount on your product or services.

Many companies offer incentives to new customers and have nothing to offset the cost to their current customers. They blindly go out and market their incentive to attract new customers. Their current customers hear about it. This makes them feel like a sucker.

Your employees will hear from your unhappy customers and listen to them complain, take their cancellations and feel like their hands are tied. This will make your employees stressed out and unhappy.

Happy employees are key to provided your customers with the interaction you desire them to have with your customers. Provide them with the tools to assist the customer into feeling that you care about them.

Most companies offer a variety of price structures. The most profit is to be gained from a loyal customer. They will wonder to themselves if your higher priced product or services are better. Your customers will always be open to new products and services from you.

Successful Advertising Techniques

When you are considering advertising your business you need to realize that customers have seen millions of ads in their lifetime. They have become skeptics and will not be fooled. Successful advertising will speak to your potential customers with honesty.

You can catch their eye with a flashy image or a deal too good to be true, loyalty to you business will not be part of this new customers makeup. If you are looking to build a loyal customer base honesty will put your business ahead of your competition in the long term and build a strong foundation.

Advertising Methods that have successfully worked in the past that you will recognize and your customers may identify with are: Create a character that identifies your company or brand. For instance, Haveli Dhaba create a character in the mind of people that its provides a Punjabi culture ambience and totally hygienic service to their customers. That why Haveli Dhaba is on the path of crescendo.

V. QUALITY OF SERVICES

SERVQUAL was originally measured on 10 aspects of service quality: reliability, responsiveness, competence, access, courtesy, communication, credibility, security, understanding the customer and tangibles. It measures the gap between customer expectations and experience. By the early nineties the authors had refined the model to the useful acronym RATER:

- Reliability
- Assurance
- Tangibles
- Empathy, and
- Responsiveness

SERVQUAL has its detractors and is considered overly complex, subjective and statistically unreliable. The simplified RATER model however is a simple and useful model for qualitatively exploring and assessing customers' service experiences and has been used widely by service delivery organizations. It is an efficient model in

helping an organization shape up their efforts in bridging the gap between perceived and expected service.

SERVQUAL measuring tool "remains the most complete attempt to conceptualize and measure service quality". The main benefit to the SERVQUAL measuring tool is the ability of researchers to examine numerous service industries such as healthcare, banking, financial services, and education The fact that SERVQUAL has critics does not render the measuring tool moot. Rather, the criticism received concerning SERVQUAL measuring tool may have more to do with how researchers use the tool.

VI. MOMENTOUS OF SERVICES MARKETING IN TODAY'S SCENARIO

The SERVQUAL method from Valarie A. Zeithaml, A. Parasuraman, and Leonard L. Berry is a technique that can be used for performing a gap analysis of an organization's service quality performance against customer service quality needs.

SERVQUAL is an empirically derived method that may be used by a services organization to improve service quality. The method involves the development of an understanding of the perceived service needs of target customers. These measured perceptions of service quality for the organization in question, are then compared against an organization that is "excellent". The resulting gap analysis may then be used as a driver for service aquality improvement.

SERVQUAL takes into account the perceptions of customers of the relative importance of service attributes. This allows an organization to prioritize. And to use its resources to improve the most critical service attributes.

The data are collected via surveys of a sample of customers. In these surveys, these customers respond to a series of questions based around a number of key service dimensions.

The methodology was originally based around 5 key dimensions:

- Tangibles. Appearance of physical facilities, equipment, personnel, and communication materials.
- Reliability. Ability to perform the promised service dependably and accurately.
- Responsiveness. Willingness to help customers and provide prompt service.
- Assurance. Knowledge and courtesy of employees and their ability to convey trust and confidence.
- Empathy. The firm provides care and individualized attention to its customers.

VII. ORIGIN OF SERVQUAL

The authors conducted a qualitative study, from which they concluded that customers ranked the importance of two SERVQUAL dimensions consistently. Regardless of service industry. Reliability is the most important contributing factor to service quality and tangibles is the least important.

VIII. USAGE OF SERVQUAL

- SERVQUAL is widely used within service industries to understand the perceptions of target customers regarding their service needs. And to provide a measurement of the service quality of the organization.
- SERVQUAL may also be applied internally to understand employees' perceptions of service quality. With the objective of achieving service improvement.

IX. PROCESS IN SERVQUAL

The method essentially involves conducting a sample survey of customers so that their perceived service needs are understood. And for measuring their perceptions of service quality for the organization in question.

Customers are asked to answer numerous questions within each dimension that determines:

- The relative importance of each attribute.
- A measurement of performance expectations that would relate to an "excellent" company.
- A measurement of performance for the company in question.

This provides an assessment of the gap between desired and actual performance, together with a ranking of the importance of service criteria. This allows an organization to focus its resources. To maximize service quality whilst costs are controlled.

X. STRENGTHS

Most users would agree that a comprehensive and thorough examination of service needs and service quality provides an invaluable approach to improving service quality. SERVQUAL provides detailed information about:

- Customer perceptions of service (a benchmark established by your own customers)
- Performance levels as perceived by customers
- Customer comments and suggestions
- Impressions from employees with respect to customers expectations and satisfaction

XI. LIMITATIONS

There have been a number of studies that doubt the validity of the 5 dimensions. And of the uniform applicability of the method for all service sectors. According to an analysis by Thomas P. Van Dyke, Victor R. Prybutok, and Leon A. Kappelman, it appears that the use of difference

scores in calculating SERVQUAL contributes to problems with the reliability, discriminant validity, convergent validity, and predictive validity of the measurement. These findings suggest that caution should be exercised in the use of SERVQUAL scores and that further work is needed in the development of measures for assessing the quality of information services.

XII. ASSUMPTIONS

The results of market surveys are accurate. The validity of the model is based around the results of empirical studies. A number of academics have since performed further empirical studies that appear to contradict some of the original findings. Customer needs can be documented and captured, and they remain stable during the whole process.

XIII. MARKETING SERVICES FOR 2014

- Have you got a business strategy and a business plan all laid out for 2014? Did you try all the usual marketing strategies last year and got less than desirable results? Up to date marketing services are what your company needs.

- Marketing has changed. Your local internet marketing efforts are where your company will find the most profit.

- Combine that with some innovative up to date ad campaigns and you will have a winner

- When you are considering marketing services you will always want to monitor your return on your investment.

- You will need to determine if the cost is worth the benefit to your business. If the average cost is one dollar for each new customer and the customer nets the company two dollars it is a good investment for your advertising dollar.

- Marketing services have changed in 2014. When radio ads were at their peak they were replaced by television.

- Then along came the world wide internet and replaced television. In 2014 the internet platform for small business is now local internet. What does this mean to companies? National companies already have the world wide web market. It is too expensive for most local companies to compete in. But the local internet market is about to explode.

- You need the marketing services of a company that understands this dynamic. Google has set its algorithms to help consumers find local companies to do business with. Yahoo and Bing have partnered in the local internet market to compete with Google. Did you know that one out of every two local business' does not even have a web site?

- To prosper in the upcoming years you will need a local internet website for your business or a mobile ad campaign. Your biggest decision is are you going to make it mobile or just for the PC user? You should be able to accomplish both with the right marketing service company.

- If you are the local grocer or dry cleaner people are going to look online either on their cell phone or PC to check things like your location, hours of operation and how you take care of your customers. If your really good at what you do this will work to your advantage.

- Marketing services you should learn about moving into the year are local internet marketing, mobile marketing and how to find out what is being said about your company online. There are many components to each. To grow your company this year either teach your self about these things or hire a service marketing firm to do it for you.

- When hiring an outside firm they should not require a long term contract. If they have done their job right it will be obvious that the investment was worth it.

- A lot of companies today are emphasizing on the feature portfolio of the product while forgetting intentionally or unintentionally about the aspect which matters the most that is – Servicing. One may simply here site the example of Indian Automotive Giant, Tata Motors which has its large service centers, next to MUL but still suffers ue to its poor image and lack of customer satisfaction though Tatas are trying to improve upon this problem, which may indeed increase the sales of there products.

- One can easily say that when it comes about the product quality, Sony corp. has no competitors virtually but the strong networks & servicing avenues provided by peer giants like LG India & Samsung is a

- glistening example which has helped them increase the sales manifold as compared with Sony India.

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Persuading Children Through Commercials

Gitanjali Bhatnagar

Baddi University of Emerging Sciences and Technology

Makhnumajra, Baddi,

Distt. Solan, Himachal Pradesh

Abstract: **Children today offer the biggest market and what's more, they are also going to being the next hottest market- that of youngsters with a high disposable income. Marketers and advertisers seem to have placed their figures on the pulse. Kids are active seekers and influencers for a whole range of products affecting their lives. The world of advertising has changed. Advertisers are making their pitches to more of young audience; "catch them young" seems to be the motto of the day. The paper brings forward how various products are successfully changing the mind set of target customer by developing commercials or communication strategies around children.**

Key words: Influence; strategies; empowering; decision, advertising.

I.   INTRODUCTION

Children today offer the biggest market and what's more, they are also going to be the next hottest market- that of youngsters with a high disposable income. Marketers and advertisers seem to have placed their fingers on the pulse of kids. Kids are active seekers and influencers for a decision regarding purchase of a whole range of products affecting their lives. The world of advertising has changed. Advertisers are focusing more on the young audience; "catch them young" seems to be the motto of the day. Kids are no longer passive consumers of brands that they once used to be, but are seekers and influencer for a whole range of products affecting their lives. While this is definitely true for products like chocolates, biscuits, ice creams for which kids are the direct consumers. Not only this it is also true for other range of high end consumables like package food, mobile phone, cameras, clothes, place of vacation, computers and believe it, cars.

The obvious question comes in the mind is that why this curious and interesting phenomenon of using kids in India persists? One would be surprised by the logics of ad world. Indian consumers are driven by emotions and family values. It is easier to communicate benefit of a brand, by surrounding marketing strategies around the kids. Kids bring warmth and feeling into a brand. Kids break down defenses of adult buyers, and let a brand establish a connect with the consumer. The emphasis in India is always on the family not on the individuals. In majority of cases we Indians seek to live our lives through kids. We want to give them the best of education and in fact everything that we cannot afford for ourselves. The burgeouning nuclear family structure means that there are multiple decision makers within the family and more often than not, the kids take the center stage in this process. Also the increasingly busy schedules mean that parents not only resort to empowering kids with more pocket money, but also gratify kids by listening to their opinions and sometimes even putting the kids at the center of the decision making process.

Children are everywhere in advertising. All of them are being used as effective ways of grabbing adult attention. Children are now the chief design element of commercials. Get an angelic chubby looking child into a commercial and viewer attention is usually ensured. Get a child and a celebrity and you multiply the chance of being the most popular brand and product. Getting a child, a celebrity and a dog was the best way to land safely in all segments. Such ads have extremely high ability to influence household decisions. Advertisers are increasingly becoming aware of this and are targeting the new emperor through marketing and advertising tactics. The fact is, when companies want to sell insurance policies, power inverters, air-conditions and even cars, they fall back on children. Marketers and ad-makers are increasingly getting convinced about the kid being a compelling force in the family. The companies know that children have great amount of influence on their parents. Various media studies reveal that children are playing a major role in steering the family purchase decisions that is why advertisements are aimed more at kids than parents.

Apart from high involvement goods like televisions, refrigerators and mobile services, children have been more effectively used in relatively less involvement categories like life insurance and paints. While insurance is generally adult oriented, many insurance ads including those of HDFC Standard Life and Metlife and paints like Dulux also work around kids, their playful pranks and their aspirations. "The critical difference is that in the current breed of such children-based communication there is a tendency to integrate the product with the activities they are associated with. For example in the Kotak ad they actually linked it to their child policy while the Dulux ad actually communicated dirt resistance based on the child's pranks," says Rajiv Bagayatkar, director, brand health solutions, South Asia, product leader, Nielsen Company, a leading market research firm[1].

The world of children has changed by manufactures of durable and non durable products   over the decades. Advertising provokes children to stay clean which are advertised by soap companies like Dettol, Lifebuoy etc. Brushing twice a day was a marketing strategy for more usage of product but such advertisement always helps the children to keep their teeth clean, healthy and germ-free.

Even the use of some cartoons or sometimes small ideas like "Pepsodent Germicheck – Dhishum Dhishum" encourages the child to use the product to realize the benefits shown in the advertisements. Companies such as Amul and Nestle are advertising milk products to the young generation as something cool & refreshing, e.g. Amul Kool. Although the motto behind the launch and its subsequent advertising is to capture the child segment of the market, the fact remains that still intake of any milk product is always good for the children. It is much more vitamin –rich and nourishing than other products like soft drinks which are actually harmful for the child. Many companies focusing on children have realised that here is a need for redefining the generally accepted definition of childhood. From cars to banks, or from cold drink to toiletries have been adopting the same strategy framework of creating advertisements around kids. An attempt is being made to analyze various popular kid oriented marketing and advertising strategies adopted by popular brands, though the list is endless.

A.	IDBI : Recently IDBI Bank has rolled out an ad on the theme 'Bank aisa dost jaisa' (A bank like a friend). One of the films features a boy and a girl sitting in school. The chubby boy says that everyone in school calls him motu (fatty). Even at his tuitions and at the playground, people call him motu, he complains, but says his best friend seated next to him doesn't. As he finishes his story, music plays in the background and his friend asks him what he had for lunch. Their banter continues even as a voice over signs off saying, "*Aisi dosti agar ek bank nibhaye toh… IDBI* Bank, bank aisa dost jaisa". Piyush Pandey, executive chairman and creative director, South Asia, Ogilvy & Mather, said, "Our initial thrust for IDBI Bank a few years ago had been to tell the world that just because we are a big nation-building bank, does not mean that we are not approachable to address your smallest need. And now when we look at the next step in the evolution of the communication, what better than the universal emotion of childhood friendships to symbolise the role that IDBI Bank plays in its customers' and partners' lives[2]."

B.	Oreo: Television advertisement of Oreo Choco Creme shows the playful relationship shared by two brothers, the ad campaign captures the essence of the brand – a complete chocolaty treat. The ad is based on the insight that consumers love Oreo for its delicious chocolaty sandwich experience. It shows two young boys, a teenager and his inquisitive little brother, enjoying Oreo Choco Creme and getting confused as to which is more chocolaty – the cream or the cookie[3]. As there is cocoa in both the cream and the cookie, that's one debate that they find impossible to win, and end up switching sides multiple times. Oreo since its launch has featured kids enjoying licking choco crème with some family member.

C.	Horlicks: From last one decade Horlicks has changed its marketing strategies, instead of just communicating with mothers, or doctors, the brand has tried to communicate with children. The tag line says that the children who consumed Horlicks are "taller, stronger, and sharper" than those who did not. The ad shows kids in the ground playing and enjoying their life Apang, Upang, Chhapang- slurp it, spread it, lick it. In the latest ad choosing Darsheel Safary as its brand ambassador, only adds on to the marketing value of the product. Every Horlicks kid shall stands tall, strong and sharp…promises Horlicks. This TVC's main objective of this ad is to announce the offer of free sunshades with every Horlicks jar. The idea to make shades "the" accessory to look cool in an easy way this summer as opposed to trying too hard to be cool, has come out absolutely successful through this TVC.

D.	Kit Kat: The Kit Kat brand, well-known for its youthful appeal, debuted 'Dancing Babies'. This time, JWT India tapped the smile-enducing power of giggling, singing, and dancing babies. The spot opens with a student doing rounds with his professor and classmates. He decides to step away from the group to take a break by enjoying a Kit Kat when the babies in the daycare start cooing and giggling. Eventually, their expressions create a pop song that brings out some "aw worthy" dance moves—that is, until the student's Kit Kat, and thus his break, comes to an end[4]. The concept of taking a break with Kit Kat is pretty old and many have enjoyed this unique proposition in the past. The ad makers and the brand is still connecting with the masses with the same old concept in the newest of rapper.

E.	Cadbury: The name itself is mouth watering for consumer of all age group. The commercial Cadbury Delite has been developed upon the innovative excuse that kids usually come up with reasons to avoid drinking milk. A line that comes to mind of the model is "if I drink up the milk, what will the cow's baby drink? Or am I a pussy cat that should drink milk" A delightful series with charming kid-speak making a simple point that kids even who are at their creative best in thinking up excuses to avoid drinking milk, will now become friend with it. Marketers draw out smile, genuine connection that link the brand benefit to the context to the target user[5]. What an intelligent way to blend marketing strategies to solve the problem of many mothers by expressing thought of kids in such a unique way.

F.	Amul: An ad which has factually changed the taste of India is none other than the one very close to our heart, a sweet looking creature, one and only Amul girl, whom we all have admired like our own kids. For more than 40 odd years the Utterly Butterly Amul girl has managed to keep her fan following intact. So much so that the ads have entered in the Guinness Book of World Records for being the longest running campaign ever[6]. Creativity in the Amul's ad is at most times, really wonderful and the interesting point is they have most of their campaign based on children. Amul as a brand has a range of products and for each product whether milk, ice cream, srikhand, cheese the ad theme is always catchy, interesting, meeting the objective-"Amul doodh pita hai India", "Dude where is doodh", "I want more" have

shown children playing their pranks and enjoying life with Amul product. The new theme 'Har ghar Amul ghar" features a family comprising a young boy and his working parents. In the story line it is shown that boy gets up before them, he gets ready by himself, butters his toast, drinks his milk and even packs his tiffin with an Amul cheese slice. The parents are shocked to see their son fully dressed and waving goodbye to them. The boy then walks out confidently with a bottle with an Amul logo on it[7].

G. Rasna**:** We all have cherished memories of the first Rasna girl from the inception of the initial advertisements. Rasna was the first brand to recognise the role of kids in brand selection. "I love you Rasana", the line was first lisped on television and it took a while for it to manifest itself in the print advertisement. Rasna's advertisement campaigns helped it in becoming a trusted and popular brand amongst Indian consumers. The advertisements essentially revolved around cute and very-likeable children who were floored by Rasna's attractive colors, taste and fruity flavors. Eventually, Rasna's TV commercial featuring a small girl with the tagline 'I love you Rasna,' was adopted as the brand's tagline for many more commercials over the next couple of years.

H. Baby Johnson: All the products of Johnson n Johnson are advertised with mother-kid as center of the story line since ages. No research is needed to say that these ads are all time favorite ads of every individual. It seems the company knows that watching kids in ads captures not only the attention but hits the bulls eye. Look at the series of ads, whether it is the baby oil ad, powder, moisturizing cream or no tears shampoo ad, makes not only the mother know what the product is all about, rather the whole family registers the benefit of the products. Johnson's soap shows a small girl making comparison between her eyes, nose, hair etc. with those of an infant are "same to same". However she is dismayed to discover that her skin and infants skin is "no same". The language expression provides clear message to mothers of being careful of well being of a child. The marketing strategies have been effortlessly penetrating into our hearts from ages and making use fond users of the product generation by generation.

I. Surf excel: Beautiful ads of Surf excel reminds you of your childhood for sure. The brand that has married the need for a stain-removing detergent for messy kids in a simple story line of brother sister relationship, teacher and student affiliation, friends enjoying life in the ground without being bothered about stains "Dag achhey hai". An out-of-the-box clutter breaking campaign (without a product window) that clearly communicates not only a bold message about stains being good but also educates the customer on growing children[8]. Talk of any ad whether it is a brother making his little sister happy by literally hitting the puddle asking it not to repeat to his sister, or boy's lovely affection for his favourite teacher Rosey miss, we all enjoyed not only the ad but each second of the simplest and beautiful depiction of emotions. Overall, the ad conveys a wonderful message 'Dirt

is good'. There are no big heads and big names, just a voice over still spreading the message that if something good prevails with stains, then stains are good. These are the ads we have seen over and over on almost every Indian television channel and still emotions in the ad gives long lasting impact even today. No harm in admitting that this innovative ad gave wings to nostalgic childhood memories; how those happy go lucky days our parents gave us to spend such a childhood.

Children are every where in the marketing strategies of a majority of industries. They are used as an effective conduct for grabbing adult attention. No doubt that's because kids are considered one of the purest and simplest ways of communicating an idea with a positive tone. An advertisement having more exposure of kid factor embedded into it, gives the buyer an impression that they are user friendly, approachable and sometimes affordable too. Remember some of the most memorable ads like that for Indian Airlines, ICICI, HDFC, LIC, Maruti (with the sardar kid, ki karan papa petrol khatam hi ni hunda) or the Johnson & Johnson (with the mother playing with the kid or the one in which she bathes the baby with milk). In this sequence one can talk about the Bharat Petroleum ad which shattered stereotypes to use the kid factor so effectively and beautifully with their energizing lives tagline. This ad showed two kids while playing in field make the boat sail through wind in river.

We need to accept that peer group factor, mass media, marketing strategies in form of advertisements has huge impact on consumption, brand choice, and influencing purchase decision of the family. No harm in accepting that in the age of Harry Potter, kids today have more knowledge and know more than ever before and marketers have in-cashed their intelligence through art work of advertising.

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Trends of Computer Graphical Designs in Modern Advertising: Survey

Sania Marwaha
Dept of Journalism & Mass Communication,
D.A.V College, Amritsar
City: Amritsar (Punjab), Country: India
marwahasania14@gmail.com

Abstract: Today, the world "Advertising" is very common term known to us. It figures in each of our lives every day. We see it on television in the sky, on the match box, in the newspapers, on the trash container, in the magazines, on the mail, on the vehicles and so on. Advertising is a power packed process pertaining to the dissemination of information concerning an idea, service or a product to impel an action in line with the intension of an advertiser. Advertising is that magic force which turns an instinct into acquisition a desire into demand and a dream into reality by influencing the consumption, directing the production, diverting the distribution, and affecting the very course of exchange. Major trends like use of Computer graphic designs in advertising have become a powerful tool for the rapid growth of Business firms. There is virtually no area in which graphical displays cannot be used to some advantage, and so it is not surprising to find the use of computer graphics so widespread. Today, we find computers graphics used routinely in such diverse areas as science, engineering, medicine, government, entertainment, art, education and training. Although early applications in engineering and technology had to rely on expensive and cumbersome equipment, advances in computer technology have made interactive computer graphics a practical tool. Graphic Designers use high tech creative programs in order to create a specific add for their client. The client is able to make changes to the design with the computer programs. With Computer graphics coming in to play, advert or commercials are now more interesting creating attention, talking of attention, 'A computer designed banner ad will have greater attention- getting capacity than a static banner ad.' By shedding light on role of computer graphics in designing of modern advertisement the paper will also observe new trends in advertisements and how these ads reach to specialised target audience.

Keywords: Dissemination, Consumption, Acquisition, Computer Graphics, Magic Force.

I.   INTRODUCTION

Advertising has evolved over the years a systemized body of knowledge. It is a science as it has set principles and the rules and regulations framed out of both experiments and experience. It is a profession for which personnel with rich experience and total training is required. Advertising has now become a profession which requires degree of general and specific knowledge derives from experimental and empirical analysis. Hence the advertising of today is not yesterday and tomorrow's not today. There is considerable factor of creativity in adverting world which has been provided through a platform of Computer Graphical Designs. The domain of advertising should be developed through practice and experience in art and its methods.

One way the marketers use to advertise their product is by visually advertising it. By the help of graphical designs, you can visually represent your product in Television, Streets, Walls, and even in Newspapers. Any advertisement we come across through Media is an outcome of visualizations and creative visualisation. Computer graphical designs in ads are concerned with various elements Namely- Illustrations, Charts, Headlines, Text matter, Pictures, graphics, Designs etc.

The industry owes its existence to advertisers –the individuals and the organisations –who are ready to send the advertising message to the intended and interested parties. The Media carry the messages from Sender to Audiences that the sender hopes to reach. The Media can be Print, Broadcast, Telecast, Direct Mail, Films etc. Whatever may be medium used the aim of each Advertisement is to cover the maximum audiences for each rupee spent by advertisers. A fine combination of Media results in better rewards for the efforts of the advertiser. To accomplish the objectives of advertisements advertising agencies play fundamental role which comprises a collection of specialists, including account executives, creative people, media experts and research personnel who are assembled to create spectacular adds. These people are organized within the agency structure on either a departmentalized or a group basis.

Designs has always been a problem solving process involving the capacity to be logical and analytical and relates to human needs in a technological world .These designs acts as catalyst between the problem and society and must be prepared to provide objective solutions with full knowledge of the social and environmental impact. This is borne out of the contentious role of the Graphical designs in making of advertisements in this computer age. Graphic design is by no means a new field. The terms used to describe the profession may have changed with the times–Commercial Art and Visual Communication - being two previous titles, but the practice has remained centered on two main elements – Images and Words.

Usually, they appear together and their combination can create a powerful and persuasive form of communication, whether in the context of advertising, packaging, books, magazines, television or most recently web designs. Hence the

Graphical designs are concerned with the problems of preparing and organizing visual symbols for the communication of ideas and information and satisfying the needs of the advertising and publishing industries The concept of graphic design is about arranging photos, computer generated images, paintings, drawings, or any product of visual arts into a graphic that communicates the message. It is a process that combines both technology and art to come up with creative ways to send a message.. Computer Graphics needs visual acuity, a keen sense of colour and proportion and highly specialized technical skills, as well as an understanding of prints production methods and the complexity of the Internet.

A major use of Computer graphics in Advertising is in Design processes. Generally referred as CAD (Computer Aided Designs), the methods are now used to create designs for attractive products such as Mobiles, Soft Drinks, FMCG, Textiles, Computers and many others goods. The various shapes and designs are created through computer graphics to deliver attractive and entertaining Adds to consumers. Animations are often used in CAD applications Animation refers to the process, in which each frame of a film or movie is produced individually whether generated as a computer graphic, or by photographing drawn images, or by repeatedly making small changes to model and then photographing the result. When the frames are strung together and the resulting film is viewed at a speed of 16 or more frames per second. There is an illusion of continuous movement (due to the persistence of vision). Animation adds to graphics the dimension of, which vastly increases the amount of information. Animated ads convey a lot information because the human visual system is a sophisticated information processor.

II. SIGNIFICANCE OF THE STUDY

Human beings are essentially emotional beings, so appealing to them only at an intellectual level normally does not prove to be the most effective. The use of Computer graphic designs in ads plays a very vital role for getting the attention of the public. The effective use of colour, fonts and concepts help in achieving this aim. The visual appeal of the graphics is as important as the message it puts across. The visuals are deliberately engineered to appeal to the emotions and intellect of the people it hopes to reach. The nature of advertising is such that it thrives visual representations of products, services, concepts and ideas. It is the main way in which companies all around the world sell their products and services. Apart from using it to sell products and services, it is also used as one of the key ways of instituting social change. Advertisements for products and services are most effective when the graphics stand out while maintaining relevance to and clarity of the message. The right graphic can attract good attention and increase the likelihood that the viewer will buy the product. A good graphic design for advertisement gives a visual taste of their product. The efficiency of graphic designing is usually seen on the effect of the advertisement.

Image-based, Text-based, Image, text, and symbols are different forms of trends which have originated in arena of graphical representation of advertisements to make them impressive. Graphic designers are tasked to arrange and develop images to come up with the message.

III. AIMS AND OBJECTIVES

A research without purpose is hollow. In order to give research accurate path and to attain feasible result, it should be Goal Oriented following are the main aims and objectives of study:

I. To study the impact of Computer Graphics in Advertising.

II. To observe new Trends in Advertising and how these trends have effected Mind-Set of consumers.

III. To study the popularity of visually designed ads and how these ads have become an aid to human problem solving.

IV. LITERATURE REVIEW

Computing power has expanded enormously in the last decade with the processing power available doubling every 18 months. This capacity has given marketers a chance to grapple with extraordinary detail, every consumer's preferences, the development of products and an integrated marketing strategy. Marketing has evolved over the last two centuries, as the systems of production and consumption have changed owing to the rapid development of technology. The rate of development in technology has seen the advent of mass manufacturing, instant communication systems and the development of rapid transport systems. There is now another technological drive, owing to powerful computing techniques (Patron, 1996). The last three to four years have seen an explosive growth in the number of people using the Internet connectivity with simple and powerful computers theoretically offers the opportunity to link with anyone on a global basis with the use of a modem. The firms communicate with their customers through various forms of media. Most media allow the customers a passive approach to communication and limited forms of feedback.

According to Kassaye (1997) who undertook a Porter (1985) analysis of the effect of the World Wide Web on agency-advertiser relationships, many companies use computer design studios and graphic boutiques or resort to producing in-house advertisements. The whole premise of advertising on the computer relies on involvement, the way in which customers 'flow' through the medium and the use of structured activities, offering individuals a completely different form of experience compared to standard television advertising .The computer designed ads offers ample opportunities for new product diffusion, the possibility of adapting products and services to meet local requirements and niche product selling by smaller companies to an instant global audience. The new technology ads now allows for animation and 'dancing' logos to be displayed. Explorers watching these ads may well be attracted and involved with attractive sites, adding to the effectiveness of advertising. With new trends in advertising Brands have offered' memorable' experiences encompassing sight, sound and

'fun', with the possibility of simple games to enhance the memory process.

V.   RESEARCH METHODOLOGY

The data for the research was collected from different viewers who observed different graphically designed ads in different forms of media like Television, Print, Pamphlets, Leaflets, Signboards, Brochures, Social Media etc. The research sent out a questionnaire to each viewer and their decisions were then analysed and presented in the report. The data had been collected from different responses of participants.

VI.   SURVEY DESIGN

The data which had been received from viewers or audience participating in the survey was sorted out and was filtered according to the objectives of the survey. The data was then processed and was analysed to extract important information pertaining to role of graphics in advertising and how these ads have changed the old trend of watching only textual ads which only provided storage of detailed information with no graphical images in them.

VII.   DISCUSSION

The range, power, and number of graphically designed ads are increasing at an astonishing rate. Animated ads with glossy colours and fonts packages are also increasing the productivity of traditional video based ads. These visual ads also provide viewers with "real-time, on-line "interaction, and also offer potentially new learning environments that would not be possible without computer technology. The computer designed ads are considered an arsenal, albeit an important and powerful resource to facilitate awareness among masses by and through visualization techniques. Computer aided ads facilitates vehicle of expression and communication. Advertisements projecting influential visuals such as facial gestures and other body movements become major part of social interactions. Through graphically represented ads consumers evaluate the ways in through visuals inform and influence people, they begin to understand the uses, abuses, and misuses of visuals in communication, but you will also appreciate more the human visual processing system.

A wide variety of graphics — from photographs, pictures, and cartoons, to charts, maps, diagrams, and outlines — is common today in most Television ads. The trend of using f graphics in ads holds a certain degree of validity. The cliché that a picture is worth a thousand words seems consistent with experimental   practice. Computer learning environments pose particularly exciting and demanding situations for visual communication. The range and diversity of visualization that graphically designed ads offer are unprecedented. The last 10 years have demonstrated marked increases in sophistication in the graphics produced and displayed on media.

Compared with conventional typeset quality ads published in print the feedback from viewers watching   visual ads designed through desktop publishing has been increased. In many cases, due to the complexity of the production and designing the computer might take up to 30 minutes to create each individual frame of the animated ads shutting out the possibility of real-time ads.

VIII.   CONCLUSION

Computer graphical designed ads provide increasingly sophisticated content and services at no monetary cost to viewers. Considerable strides have been made in assessing the impact of   graphical advertising and some studies are often tightly controlled in laboratory-based situations. The fluency and ease of Designing of ads by experts, including good Web designs (from the point of ease of use, interest and likeability) had help to create a better understanding of advertising effectiveness. Larger companies such as Ford, Visa, Sony and Microsoft with their recent web designed ads have created a very successful community, where ideas are shared, plants are exchanged.

IX.   ACKNOWLEDGEMENT

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Quality Management : A Case Study on Nestle Waters

Ekta Batra

D.D.Jain Memorial College for women Ludhiana.

profektabatra.mgmt@gmail.com

Abstract: - Quality leadership from a national has changed over the past five to six decades. After the Second World War, Japan decided to make quality improvement a national imperative as part of rebuilding their economy. Nestle waters; the world's leading bottled water company has built a solid reputation on the quality and purity of its products. Nestle water's goal was to implement a system that would allow them to easily monitor, review & trend real time quality data. By upgrading their factories Nestle water co. are able to make more accurate and time decisions about process improvements.

I. QUALITY MANAGEMENT

The act of overseeing all activities and tasks needed to maintain a desired level of excellence. This includes creating and implementing quality planning and assurance, as well as quality control and quality improvement. It is also referred to as total quality management (TQM).

While quality control and quality assurance departments have been around for a long time, the concept of quality management is relatively new. In a sense, it is a "first cause" approach to quality assurance, as it approaches the issue of quality from many different angles.

Management activities and functions involved in determination of quality policy and its implementation through means such as quality planning and quality assurance (including quality control).

II. QUALITY MANAGEMENT SYSTEM

A system by which an organization aims to reduce and eventually eliminate non-conformance to specifications, standards, and customer expectations in the most cost effective and efficient manner.

III. QUALITY TERMS

- Quality Improvement can be distinguished from Quality Control in that Quality Improvement is the purposeful change of a process to improve the reliability of achieving outcome.

- Quality Control is the ongoing effort to maintain the integrity of a process to maintain the reliability of achieving an outcome.

- Quality Assurance is the planned or systematic actions necessary to provide enough confidence that a product or service will satisfy the given requirements.

IV. OBJECTIVES OF QUALITY MANAGEMENT

Derived from the ISO 9001:2000 standard, these eight principles are

(1) Customer focus: Management should understand (and anticipate) the customers' needs and requirements, and strive to exceed customer expectations in meeting them.

(2) Leadership: Management should establish unity of purpose and direction, and create and maintain an environment in which everyone can participate in achieving the organization's objectives.

(3) Involvement of people: Management should involve all people at all levels so that they willingly contribute their abilities in achieving the organization's goals.

(4) Process approach: Management should recognize that an objective is achieved more efficiently when activities and associated resources are managed together as a process.

V. BENEFITS OF TOTAL QUALITY MANAGEMENT

When stacking the pros and cons, the potential for boosting your company's success makes the implementation of a TQM business philosophy extremely attractive. Those who've initiated a Total Quality Management analysis have routinely experienced an improved understanding of their customers' needs, an overall increase in customer satisfaction, streamlined communication within their organization and better problem-solving. Plus, TQM has enabled many businesses to unify their workforce though enhanced levels of motivation – a key reward many hope to achieve as a result of the process. All of these revelations lead to stronger relationships with suppliers, fewer product and supply errors and a noticeable reduction in waste related to business processes.

VI. THE LIMITATIONS OR DOWNSIDE OF TQM FOR SMALL BUSINESS

Though the valuable insight delivered through TQM makes it extremely attractive, nothing comes without a cost. And that cost can be excessive, even for large-scale organizations.

Revealing both the strengths and weaknesses of your organization, the findings from a Total Quality

Management analysis can result in significant increases related to additional employee training as well as a disproportionate consumption of management's time. In addition, the process may include an increase in paperwork and the failure to address the individual needs of your small business due to an emphasis on 'process' rather than 'results'.

VII. Case Study

Nestle Waters determined that Infinity QS ProFicient best satisfied their criteria for quality documentation and analysis.

A. Nestle Waters

A Case Study in Quality Control

B. Background

Nestle Waters, the world's leading bottled water company, has built a solid reputation on the quality and purity of its products. Established in 130 countries, with a portfolio of 72 brands, Nestle Waters continues to meet consumer needs by keeping its wide variety of products flowing through strong distribution channels.

Nestle Waters has 100 manufacturing sites operating in 38 countries. With 2007 sales of over $10 billion and a market share of 19.2%, Nestle Waters has emerged as a substantial player in the flourishing bottled water market.

C. Challenge: From Paper-Based to Electronic Data Analysis and Storage

Nestle Waters' goal was to implement a system that would allow them to easily monitor, review and trend realtime quality data. Additionally, Nestle Waters needed to standardize on one solution across all of their facilities to complement their existing IT infrastructure. They were operating in both LAN and WAN environments and needed to maintain their IT framework. Nestle Waters had been using a cumbersome paper-based system to collect and analyze data. When issues arose that required immediate attention, Nestle Waters' quality engineers had to disrupt the operators on the production line to retrieve the necessary data.

D. Solution: Integrate Infinity QS SPC Software with Existing IT Infrastructure

After a thorough needs/analysis evaluation, Nestle Waters determined that InfinityQS ProFicient best satisfied their criteria for quality documentation and analysis.

The IT department played a vital role during all stages of the implementation. From an IT standpoint, the implementation focused on two separate manufacturing units—Retail Manufacturing and Home and Office Manufacturing. They spread the implementation across 16 Retail sites as well as 8 Home and Office sites and integrated them with corporate headquarters.

E. Nestle Waters Retail objectives were to:

- Upgrade all factories to the latest release
- Organize the purchase of all the PCs required for the work stations.
- Image new PCs to the Nestle standard and install InfinityQS
- Ensure that the project leader had all necessary rights and permissions to access the servers
- Nestle Waters Home and Office objectives were to:

F. Format existing servers

Install SQL databases and InfinityQS on the servers

Purchase new PCs, image, put users in the user group and grant necessary permissions and access

As part of the organizational effort, IT planned hardware purchases in advance to ensure that servers were set up, racked and usable prior to trial production runs.

On the shop floor, emphasis was put on location of the workstations to facilitate efficient and effective workflow.

VIII. RESULTS

Informed, Timely Decision Making to Improve Quality

With the Infinity QS solution in place, Nestle Waters now has real-time visibility over production processes—both within the individual sites and from the corporate level across 26 factories. By tracking trends in quality data, they are able to make more accurate and timely decisions about process improvements.

Nestle Waters is using InfinityQS software to review sampling frequency optimization and in-line monitoring as well as to track the following projects:

Cap Torque and application analysis from retail factories comparing different cap vendors

Light weight bottle initiative to optimize process and ultimately reduce unnecessary full bottle testing

Automatically capture air consumption process data, using analysis functions to optimize production processes.

"There are many advantages to having a computerized system that sometimes, in the fog of having this powerful tool with its many capabilities, one can over look," said Julie Chapman, Quality Systems Manager. "It is ultimately easier for the operator. Even with the minimal computer skills many of the operators had in the beginning, the overwhelming consensus is that they prefer using InfinityQS over a paper system."

Nestle Waters is also taking full advantage of InfinityQS' real-time alarms. Any events that occur require assignable cause and corrective action entries. Shop floor operators review, evaluate and respond to any events that occur, before they cause quality issues.

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Quality Assurance-A Need In Food Industry

Iqbal Singh
School of Energy Studies for Agriculture
PAU Ludhiana
erisingh@pau.edu

ABSTRACT-The food industry has a number of Quality Assurance(QA) systems available like GMP (Good Manufacturing Practices),HACCP (Hazard Analysis Critical Control Points), ISO (International Organisation for Standardisation) standards. These systems and their combinations are recommended for food quality and safety assurance. The agri-food production requires a specific approach to achieve the expected quality level. It is important to know to what extent the systems contribute to the total quality of the product and to balance the tools used for achieving the quality and safety objectives.

Keywords: food; quality; safety; quality and safety management systems.

I. INTRODUCTION

Despite the huge efforts paid by the food safety authorities, specialists and industry, food safety still remains critical and often is coming into spotlights attracting media's attention with outbreaks that can bring a stack of multiple negative consequences. The effectiveness of the food quality assurance systems and food safety management applied and demonstrate that new tools are needed to complement the actual systems in place. When evaluating the negative consequences one have to take into account the medical costs incurred, the economical losses that can badly shake local small industries, and least but not last consumers` trust. The concept of quality is often confused with the idea that a product of quality is a luxury item. From a practical point of view, however, quality is nothing more than customer satisfaction. At the manufacturing level, quality is defined as an increased level of productivity and safety.

However, Quality Assurance is a relatively new area of activity in the food industry, beginning in the late 1950s to early 1960s with the advent of concepts such as Hazard Analysis and Critical Control Points (HACCP) as a means of preventing, rather than correcting, the occurrence of defects and contamination or the presence of foreign substances during product manufacture. Although more than 50 years have passed since then, the concept of a QA program is still not well understood by many and is confused with QC. But, these two terms have been used indiscriminately and the difference between them is blurred. QC constitutes a fundamental part of a QA program, but is normally associated with the production line to regulate it to some standard. So, a distinction needs to be drawn between QA and QC. According to the

International Standards Organization (ISO 8402 – Terminology), QA is "all those planned and systematic actions necessary to provide adequate confidence that a product or service will satisfy for given requirements for quality." In other words, QA is a strategic management function that establishes policies, adapts programs to meet established goals, and provides confidence that these measures are being effectively applied. QC, on the other hand, is "the operational techniques and activities that are used to fulfill requirements for quality" (ISO 8402-Terminology), i.e. a tactical function that carries out the programs established by the QA. During the last 2 decades, many changes have been taking place in the area of QA, particularly with the development of the concepts and applications of Total Quality Management (TQM), the empowerment and training of the line operator, and the practices for the control of quality on the production line, reducing the work of the QC laboratory. By empowering the line operator to control his unit operation to given specifications — as part of this process — the quality of the product can be more uniform and consistent. The work of QC in all manufacturing unit operation steps of a process and the evaluation of the final product at the end of the line, or in the market, together with human management, and management of regulatory aspects of the food industry. In order, to reach and maintain these goals, a QA program is built around three fundamental functions:

A. Quality Control

A program established around a processing operation to regulate a resulting product by some standard, the function of QC is associated with the production line, i.e., with specific processes and unit operations. QC activities are the operator's tools that help him to maintain a production line in accordance with predetermined parameters for a given quality level.

B. Quality Evaluation

Describing or appraising the worth of a product, quality evaluation generally means taking a measurement of the product to the QC laboratory to evaluate the performance of incoming materials, products in process, or finished products. The finished product can be evaluated as offered in the market, ready for the consumer.

C. Quality Audits

Quality audits are programs designed to verify or examine a product or manufacturing process over time. A quality audit is a fundamental part of a QA program. It allows for quality verification of a product during manufacture, in the

warehouse, in the distribution system, and in the market to assess performance over time or for comparison to competitor brands.

II. BEGINNING OF QUALITY CONCEPT IN FOOD INDUSTRY

Quality control had its beginnings in the factory system that developed after the English Industrial Revolution of the 1850s. At that time, products were made from non-standardized materials using non-standardized processes, resulting in products of varying quality. The only standards used were measures of dimensions, weight and in some instances, purity. The most common form of quality control was inspection by the purchaser under the common law rule of caveat emptor ("let the buyer beware"). At about the same time, the concept of "go–no go" tolerance was introduced, allowing for a less-than-perfect fit between two or more parts. This concept in turn created the concept of upper and lower limits, allowing more freedom in production and lowering costs.

Around the turn and early part of the 20th century, quality consciousness increased at a tremendous rate, with much interest in the application of statistical quality control. Frederick Taylor developed his system of scientific management, which emphasized productivity at the expense of quality. Control of quality focused on final inspection of the manufactured product, and a number of techniques were developed to enhance the inspection process, most involving visual inspection or testing of the product following manufacture. Centralized inspection departments were organized to check for quality. Modern quality management was initiated with the works of Walter A. Shewhart, Joseph Juran and W. Edwards Deming at Bell Telephone Laboratories in the 1920s. Lord Cherwell, science advisor to Winston Churchill during World War II, stated that Bell Laboratories' most important contribution to the British effort in World War II was the concept of quality control and quality assurance. The need to increase factory production during the years of World War II, while using many people new to the workforce, brought unprecedented demands on industry. Quality control techniques were used widely to help meet production quotas and generally were recognized as making an important contribution to the war effort.

III. DIMENSIONS OF QUALITY

The definition of quality also must take into consideration its dimensions, which include strategic as well as operational aspects that play an important role in characterizing the product presented to customers. In this regard, David A. Garvin gave eight dimensions of quality to link customer requirements to engineering design:
A. Performance. Refers to the primary operating characteristics of the product or service; they are usually measurable, e.g. number of rooms, baths etc. in a house.
B. Features. Additional characteristics that enhance the product's or service's appeal to the user, e.g. de-leaded ink used for newspapers, glare-reducing coatings on bulbs, etc.
C. Reliability. The likelihood that a product will not fail within a specific time period, e.g., services that guarantee, certified mail delivery etc.
D. Conformance. The precision with which the product or service meets the specified standards by approaches such as pre-specified tolerance limits.
E. Durability. Measures the length of a product's life e.g. shelf life of food products, light bulbs.
F. Serviceability. The speed with which the product can be put into service when it breaks down, as well as the competence and behavior of the service person. The speed of service can be measured by response time and mean time to repair (MTTR).
G. Aesthetics. The subjective dimension indicating the kind of response a user has to a product. It represents the ways an individual responds to the look, feel, sound, taste, and smell.
H. Perceived quality. Also a subjective dimension; it is the quality attributed to goods or services based on indirect measures e.g. well-maintained tools and an immaculate workplace may indicate a good workmanship.

IV. STANDARDS OF QUALITY

The four most common standards are:
A. Legal Standards: Legal standards are mandatory and are set up by law or through regulations. Legal standards are generally concerned with the lack of adulteration involving insects, molds, yeasts, and pesticides; the maximum limits of additives permitted; or by establishing specific processing conditions so that extraneous materials do not contaminate foods.
B. Voluntary Label Standards: These standards represent those established by various segments of the food industry. They represent a consumer image and may become a trademark or symbol of product quality. Voluntary standards are generally used by private companies or supermarkets and tend to vary depending upon the particular requirements of a given label.
C. Industry Standards: Those whereby an organized group attempts to establish given quality limits for a given commodity. Industry standards are implemented due to pressure from marketing organizations or by specific commodity groups where legal standards are not involved e.g. the standards for peanut butter and some frozen foods.

D. Consumer or Grade Standards: These represent the consumers' requirements for a product. Generally, they are based on past consumer experience. The U.S. Department of Agriculture standards for grades represent the best standards in this area.

V. ORGANIZATION OF A QA PROGRAM

The organization of a QA program is the first step that must be carefully considered. Upper management must support the program and the QA department should be directly responsible to upper management. Management must make the decision between quality and quantity. The QA professional should, however, have the authority from management to work closely with production to maintain operations so that the product being packed at all times meets the desired standards. Therefore, it is necessary that QA professionals should be familiar with the technical aspects of the organization with which they work and understand basic quality concepts.

VI. METHODS FOR DETERMINING QUALITY

The methods of analysis used by the food industry can be classified in two groups:

A. Subjective Methods

These methods are based on the opinions of individual evaluators or investigators; they consist of a physiological reaction resulting from prior training/experiences of the individual, the influence of personal preference, and powers of perception. They usually involve the various sense organs and therefore may also be referred to as sensory methods e.g. flavor, odor, color, or touch.

B. Objective Methods

These methods consist of determinations from which the personal influences of the investigators are entirely excluded and are based on recognized standard scientific tests applied to a sample of the product or products. Objective methods are divided into three general groups:

1. Physical Methods-These are the quickest methods and require the least amount of training. The physical methods for quality evaluation of a product deal with such attributes as size, texture, color, consistency, and imperfection, or with process variables such as headspace, fill weight, drained weight, vacuum, etc.

2. Chemical Methods-Chemical methods are used for quantitative evaluations and for determination of nutritive values and qualitative levels. Chemical analyses are, in general, long and tedious.

3. Microscopy Methods-These methods have excellent applications in QC programs. They require considerable training of the technical personnel to properly interpret results. They can be divided into two general categories:

a. Adulteration and Contamination: Used to indicate the presence of bacteria, yeast, mold, insect fragments, insect excreta, or foreign materials.

b. Differentiation between cell types, tissue types, and microorganisms of various stored foods

VII. QUALITY ASSURANCE SYSTEMS

The quality assurance systems and prerequisite programs that are applied by the industry are:

A. Good Manufacturing Practices (GMP): GMPs are the minimum sanitary and processing requirements for food companies. The basic aim of GMP is concerned with the precautions needed to ensure adherence to all quality and safety basic requirements.

B. The Codex Alimentarius General Principles of Food Hygiene describe the basic conditions and practices expected for foods intended for international trade. In addition to the requirements specified in regulations, industry often adopts policies and procedures that are specific to their operations.

C. Good Manufacturing Practice guidelines are not prescriptive instructions on how to manufacture products. They are a series of general principles that must be followed during manufacturing. When a company is setting up its quality program and manufacturing process, there may be many ways it can fulfill GMP requirements. It is the company's responsibility to determine the most effective and efficient quality process.

D. Hazard Analysis Critical Control Points (HACCP): HACCP is a preventative, proactive and systematic approach of food safety, which relies on the identification and control of the all the known associated health hazards in the food chain. The system based on seven principles was developed to control the biological, chemical, and physical hazards from the raw material production, through manufacturing, distribution and consumption of the finished product.

E. ISO 9000- series of standards had a major revision in the year 2000 when three standards (9001, 9002 and 9003) were combined into one, called 9001. Design and development procedures are required only if a company is in fact engaged in the production and development of new products. ISO 9001 made a radical change in thinking by actually placing the concept of process management front and centre.

F. ISO 22000:2005 is a food safety management standard that is developed based on the ISO 9001 approach. The standard was especially developed to manage food safety. ISO 22000:2005 specifies requirements to enable an organization:- to plan, implement, operate, maintain and update a food safety management system aimed at providing products that, according to their intended use, are safe for the consumer.

G. Total Quality Management – TQM is an integrative philosophy of management for continuously improving the quality of products and processes. TQM functions on the premise that the quality of products and processes is the

responsibility of everyone who is involved with the production or the services offered by an organization. TQM considers every interaction between the various elements of the organization. All are responsible for ensuring quality in terms of satisfying the customer in all they do, and the approach is one of prevention of errors and faults rather than detection and correction. Thus, the overall effectiveness of the system is higher than the sum of the individual outputs from the subsystems.

VIII. CONCLUSION

Food quality management has become increasingly important in food companies, which is demonstrated in an increase of applied QA systems and higher requirements on these systems by the customers. Having multiple options in the form of different quality and/or management systems such as GMPs, GAPs (Good Agricultural Practices) or other prerequisite systems and HACCP, food producers should decide the most appropriate one for its specific activity and should establish, document and implement effective systems for managing quality and safety in industry. By all means, to the food industry, food safety is a pathway to quality management.

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Just in Time: In Indian Context

Shahbaz Khan
Dept. of mechanical engineering
Jamia Millia Islamia
New Delhi -110025
Shahbaz.me12@gmail.com

Mohd Imran Khan
Dept. of mechanical engineering
Jamia Millia Islamia
New Delhi -110025

Mohd. Shuaib
Dept. of mechanical engineering
Jamia Millia Islamia
New Delhi -110025

Abstract- Every industry has put in continuous efforts for its survival in the current volatile economy. In order to face the situation, industries are trying to implement new and efficient techniques in their manufacturing operations. One of the established tools in this context are Just In Time, and its realization has been growing among the industries. Indian manufacturing company has to become competitive or its survival, it has to supply products of consistent high quality at reliable and reduce delivery time. Applying Just In Time (JIT) philosophy is one of the most important concepts that help enterprises to gain competitive advantage in the world market. JIT concept is based on the pull demand model. Everything is done when they are actually needed. It requires a special set of attributes for successful implementation. Many studies has been conducted on JIT and its transferability to various industries around the world but very few in the case of India. The objective of this paper is to analyze and discuss the issue of implementation of JIT in Indian industries.

Keyword: Just in time; pull system; lead time;

I. INTRODUCTION

In today's competitive global business environment, the goal of all manufacturing system to survive long term. Survival of manufacturing in an increasingly competitive market will depend on its ability to produce the best quality at lowest price possible and in a timely manner with the shortest delivery time. More over these goals must be achieved by paying greater respect to mankind staff who operate the system. It is not hard to build quality, but it become extremely difficult to do so while maintaining the excellent quality and respect for the humanity of people who do the actual work to building the product. A Just In Time (JIT) approach proposed here is able to achieve all the objectives above.

The basic idea of a JIT was originally developed in Toyota Company of Japan. The basic goal and objective of TPS is to reduce their lead time [1][2]. Lead time can be describe as a moment when customer place an order to the point where the receive the order and manufacturer collect the case.[1]. To reduce lead time, Toyota aimed to reduce non value added waste. Now Days, JIT concept are being applied on a variety of industries across the globe. Survey and case studies to industries of United States, the United Kingdom, Germany, Italy, Korea and India[3][4][5] have shown growing acceptance of JIT. It is an extension of original concept of managing the material flow in a factory to reduce the inventory levels. In fact, there is much more involved in a manufacturing organization than reducing inventories to control costs. Conceptually, JIT is an approach that combines apparently conflicting objective of low cost, high quality, manufacturing flexibility and delivery dependability. In short, JIT system that produces the required items at the time and it the quantities needed.

JIT encompasses every aspects of manufacturing, from design engineering to delivery of the finished goods, and includes all the stages in the processing of raw material. Other name of JIT process are short-cycle manufacturing, stockless production, and zero-inventory manufacturing.

Just-In-Time is much more than a material than a material ordering plan that schedules deliveries at the time of need. JIT supports the new approach to value-added manufacturing. The concept developed in japan following World War II, focuses on the elimination of all waste. Robert Hall's 1987 classical Alternating Manufacturing Excellence, present a summary of "Seven Wastes" that become the target of elimination in a JIT process.

The Seven Wastes [24]

1. Waste of over production:make only what is needed. Reduce the set time, synchronizing quantities and timing between steps, compacting layout.

2. Waste of waiting: synchronizing work flow as much as possible, balance uneven loads by flexible worker and equipment.

3. Waste of transportation: Establish Layout and locations to make transport and handling unnecessary. If possible reduce what cannot be eliminated.

4. Waste of processing itself: Question why this part should be made at all? Why is this process necessary?

5. Waste of stoke: Reduce stocks by reducing setup times and lead times, reducing other wastes reduce stokes.

6. Waste of motion: Study motion for economy and consistency, economy improves productivity. Consistency improves quality. Be careful not to just automate a wasteful operation.

7. Waste of making defective products: Develop process to prevent defects from being made. Accept no defect and make no defect. Make the process "fail safe"

JIT takes the "problem of manufacturing" to the extreme level of having only the right materials, parts, and product in right place at right time. It is a relentless approach where waste at any point in the operation (even at the management level) not tolerated.

The definition of JIT outlines the two fundamental objectives of waste elimination and kaizen, an attitude of continuous improvement. Supporting these objectives three JIT element that help keep the JIT focus and foster an environment conductive to successful implementation: Technology management, people management and system management.

II. LITERATUTE REVIEW

A few paper are available on JIT practices; implementation case studies; and capital empirical survey which highlight the positive impact of JIT on Indian manufacturing industries.

Goonatilake [8], Ebrahimpous and Schonbrger[9] have exposed the problem of developing countries on the basis of their studies of manufacturing firms, in developing countries. The problem include underutilization of capacity, low productivity; unreliable and long lead times, shortage of raw materials and parts, inferior quality, lack of technology transfer and management etc. Some problems identified by researchers [9][5]in the context of developing country (including India) include inferior quality, little worker's motivation, exact quality on exact time, and unreal transportation system etc. Since most manufacturing enjoy a certain degree of monopoly status, they are more concerned about maintaining efficiency rather than reduce cost (two main inventory control objectives), which is just reverse the case of developed country, where marinating efficiency is automatically achieved due to better infrastructure and practices. Ebrahimpour and schonbeger,[9] have also suggested JIT and TQM to solve such problem.

Koley [6] suggested an approach to access a vendor on an overall performance index, which was certainly useful in the area of supplier management in Indian context.

Garg et al. [10] have found "work culture" a critical element if a company wants to implement JIT. Adopting JIT culture in India is not an impossible task. According to them, dimensions of work culture in JIT include multifunctional workers, long term employment, motivation and trust, top management attitude and commitment, support from union leaders, effective communication, Poka Yoke inspection method, and incentive scheme. It felt that JIT could be great opportunity for India in the context of recent reforms in economy and trade towards opening of economy and

globalization. Some benefits attained in quantified from were also presented when some elements (quality circle, suggestion schemes, kaizan etc.) were applied in an Indian company.

Garg et al. [11] examined critically JIT purchasing in Indian context. An analysis of a questionnaire supplied to various industries is carried out with the help of statistical tests. A test of significance (t-test) was applied for the importance of JIT attributes, problems in implementing JIT attributes and expected percentage benefits of JIT purchasing implementation. There was an indication that Indian industries were giving importance of JIT attributes, facing some problem in implementing JIT, and expecting an overall benefits on an average 59.8% if JIT purchasing is fully implemented. Test confirmed that the scope of JIT implementation in India was fair and it was independent of the type of industries, layout and number of employees. Small industries were more optimistic than large and medium scale industries about JIT implementation.

Singhvi [12] has presented the experience of implementing the JIT in Indian automobile company. The study has found the "employee involvement "as a critical element for implementing the JIT, while large investments are not found essential.

Many scholar [13][14] have started the benefits obtained by JIT . It has been overall agree that culture is the biggest component in transferring this management practices. Interaction with the people from different cultures pose a great challenge. With many researches being conducted on cross cultural-impact [15] there has been wide spectrum of inferences obtained, specified for each country and business around the globe.

III. IMPLEMENTATION OF JIT

Organization are force to reduce lot sizes, inventories, and lead times, production costs and enhance the overall performance. The edge to achieve these objectives is the implementation of Just In Time production philosophy. The JIT system is the approach by which the organizations can deliver right items at right quality [16].

A. The critical principles for successful implementation of JIT system are:

1. People Involvement, Training and Education: the successful implementation of JIT depends on the establishment of a communicative working environment to ensure all the people involvement. Hood training and education programs are basic elements for flexible multi skilled employees who are responsible for implementing the successful JIT system [17].

2. Supplier relations: integration good relationship with supplier are important component which ensure continual flow of right quantity of material in the right time. Working

together and sharing the benefits with the suppliers will eliminate the inventory wastes and improve the quality [18].

3. Waste elimination: the key element of JIT is to produce only the requested quantity by which the overproduction waste will eliminated. Furthermore the primary aim of the JIT is continual reduction and elimination of waste forms [19].

4. Kanban or Pull system: Pull system responds to actual demands of dependence on forecasting and estimation strategy [20]. Kumar et al. have reported that the Kanban system aims to eliminate the inventory wasters through scheduling and controlling the production and Work in progress.

5. Uninterrupted work flow: JIT philosophy concerns about continuity of work process without any interruption. The smooth flow leads to minimize the WIP, lead time and production costs [19].

6. Total quality control: Quality at source is vital requirement for successful JIT system; it is concerns about assuring of producing the right product first time. The total quality control aims to achieve zero defect system in order to eliminate and minimize scrap and rework level, and to enhance the productivity and overall performance [21].

B. The major issue arise in implementing the JIT system in India:

1 Culture: Researchers have found that culture plays a vital role in the successful JIT system [22][23]. The business-culture combination in India is filled with diversity making it difficult to characterize, due to innumerable ethnic groups, 17 major languages and 844 dialects. The national language of India is Hindi and English is the mode of education in the most of the states. With twenty nine states, seven union territories with eighteen official recognized languages and more than three hundred dialects, a typical organization it in any industry would in some way or the other represents this diversity. This diversity is create a communication gap, which is the great challenge in implementing JIT. The average education level of the entire work force is very low and they are not expected to have any technical expertise in their field. Therefore, it is very difficult task to provide training with such type of diversity and very low educated work force.

Several key element of JIT that are required to be implemented in a proper manner. Some element are non-cultural and some are related to cultural. However, mainly proper technology and capital investment can successfully implement these non-cultural related elements. On the other hand it takes a longer time to implement these culturally related items successfully since they require proper training and mental preparation. If we compare with Japanese culture then the largest difference between India and japan lies in the people. The individualistic "every man for himself" temperament of worker in India contrasts sharply with Japanese cooperation, dedication, harmony and group thinking decision process.

2 Plant layout and manufacturing system: The Indian companies use the traditional process product or job layout. These layouts are no more useful in JIT environment. Group technology based cellular layout is needed. The flow of material and arrangement of machines in a cell may preferably U-type. This arrangement is useful for reduced inventory, multifunctional worker and elimination of other forms of waste like set time etc. very few companies are using GT based cellular layout, mostly cellular layout used in automobile industries. JIT system required pull system using Kanban but mostly Indian companies adopt push system using MRP. Another important issue is lot size, in Indian companies lot size is determine using EOQ. So the lot size is not small as required in JIT system.

3. Labor and Union: Due to cheap labor and low educational standard, women and young adults' form the major work of the shop floor. People with minimum education level, with no specialization in their field of operation from the middle management. These labor are not capable to take any decision form himself. In the most cases, the owner of these kinds of small firms the sole brain behind the business. Above discussion shows that in Indian firm lack of involvement of labor n middle management.

Unlike the situation in Indian industry, where there is demand of specialist workers, JIT demands for multifunctional worker with flexibility to switchover. Union must be enterprise-oriented rather than worker-focused. Indian labor is usually uneducated, lacking in motivation and more concerned with monitory benefits and job security than carrier progress and development of their potential. Labor unions and their reluctance are also unfavorable for implementing the JIT. Unionized worker are as a hindering factor to JIT implementing.

4. Supplier relationship: the buyer and the supplier are integrated on aspects regarding the transfer of material from the supplier to the buyer. JIT had adopted at the beginning of their renewal process. An important factor of implementing JIT is high quality. Quality should be at two places- one within the firm and other at thr supplier end. So the selection of supplier and relation with the supplier is very important aspect.

JIT believes single but highly reliable vendor. Supplier as treated as partner rather than competitors. They are trained in quality and production so that no defective should reach at the shop floor or assembly line. Extreme care is needed in choosing and developing vendor in JIT environment. In Indian context supplier are selected on the basis of low cost and treated as a competitor. So the relationship with the supplier is very short time which is a challenge for the implementing JIT.

5. Slow JIT Implementation: As a part of survey, the respondent were asked to access the reason for the slow implementation of JIT in India. Very remarkable note in the feedback was"… JIT is something that is already implemented in the industries of India without much know –how what JIT is actually means…" this shows that Indian manufacturing , even though practicing the elements in the form of islands, effort are needed to coordinate and systemize the JIT implementation. The major reason pointed out for the slow implementation by respondent's are-

(i) Lack of information on JIT implementation (ii) lack of justification for practicing JIT (iii) lack of formal cross training program for workers (iv)problem in maintenance time reduction.

IV. CONCLUSION

Implementation of JIT is not a one day affair. It is a continuous process. The top element that appeared in literature is lot size reduction, education and training, employee involvement, total preventive maintenance, process and worker flexibility, uniform workload, vendor and supplier relationship, Kanban, top management commitment, pull system, and waste elimination in implementing JIT. Mostly Indian industries can using traditional system. Shifting from traditional system to JIT system may not be possible at once but in industries can start with applying some JIT elements that may be easy to implement aspects. Indian company requires creativity and must be willing to modify their procedures and operations. The training of employees in order to create an organizational culture, establishment of new procedures for dealing with suppliers, analysis of operations to identify the areas of standardization, simplification and automation and reengineering of operational processes and procedures are some important issues, which should be examined prior to implementation of JIT.

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Social Media – An innovative method of Election Campaigns

(Study based on 16th Lok Sabha Elections 2014)

Jasvir Singh

P.G. Department of Journalism and Mass Communication

Doaba College Jalandhar.

Abstract: The research paper attempts to study the impact of social media in the Lok Sabha elections. It shows that the ordinary receiver of the election related message on the social media automatically became the campaigner for the political parties or turned to be propagandist.

I. INTRODUCTION

Social media have become unavoidable components of our daily life to exchange ideas thoughts regardless of the distance/geographical boundaries that separates them.The explosion of the social media has democratised the information generating and operating.Whenever an information on Facebook, Twitter or any other social media site is floated an opinion is generated.It could be piece of information designed to make those who read it think about an issue or behave in a certain way conducive to what we want them to. Various methods of information i.e., images, signs, symbols, words, sketches etc. Act as tools of propaganda and persuasion.

Power of social media could be evaluated from the popular revolutions and protests across the world in the recent past. It plays a vital role in mobilising informing and influencing public opinion and shaping consensus of events from around the world. With the growing power of social media, the political parties in India also could not ignore it as an effective tool of campaigning during 16th Lok Sabha elections. Elections are complex events which effects and are affected by the total political context in which they are held. The study of elections of any period is imperative to judge political system in action. Almost every elections witness some shifts in issues, manifestoes, election slogans, campaigning techniques and voting behaviour.In the recent past, election campaigning has also switched over from traditional methods to innovative digital campaigns.

With the advent and popularity of social media today the political information related to various parties, political leaders, issues and agendas is transferred in huge volumes to vast audiences at great speed. These data could be in the form of images, sketches, jokes, videos, graphs and text etc. This content is not only seen or read but simultaneously shared with any number of people

consciously or unconsciously. Thus social media has transformed the content (propaganda) beyond anything those tasked with its production and spread. Unlike previous methods of disseminating propaganda, it has become near impossible to judge or regulate or officiate it. Interestingly by receiving and sharing this data, the social media has made its users share, spread and promote information and hence it has transformed the audiences as propagandists.

Today the political leaders in Indian political parties cannot afford to ignore social media as a tool to promote them individually and their party. The maximum of voters in the 16th Lok Sabha elections are youth with 3 percent new entries (i.e. first time voters) so every political party after realising this has incorporated social media along with other medium. Social media has simultaneously increased interactions of the party candidatewith every oneand vice -versa. An individual need not to seek appointments, wait for them to talk, now interaction is just a click on the button.

Social media like other forms of media has its own importance and use, i.e., a voter can view a politician's profile on their party's website or else he might read his/her blogs, comment his views or ideas on the blog. This helps the voter to understand what he expects from the future government and accordingly vote for the same. Hence the fortunes of contestants seeking election to the next Lok Sabha from various constituencies will be determined by Social media users making them the newest vote bank with the power to shape Indian politics.The split of the popular vote between the ruling UPA, the principal opposition NDA and the emerging third front formation increases the relevance of social media users as a community, rendering unto them an opportunity like never before to register their presence.

According to a study carried out by the independent IRIS Knowledge Foundation suggests that social media usage is now sufficiently widespread to have the power to influence the outcome of the elections to the 16th Lok Sabha and consequently government formation. The study has serious implications, all of it positive, for Indian democracy, for the way it empower the citizens. The study revealed that the candidates need to plan out a well

thought strategies to make use of social media for their campaigns to be effective.

In Punjab there are 13 Lok Sabha seats in which 9 are general and 4 are reserve. The politics of Punjab has always been eventful as compared to other states.Their have been many ups and downs due to existing political, social and economic environment in Punjab. The basic structure of party system in Punjab is rightly characterised as dualistic as The Shiromani Akali Dal and The Congress Party, till day, happens to be the major political outfits in the state. The other active parties in Punjab politics include-Bhartiya Janta Party, the Communist Parties (CPI & CPI (M)), Bahujan Samaj Party and SAD (Amritsar) during Vidhan Sabha election 2012 another party surfaced i.e. is People's Party of Punjab headed by Manpreet Badal former Finance Minister in the ruling SAD-BJP alliance. PPP along with its alliance CPI and CPI (M) gave a dent to other parties by gaining 5.18% share of the vote bank during assembly elections 2012. The Assembly elections 2013 in five states gave birth to another party at national level i.e. Aam Aadmi Party (AAP) headed by Arvind Kejriwal.

The 16th Lok Sabha election have 2 crore 4 lacs new voters aged 18-19yrs added in the voters list which are another deciding factor for the party in power. Technology had a major impact on youth especially in the last five years. There has been continuous increase in total number of mobile users in India and the social media users. Hence the political parties experimented on social media as a tool for election campaigns for the first time.

II. OBJECTIVES

- To study the role of social media during elections.

- To study the role of social media as opinion maker.

III. RESEARCH METHODOLOGY

The study is based on the survey method. The data has been collected with the help of a close ended questionnaire of 20 questions with multiple choices. The universe of the study was Jalandhar district and 200 respondents were selected randomly (100 males and 100 females). All the respondents were either 18yrs of age or above as in India, the individual gets right to vote at the age of 18yrs.

Jalandhar is a famous district of Doaba region and is also known as the NRI hub of Punjab. According to census 2011, the total population of Jalandhar is 21,87,753 with population density 831 person sq./km. It constitutes 8% of the total population of Punjab. According to census 2011, literacy rate of Jalandhar is 82.4% with 86.1% male literates and 78.4% female literates.

A. Results: The research paper is an attempt to study the use of social media by voters to seek information regarding forth coming Lok Sabha elections. Following inferences were drawn from the research.

After collecting data with the help of questionnaire, the study reveals that there were 70% of respondents in the 18-30yrs group of age, 20% in 30-45yrs age and 10% in 45-60+ yrs of age.

For the last couple of decades the elections in Punjab had become a very costly affair. A huge amount of money is poured by into election. A lot of money is spent on high pitch rallies, Vikas Yatras and regular propaganda through print and electronic media.

With the ever increasing social media user in India, the politicians could not ignore this platform as it is being used by maximum number of youth. Interestingly, in the 16th Lok Sabha election maximum voters are of young age. Considering these politicians launched e-campaigns to woo the voters through blogs, emails, Youtube, SMS, Twitter and various google applications, covering rural and urban voters. Images, videos, cartoons, punches, slogans etc were floated in bulk on internet and unlimited data of political campaigning was exchanged among the target audiences in a day.

B. Inferences: Only 35% of the respondents were first time voters for the fourth coming Lok Sabha elections and 65% have exercised there right to vote many times.35% of the respondents use Facebook regularly whereas 40% are not so regular on Facebook. 25% of the respondents do not use Facebook in which majority are of 46 to 60 and above age group.

• 80% of the respondents spend less than 1 hour on Facebook and 10% spend more than 1 hour and 10% spend 1 hour. Only 30% respondents have political leaders as friends on facebook whereas 70% of the voters do not have politicians as their friends. 40% voters receive information from political leaders on facebook as compared to 60%, who don't get any information from political leaders.

• The 55% voters don't use social media on priority for updating themselves regarding Lok Sabha elections. However 30% sometimes update themselves through social media whereas only 5% use social media for getting information related to Lok Sabha elections.

• 35% of the voters have blog and twitter account whereas 65% do not have any blog and twitter account.80% of the voters use internet on mobile & majority of them carry android phone. 15% do not use internet whereas 5% use internet sometimes on mobiles.

- 80 % voters receive information regarding political leaders on whatsapp, twitter, blog whereas 20% do not receive this information. Interestingly 45% voters get this information in the form of jokes / cartoons /slogans/videos etc. Whereas 10% like jokes, 20% photos/cartoons, 15% like slogans, 10% like videos.

- Voter did receive the political information but interestingly 45% did not pass/share it further. 25% share it regularly, 30% does it sometimes. Half of the respondents (50%) shared this message with all whereas 40% shared among friends and only 10% share it in the family.

- 35% of the voters considered these messages as information, awareness and   entertainment whereas 10% considered it as only entertainment 30% found them informative whereas only 25% considered it created awareness. After reading/watching these messages maximum number (80%) of voters discussed them with their friends/relatives whereas only 20% did not further indulge into debates and discussions regarding Lok Sabha elections. When asked about authenticity of the information only 15% voters blindly trust it whereas 70% said that sometimes it is factual whereas 15% said NO. 65% voters opined that these social media affects the election campaign whereas 25% said to some extent whereas 10% reject this opinion.

- 60% of the voters considered social media as a tool of propaganda and similarly 30% voters were of the view that it acts as tool of propaganda to some extent where 10% denied this.The query revealed that 65% voters considered that social media generated public opinion whereas 25% said that it as an opinion maker to some extent and 10% denied.

IV. CONCLUSION

With the ever increasing social media user in India, the politicians could not ignore this platform as it is being used by maximum number of youth. Interestingly, in the 16th Lok Sabha election maximum voters are of young age (3%) have just entered to participate in Indian democracy. Considering this politician launched e-campaigns to woo the voters through blogs, emails, Youtube, SMS, twitter and various google applications, covering rural and urban voters. Images, videos, cartoons, punches, slogans etc. are floating in bulk on internet and unlimited data of political campaigning is exchanged among the target audiences in a day. The study reveals that almost all the respondents (95%) have facebook account and spend almost around 1 hr or less than on it whereas only 10 % spend more than 1 hr. The 70 % respondents do not have any politician as a friend on facebook but 40% do receive information addressed by politicians through facebook. The large numbers of voters are not bloggers and they do not tweet either but 35 % do update themselves through it. Majority of voters (80%) use internet on mobile and mostly carry android phones. The same %age of the voters receive regular information through whatsapp, twitter and facebook. The maximum data received is in the form of images and videos. The information received is also quickly transferred / shared with family and friends hence reaching unlimited audiences within no time.

This information leads to debates and discussion among various groups which not only do propaganda but generates public opinion also in favour or against a particular candidate or a party. The respondents admitted that the content on the social media influence the voter behaviour. It even turns the receiver of the message as apropagandist when he/ she further shares the message.Message also is not restricted to the limited area but reaches limitlessly around the globe.

To conclude the social media is a hot media for campaigning, competing with mainstream and traditional media. The information communicated through it has unlimited impact in generating public opinion.

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Portrayal of Woman in Advertising

Simran Sidhu

P.G. Dept. of Journalism & Mass Communication

Doaba College

Jalandhar

Abstract-The research paper aims to investigate the portrayal of women, sex appeal and the relationship of the latter as recalling power in Advertising in the present age of information technology. The advertising agencies have become dumb and blind to the finer roles of woman and have portrayed only one aspect of her life for their own selfish advertising monetary purpose. The advertising industry as a whole has been subject to controversy over the ethics of propagating factual veracity in its contents, sex role portrayals, aesthetic values and its victims are vulnerable sections of the society.

Key words: Advertisement, Sex Appeal, Commodification

I. INTRODUCTION

Advertisement is a form of communication intends to promote the sale of a product or services to influence public opinion, to gain political support, to advance a particular cause or to elicit a response desired by the advertisers. The message is delivered to the audience through various media like newspapers, magazines, films, radio, television and online etc, other advertising aids are billboards, posters, walls and vehicle, sticker, banner, vender histrionics, competitions, quiz etc. The advent of internet and then social media has brought revolutionary changes in the world of advertising.

Advertising turns the attention of the public to a commodity or a service desired whether the public needs to do so or not. Various appeals used in the content of the advertisement are the unique selling points (USP) of the advertisement. Here too, the advertisers are often objected for using Sex appeal as it is considered with strong recall power. In many gender discourse studies it is revealed that sometime the gender in images, visuals, language influences the buying behaviour of the customer.

Bernstein's definition of advertising has been considered very compact, clear and comprehensive. According to him, it is the organization or communication of ideas about certain products in order to motivate, persuade or influence consumers. The Advertising induces those deliberate and planned activities by which visuals, lingual or oratory message are addressed to the common people for the clear out purpose of informing them and persuading them either to buy a commodity or to become inclined, favorable towards some definite ideas, views, institutions or featured persons.

II. STATUS OF WOMEN IN ADVERTISEMENT

In a consumer –oriented culture, advertisers must position the products they represent as enhancement to both happiness and desirable life-styles. Image serves as the link between product and consumer motivation. An analysis of the people's liking for products shows that certain items are popular not because of any quality in the product themselves but because of the emotional appeal they have gained through advertisements. It seems that women are born to serve and make men happy in all possible ways. The woman as sex object is used in advertisements irrespective of the message. The family, marriage, law, religion and culture are all construed in such a way as to make women accept their subordination as natural. The saddest part is that women themselves allow themselves to be exploited sexually because it brings easy money and comfort. Advertisers know that people buy the skin they love to feel and not soaps and creams. They buy kissable lips and not lipsticks. The mattress company sells not sleep but comfort in the company of a pretty girl. Even in the advertisements of jewellery the slogans express that woman is incomplete or not a women if she does not wear it. e.g.

' *I believe in me, Loved by real women'.* This shows that a woman without jewellery is underestimated.

The picture of a handsome man and pretty girl hugging each other can be used for hundreds of products because the picture suggests love, beauty freedom, excitement, youthfulness, freshness, nature and liveliness etc. Besides the use of woman-image unnecessarily, language of sex in advertisements is extensively used to push its message. As it is not so long when we saw in the papers an advertisement with a woman's back to us with just two words," *Its coming down".* The next day, the advertisement showed the dress half way down and on the third day fully down. By the way, the purpose of the advertisement was to say that the price of one brand of Cigarette had come down.

To keep the consumer system going, new strategies must be constantly invented to keep the buyer motivated to spend money, not only to replace old items and replicate product choices but also to stock the newest available goods and services. The pressure of the newness of product and novelty of the approach keeps the creative department of advertising agencies experimenting with novel strategies. The results often appear ludicrous, startling and bewildering in their separation of the product from the gimmick used to gain and hold attention. The advertisements of body sprays or deodorants used by men are sold with the slogans like 'How many can you handle' and the photograph has three women hugging one male or lipstick marks on the body of the male is not only objectionable but also lowers down the status of woman which interprets woman as a commodity.

III. OBJECTIVES

The general objective of the research is to analyse the role and portrayal of female models in advertisements.
-To study the response of different types of audiences towards the advertisements with woman as a model or sex appeal in it.

IV. RESEARCH METHODOLOGY

Research methodology is an important aspect that helps researcher to meet the objectives of the study. To analyse the role and portrayal of female models content analysis of total 40 advertisements from print, electronic and online advertising were studied. Normative survey method was adopted to study the response of the audience. To collect data a questionnaire with 20 close ended questions and one open question to know their view about exposure of women in the advertisement was administered to the respondents. The study was conducted in Jalandhar District and was confined to 60 adult respondents with 20 in each category of Students, Teachers and Media Professionals.

V. INFERENCES

- Content analysis of the advertisements selected for the study of the representation of woman in its content revels that 35% advertisements portrayed the models displaying their beauty. In 30% advertisements woman has been projected as sexual or decorative object with sex appeal.13% advertisements portrayed women performing household Chores, with the advertised products in hands. 10% women were shown as loving and caring mothers.7% advertisements had shown woman in dependent capacity. 5% advertisement portrayed women as belonging to burgeon high living category.

- Responding to the query in total 37% (18% media professionals) respondents preferred the advertisements with female models. 30% liked couples in advertisement where as 6% preferred men as model in the advertisement. 18.3% respondents revealed that they like appealing language, good photography, and right display of the product in an advertisement. Advertisement without human figure got preference of 8.2%.

- Majority of the respondents 40% media professionals like models displaying beauty in the advertisements whereas 55% teacher respondents like women shown as professional in advertisements.

- Emphasising on the female model as recalling power for the product in the advertisement 90% media professionals remarked that such advertising is the cheapest and the most convenient way to know about the latest fashion, trend service or product.

- 55% of the media professionals and 36.6% of the total respondents believe that female exposure help in recalling the brand name. Whereas 85% of the teachers does not agree to it. 66% of the respondents felt that sometimes the female model overshadows the real message of the advertisement.

- The teachers (60%) agree that the exposure of the female models in the advertisements exploit the females psychologically where as only 15% media professionals

agree to it .Most of the respondents (93.3%) agree that women in advertisements is never shown as she is in real life who slogs and earns for her family. 60% of the total respondents are strictly against the exposure of the female model in advertisements of the products used by men.

- 80% of the respondents reveal that they had bought the product related to beauty, cosmetics, deodorants etc. after watching these advertisements.

VI. CONCLUSION:

A thorough analysis of the present study reveals that even though the modern women is fully aware of herself and asserting her independence, yet it is her beauty, figure which is highlighted by the advertisers which projects her as a commodity. The certain parts of her body are exposed to get the attention of the customer, but never the parts of her talents exposed. Her creativity, artistry and mental caliber are never shown. She is shown as paragon of beauty, incarnation of romance embodiments of sexuality and sensuality, touching every commodity with her dampened, curvaceous body, alluring looks, inviting postures, transferring and sex hungry eyes. She is considered as sex object of beauty and attraction used selfishly and feelinglessly by the adverting agencies and commercial organizations. The human touch in her is completely over shadowed by the malignant and thick headed advertisements and the advertisers hardly reflect in their creativity that she is better half of man, the most affectionate companion to her husband, the most deeply devoted mother of children and affectionate daughter and sister. In the commercial arena of advertising, widespread attention is focused on misusing and exploiting women in a wide variety of advertisements. The self- centered and purely commercial advertisers have used young and beautiful women as an attractive to keep alive the interest of the audiences as consumers. The advertising agencies have become dumb and blind to the finer roles of women and have portrayed only one aspect of her life for their own selfish advertising monetary purpose.

The advertising industry as a whole has been subject to controversy over the ethics of propagating factual veracity in its contents, sex role portrayals, aesthetic values and its victims are vulnerable sections of the society. There have been accusations against some advertisement of being inaccurate in their claims, obscene and exploitation of women.

The woman in Indian advertisements is badly presented and exploited. Woman is portrayed as sex object, in inviting or suggestive poses and in semi nude and nude postures. She is always shown in traditional roles and even if she is portrayed as modern women, this is just in dress i.e., in her out ward physical appearance or in the negative aspects as in the advertisements of cigarettes .Women are often connected with luxury, leisure and material possessions. The study shows that it also misleads adolescents and young girls leading to feelings of depression, body dissatisfaction to attain **zero figure**.
Some critics express that advertising to some extent is

constantly stereotyping the image of women as a sexual object. Even the Indecent Representation of Women (prohibition) Act, 1986, takes a back seat to put check on such advertisements. A woman, even after making strides in various streams of media, is still struggling to get recognition. She has to succumb to various pressures, sometimes professional to social, from personal to market driven. She is not only used as sex objects but she, use others the same way. AAAI and ASCI and various controlling bodies often ignore or overlook various factors. Moreover internet has offered freedom to various corporations and expressionists from the clutches of media watchdogs. The need of the hour is to change the role of governing bodies from watchdogs to bite dogs.

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Pricing-A Vital Weapon in a Company's Strategic Arsenal.

Navdeep S. Thind
CT Institutions, Jalandhar

Harpreet Singh
CT Group of Institutions, Jalandhar

Abstract-Pricing in itself is a study so vast that needs no introduction in this competitive era where each company is focusing on capturing the maximum market share & maintaining a firm customer base by aggressive pricing strategies or by focusing on pricing delights. Companies need to understand the thin line of distinction between pricing vitality & risks of brand rusting .Only some or few managers think tactfully about pricing, and few companies proactively work out their business to create the condition that dwells and fosters more profitable pricing. Sometimes pricing decisions are taken without referring to the the company's instinctive strategic choices – prospects to target, what to offer, distribution channel selection, the competitive position. This paper focus on price as an important strategic weapon in the arsenal of companies, unwrapping the real world scenario for strategic pricing, and bring the facts forward between

Tactical and strategic pricing. The paper shall try to justify the premises which make pricing the most important ingredient of devising a company's strategic intent.

I.   INTRODUCTION

Pricing is one of the key elements of marketing, although it is only a part of the marketing-mix it is critical in achieving desired outcomes and specific marketing objectives . Pricing helps to differentiate in the marketplace and obtain customer satisfaction. Furthermore, is the most important communication tool for a product addressed to the audience, the customer. In practice pricing has multiple levels of implementation. At the highest level is strategic pricing, which takes into account long-term profit objectives of the organization. The next layer is tactical pricing, which optimizes price, taking into account short-term market dynamics, including demand shifts and competitive effects. The lowest layer is execution level, where stock dynamics and inventory and supply management have there well defined role. Nowadays the need to focus on pricing as a strategy based on the overall company strategy is going to become more acute in companies life. Nonetheless, most of the companies never adopt strategic pricing because it requires leadership, interdisciplinary skills and the execution of strategic decisions. But, companies that price by instinct are more likely than ever to fall behind

competitors, no matter how good their products and services are. Adopted correctly pricing can become a powerful strategic tool if it is understood in the context of the company or the product market environment. In order to achieve specific goals, such as maximizing sales and profit or driving penetration an entering company in a new market needs to behave differently than a new company entering an already existing market or an existing company entering existing market. Not giving enough attention to understand this dynamic seriously limits the options available to companies and undermines the ability to use pricing as a strategic tool.

II.   STRATEGIC PRICING OR REACTIVE PRICING

Approaching pricing from a reactive point of view is meaning that pricing decisions are made in reaction to a pricing problem, whereas proactive pricing is planned to exploit an opportunity. In the first case the company analyses the immediate impact of decisions on profitability, in the second case also considers how the reaction of customers or competitors might change the picture. The difference between the two pricing methods is the difference between reacting to market conditions, and proactively managing them. Busse and Rysman (2010) found that the same product had different price elasticity in different regional in consumer markets which lead to different price strategies.

First of all strategic pricing requires the management of the company to take responsibility for establishing a coherent set of pricing policies and procedures, consistent with its strategic goals for the company . Only after reasonable pricing objectives are developed and made an objective of business strategy it is possible to select target markets, create product and service bundles, develop promotional messages that communicate value, and design price structures that will maximize customer's willingness to pay. Whereas, price setting is one tactical decision in sales effort, the day-to-day management of pricing strategy is the coordination of multiple activities to achieve a common objective. While strategic pricing decisions can lead to long term competitive advantage, tactical pricing often yields bigger and an immediate pay-

off, it is the guerilla maneuvering to achieve the day's victory. Tactical pricing can be very helpful for a company in his daily decision making process, it will help to:
- shift the mix of orders toward more profitable products
- reduce the amount of money left on the table in winning situations
- gain share by selectively cutting price with specific customers
- doing so will not lead to a price war.
- appear to exert upward pressure on industry prices in order to misdirect and confuse competitors

On the other hand tactical pricing requires close attention to three key elements: price level, timing, and method of communication. Determining the price level, gives a clear understanding to companies where they stand not just in relation with competitors, but also in relation with customer's price sensitivity and price visibility. Timing price changes can also be as important for companies as the changes themselves. A simple tactic of lagging competitors in announcing price increases can produce the perception of the company among customers of being the most customer-responsive.

The method of communication of price increases or price decreases has a high importance, regarding the fact that price reduction that are widely announced can produce a competitive downward price spiral. Successful pricing depends on much more than simply selecting the right price level, it means that the process for setting price levels must also be proactive. If managers think about pricing only when they must set a price, they can control only the price level. If they are concerning about capturing value as the primary objective, they can expand their ability to set prices profitably by controlling much more than the price level. Pricing strategically involves managing customer's expectations to induce them to pay for the value they receive, pricing strategy involves managing everything that raises willingness to pay closer to the value received. Chen's (2002) study on airline tickets available for purchase over the Internet. Chen (2002) found that the more user-friendly the interface for a website was, the higher the ticket prices charged

A proactive pricing strategy must be a part of a marketing strategy that is value-based. A long-term competitive positioning that is profit driven, rather then driven by sales or market share, must guide the value based marketing strategy. Figure 1 illustrates the multiple levels of pricing strategy, where success within each circle is limited by the successful execution of the ones

surrounding it.

III. PRACTICAL CONDITIONS FOR STRATEGIC PRICING

Aaker (2001) suggested that products with similar attributes tend to sell for a similar price in a competitive market. Price theory asserts that the market price reflects the interaction between demand and supply considerations. Perhaps most important, strategic pricing requires a new relationship between marketing and finance. Strategic pricing should be the interface between those two sciences. It involves finding a balance between the customer's desire to obtain good value and the firm's need to cover costs and earn profit. Furthermore, has to be the coordination of interrelated marketing, competitive and financial decisions to set prices profitably. Regrettably, the pricing policy at most companies is characterized more by conflicts than by balance between those subjects. We can fairly ask then: who owns pricing? Sales? Marketing department? Product Management? Finance? All of them have an opinion and all only see one piece of the puzzle. After all, someone needs to own the value and pricing functions someone who can be held accountable for creating and capturing value across the entire range of customers. If we consider how much executive attention the cost

Accounting and purchasing functions receive in most organizations, with the appearance of a new title, chief purchasing officer shouldn't the pricing function get the same level of executive commitment, attention and resources as a function designed to control cost? In order to set prices profitably and to reflect value to the customer prices must be set by those best able to anticipate that value, probably marketing and sales managers. However, their effort will not generate sustainable profit unless constrained by appropriate financial objectives.

Another approach to strategic pricing is that the company pricing strategy should be seen in relation to developments in the company variables, internal ones (capital strength, competencies, organizational conditions, efficiency of the work force) as well as external ones (customers, competitors, the technological development. These four approaches we can see in the table below:

	Changes in internal variables	Changes in external variables
Consequences of a chosen company price strategy	Type I analysis	Type II analysis
Consequences for company's choice of price strategy	Type III analysis	Type IV analysis

In type I analysis, changes in the company's internal variables are viewed as a consequence of the pricing strategy, e.g. changes in the company's capital resulting from a low pricing strategy. In type two, changes in the company's external variables are viewed as a consequence of the pricing strategy; competitors may initiate extensive price reductions as a reaction to a company's low pricing strategy. With type one and two analysis, the company's choice of pricing strategy is thus viewed as cause and the influence on the internal and external variables as effect. In contrast in type three and four analysis, possible changes in the internal and external variables are viewed as cause and the consequences for the company's choice of pricing strategy as effect. A type three analysis could provide the result that new company competencies have effected a technological leap, which enables the company to improve the durability of its products. If customers emphasize durability, this could result in the company changing a chosen lowpricing strategy.

J. D. Richards, John Reynolds and Matt Hammerstein have defined the organizational conditions for developing an integrated strategic pricing capability which will yield dramatic improvements in financial as well as organizational performance. First of all companies have to gain talent through training programs to broaden and deepen technical pricing expertise and knowledge of company overall strategy. The next step should be the so called strategic management process, to be formed a new pricing management team who would report to the executive committee, and take the responsibility for debating alternative pricing strategies, ensuring the decisions are consistent with the company's strategy. The following element of the mode, roles and decision rights consists of the assumed responsibility of the formed pricing management team over decision rights on pricing, rather than leaving pricing decisions to individuals much lower in

organization, over delegating decisions regarding prices. Abdicating responsibility for pricing to the sales or to the distribution channel for instance it means giving up the responsibility for the strategic direction of the whole company.

Information and technology – should be very carefully selected, companies need timely, dynamic decision support information, combined with a deep understanding of customer attitude and behavior. The revenue optimization systems which are adapted from earlier systems developed for airline and hotel industries are not capable to replace management judgment and therefore should not be the sole basis for decision, they can help only with tactical, short term decisions. Last but not least companies need a change in their mindset and culture. A core group of managers with the expertise needed to develop pricing decisions that would be grounded in not only the company's own economics, but also competitor and market realities.

The adoption of this model will generate new behaviors in the company life:
- pricing will be based on strategic intent, not on profit targets
- prices will be set proactively not reactively
- pricing changes will be agreed quickly and based on an evolving fact
base
- pricing decisions will be consequential and transparent, inducing a
virtuous circle of performance

IV. THE IMPORTANCE OF PRICE SENSITIVITY IN TODAYS CONTEXT :

In a country like India Price sensitivity is of supreme importance .It is a term for a variety of research methodologies used to help identify specific price points potential customers would be willing to pay for a particular product or service. The methods used are quantitative in nature allowing for projections to be made about the likelihood of a product's success. This information, combined with forecasting tools, can provide powerful insight into what a company is facing as it evaluates various pricing options.

Price Sensitivity is the awareness of the consumer to what they perceive to be the window of cost within which they will buy a particular product or service. It is imperative that the marketing professional be able to assess price sensitivity in the target market accurately as missing the "window", even by a small margin can have enormous consequences for the company's bottom line. Priceline companies have use their format to mine the price expectations and tolerances of their customers so the offerings they make can be as near the customer's expectations of discount deals as possible and still maintain viability. Each customer will have a certain price acceptability window and different customers have different limits in their perceptions of what price is within their range.

V. NECESSITY OF PRICE SENSITIVITY TESTING

A. Maximizing the revenue potential – Setting a price too high, or too low, can cost a company money in lost customers or lost revenue.

B. Determine if you can deliver at the right price – Having a good product isn't always enough. Delivering that product or service at the right price is the key.

C. Project revenue – Using normative data, you will be able to project how much of the market will buy at different price points.

VI. CONCLUSION

In organizations pricing is one of the most complex strategic activities. Pricing strategy involves establishing cross-functional objectives and synergistic goals to create an organization that can profitably produce and capture value. Nowadays for many companies, pricing is still a collection of short term activities rather than a business discipline and an embedded core competency. Despite of his advantages tactical pricing must not dominate companies overall pricing strategy, there have to be room for the future perspective, for long-term profitability, namely for strategic pricing. And when it is adopted strategic pricing should not be about shifting authority, rather about providing an efficient robust process and methodology that helps the company to understand and articulate the components necessary for strategic pricing decisions integrated in the company's overall strategic goal.

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Track 5

Technical Session: 2

HRM, Finance &

Strategic Management

E-HRM : Conceptual Framework and Benefits

Ivreet Kapur
CTIEMT
Jalandhar (Pb.) India
Ivy10sept@yahoo.com

Sunny Gulati
CTIEMT
Jalandhar (Pb.) India
sunny_glt@yahoo.co.in

Gurpreet Singh Virk
CTIEMT
Jalandhar (Pb.) India
er.gurpreetvirk@gmail.com

Abstract-This paper constitutes and attempts to connote the role of electronic human resource management practice being followed in the interim. All the organizations whether national or multinational have started implementing web based human resource management tools i.e. E-HRM as a most effectual and proficient surrogate for face to face human resource management activities undertaken. The review reveals the positive consequences of E-HRM in today's organizational scenario such as outlay diminution, augmented speed, enhanced qualitative statistics, elevated adequacy, timeliness, and improved strategic human resource management within the organization. This paper contributes the all-inclusive study of operational, relational and transformational E-HRM followed in the organizations. This paper illustrates all types of tools used by an assortment of organizations for practicing E-HRM.

Keywords: E-HRM (Electronic human resource management); HRM (Human resource management).

I. INTRODUCTION

E-HRM is the field of planning, organizing, directing and controlling the procurement, development, compensation, integration, maintenance and separation of human resources to the end that individual, organizational and social objectives are accomplished efficiently. The procurement and transmission of digitalized human resource information is called electronic human resource management E-HRM stores information regarding payroll, selection, recruitment, performance appraisal, absenteeism, training, orientation and induction. E-HRM is in the essence of the devolution of human resource functions to management and employees as they access these functions typically through intranet or other web technology channels. It is seen that electronic human resource management has developed and became more entrenched in business culture, these changes will become more apparent, but they yet to be manifested to a significant degree. E-HRM is not same as the HRIS (Human resource information system) as well as VHRM (Virtual human resource management) as this is an altogether a different approach to HRM (Human resource management). IT (Information technology) and HRM (Human resource management) are the two terms complimentary to each other. This decreases the usage of papers in the organizations as information technology and human resource management are the two sides of the coin E-HRM is in essence of devolution of human resource functions typically through intranet and other web technology channels. E-HRM is aiming to leveraging of technology to deliver human resource solutions that brings about convergence in human capital, processes data and tools as a catalyst towards achieving business strategies. This term E-

HRM has achieved currency in terms of monetary and electronic commerce simultaneously. As internet technologies has reduced the entry barriers to a particular industry so the organizations are more focusing on decentralizing their functions while trying to maintain a centralized control through standardized processes and information. This electronic human resource management has played a crucial role in decreasing the global barriers, redundant activities as well as reduced cycle time for key processes. As nowadays workforce is becoming more diversified in nature, educated and globalised therefore organizations require most suitable tools and insight related with humans and statistics which would make their employees feel more empowered and connected to each other as well as with organization

II. TYPES OF E-HRM (Electronic Human Resource Management)

After reviewing electronic human resource management from various aspects we analyze that electronic human resource management is being divided into three aspects i.e.

A. Operational: This section deals with the information related to administrative level i.e. policies, programmers, strategies in relation with web technology. This section provides and maintains all the records of humans in context of their payroll and personal information. This level includes the thinking, structure and processes lying behind the people related with the success of every organization.

B. Relational: This section deals with the tasks related to training, recruitment, leave applications, performance appraisal in relation to web technologies. This section deals with the proper recording and steering of all the interactions and mutations undergone while performing activities related to humans. This level provides assistance and act as a backbone for supportive business processes

C. Transformational: This level endeavors to refurbish the human resource management function itself. This is related with knowledge management, strategic reorientation, strategic competence management, organizational change processes. This includes and carries out most of the daily routine activities which take place via smart suites of technological tools like PeopleSoft and oracle interrelated with the application of the enterprise.

III. TOOLS OF E-HRM (Electronic Human Resource Management)

There is enormous number of tools available to implement electronic human resource management competently and in point of fact to carry out organizational tasks related to humans in relation with web technologies as discussed below:

A. E-Recruitment: Recruitment is a process of searching most suitable employees and stimulating them to apply for the jobs vacant and the organizations. As nowadays internet has provided an easy access of employees with the help of number of job recruiting websites availability. Nowadays companies have made their data banks and published as whenever the organizations desires to have vacancies they just feed their job related requirements and specifications.

B. E-Selection: Selection is a process of hiring most suitable individuals from the pool or hub of applicants with requisite qualifications and competencies. As nowadays most of the employees of various organizations are following recruitment through internet with full zeal and enthusiasm but the dissemination of these tools has so far limited. Today only few of the organizations are using online assessment tests as rest of them are still following acre fit questionnaire in the pages of their websites.

C. E-Learning: Learning through the medium of internet and other web technologies. It merely refers to the programmed learning where electronic devices and applications are being implied for knowledge creation, management and transfers. It covers a wide set of applications and processes i.e. web based learning ,computer based , virtual classroom and digital collaboration which is done through internet ,intranet ,extranet ,satellites ,broadcast ,etc.

D. E-Training: Training is something which is required for the individuals to make them expertise in their prescribed field of knowledge. Nowadays organizations are providing a rich learning interface to the employees to make them well-organized in their vocation assigned. With the introduction of internet facility now training can be imparted from both work places as well as from home too. Trainings are being given in the form of virtual as well as classrooms too.

E. E-Employee Profile: This provides a central point of access to the contact information and detailed information about the employees. This employee profile consists of various things like name ,age ,qualification ,address ,contact information ,marital status ,experience ,competency ,skills ,achievements ,honors and awards ,service details ,rules and regulations ,etc.

F. E-Performance Management System: This application deals with the evaluation of all the employees by measuring their performance done to achieve the organizational goals. This constitutes appraisal system in which the behavior of employees in the work spot ,normally including both the quantitative and qualitative aspects of job performance through the medium of internet / intranet to effectively test the knowledge ,skills and the performance of employees.

G. E-Compensation: Compensation is referred as to monetary benefits earned by an employee for the services rendered by him or her within the organization for the employer. This application includes processes that are concerned with job analysis, market rate analysis, and competence, designing and maintaining pay structures. All companies have to properly undergo the strategic procedure of aligning pay, incentives and benefits of employees linked with organizational goals and objectives

IV. BENEFITS OF E-HRM (Electronic Human Resource Management)

- E-HRM seeks astute use of monetary resources as by paying reasonable compensation to the fraction of pains done by them.

- E-HRM provides diversified and flexible workgroups by reducing the cost incurred on recruitment, selection and assessment of suitable candidates.

- E-HRM helps the organizations to formulate and preserve the personnel records for further references as and when requisite undamaged and precisely.

- E-HRM maintains inscrutability of personnel in estimation and a decisive step towards paperless office.

- E-HRM helps in collecting information on the basis of strategic re-orientation and decision making.

- E-HRM has the ability to manage voluminous and confidential statistics easily and in a prescribed manner.

V. CONCLUSION

As through the middling of this paper we started in advance acquaintance about the up-to-the-minute impression or silhouette of HRM is nowadays altering in E-HRM. This paper compiled an overview of E-HRM. In this we actually laid anxiety on what this concept in point of fact means and how it is working for the assistance of the organizations. We have premeditated three dissimilar levels i.e. operational, relational and transformational by which E-HRM is functional in the different fields to pull off organizational goals. We also discussed in element with reference to the apparatus of E-HRM to lug out effortlessly its schedule works and to appropriately deal with humans as a resource. Undoubtedly aphorism E-HRM is a new-fangled and intrigue meadow of research at the fork of HRM and IT systems. As this will auxiliary endow with assistance for conducting debates and research in electronic

human resource management. Electronic human resource management is an innovative manner of running humans as a resource which will show the way to diminution of organizational costs and will increase worth, effectiveness and yield. To sum up this researchers are without a doubt amplification how human resource management is shifting to electronic hrm to visage unbending antagonism in the world market. This was just a preliminary begin or an endeavor to lay down the foundation for this integrating of technology with human resource management system. This is not an adequate amount of or closing stages as more number of researchers are obligatory to shell out luminosity a propos HRM, IT and E-HRM

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Employee Engagement

(a study on IT industry)

Jagriti Rana
Punjab Technical University
Kapurthala
Punjab, India
jagritirana12@gmail.com

Kiran Thakur
Punjab Technical University
Kapurthala
Punjab, India
kiran.verma.0840@gmail.com

Rajani Sharma
Punjab Technical University
Kapurthala
Punjab, India
sharmarajani18@gmail.com

Abstract— **Employee engagement is important to both employers and employees in an organization. For employers, engaged employees will be more productive and committed to their jobs and are less likely to leave. For employees, it helps them to be more responsible and more productive at the workplace. Employee Engagement is a state of mind in which people employ themselves physically, mentally, and emotionally during role performances. The aim of the research was to know the factors affecting low and high engagement of employees. Research was also conducted to know the factors strengthening employee engagement in the organisation. Employee engagement matters, but the extent to which it can lead to a step-change in organisational performance is uncertain. Some of the approaches aimed at improving employee engagement can significantly increase employee engagement and, in turn, this can have a measurable impact on HR variables such as retention and staff sickness.**

Keywords— **Employee engagement; Job involvemet; Organizational commitment; Psychological contract; Job responsibility.**

I. INTRODUCTION

Most organisations today realise that a 'satisfied' employee is not necessarily the 'best' employee in terms of loyalty and productivity. It is only an 'engaged employee' who is intellectually and emotionally bound with the organisation, feels passionately about its goals and is committed towards its values who can be termed thus. He goes the extra mile beyond the basic job responsibility and is associated with the actions that drive the business. Moreover, in times of diminishing loyalty, employee engagement is a powerful retention strategy. The fact that it has a strong impact on the bottom-line adds to its significance.

In quest to find and retain top talent, businesses often try to match competitors' offers, ensuring that their compensation schemes, health care benefits, training programs, and other talent-management practices are in line with the rest of the industry's. While this strategy may be useful for bringing candidates to the organization's door, it's not necessarily the most effective way to usher the right people across the threshold—great employees who will be enthusiastic about their work and fiercely loyal to the organization and its mission.

II. EMPLOYEE ENGAGEMENT CONCEPT

In his book, Getting Engaged: The New Workplace Loyalty, author Tim Rutledge explains that truly Engaged Employees are attracted to, and inspired by, their work ("I want to do this"), committed ("I am dedicated to the success of what I am doing"), and fascinated ("I love what I am doing").

A. Aspects Of Employee Engagement

Three basic aspects of employee engagement according to the global studies are:-

1. The employees and their own unique psychological makeup and experience

2. The employers and their ability to create the conditions that promote Employee Engagement

3. Interaction between employees at all levels.

Thus it is largely the organization's responsibility to create an environment and culture conducive to its partnership, and a win-win equation

B. Driver of Employee Engagement as per Hewitt Associates
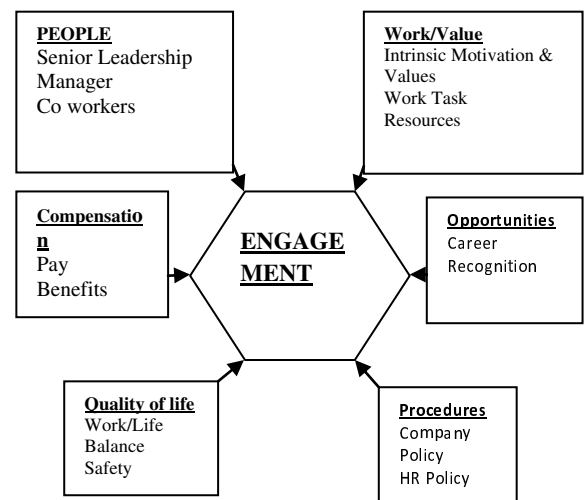
Figure No- 1 Delphique HR Panel MDI Gurgaon

III. RESEARCH METHODOLOGY

The present study is an exploratory primary data based study. Questionnaire is used to collect data about the Employee Engagement. Three components of Employee ngagement have been covered in the present study. These are Employee Involvement, Employee Commitment and Psychological contract. Population And Sample Size Employees working in the I.T industry in India constitute the

universe of the study. Employee working in working in Wipro, Infosys, TCS, NSPL, HCL COMME, IBM, Satyam, InfraSoftTec, Aspect Solutions, XIUS-BCGI, Mediatek India, Cisco Systems, STERIA, and EM2 are surveyed for the purpose of the present study. A total of 150 employees have been surveyed.

A. Demographic Profile Of Respondents

1. Age: The average age of respondents is 28 years

2. Gender: 80% of respondents were male.

3. Experience: Maximum number of Respondents has experience of 3-4 years.

4. Qualification: Most of respondents are graduates with technical background

IV. RESULTS

A. Job Involvement

Employee involvement is creating an environment in which people have an impact on decisions and actions that affect their jobs. This involvement increases ownership and commitment, retains your best employees, and fosters an environment in which people choose to be motivated and contributing.

TABLE 1: JOB INVOLVEMENT

	SD	D	M	A	SA	WA
S1	19	40	37	38	16	2.946667
S2	2	23	15	95	15	3.653333
S3	21	8	68	44	9	3.08
S4	16	12	45	68	9	3.28
S5	5	30	51	49	15	3.26
S6	21	27	40	56	6	2.993333
S7	20	49	40	31	10	2.746667
S8	6	26	32	79	7	3.366667
S9	3	29	27	58	53	4.26
S10	32	45	53	16	4	2.433333
S11	0	35	68	28	19	3.206667
S12	35	20	30	49	16	2.94
S13	9	57	49	35	0	2.733333
S14	14	43	27	42	24	3.126667
S15	0	20	35	87	8	3.553333
S16	26	73	37	7	7	2.306667
S17	10	65	32	34	9	2.78
S18	1	36	71	26	16	3.133333
S19	3	76	56	12	3	2.573333
S20	4	32	52	52	10	3.213333

(SD: Strongly disagree, D: Disagree, M: Moderate, A: Agree, SA: Strongly Agree, WA: Weighted Average)

Criteria for interpreting the results

1-2   Low/Lack of Job involvement

2-3   Moderate Job Involvement

3-5   High job Involvement

The following table represents the distribution of employees according to their degree of job involvement.

	1-2	2-3	3-4
Respondents	82	65	3
	low	Moderate	High

B. Organizational commitment

Organizational commitment is, in a general sense, the employee's psychological attachment to the organization. It can be contrasted with other work-related attitudes, such as Job Satisfaction, defined as an employee's feelings about their job, and Organizational Identification, defined as the degree to which an employee experiences a 'sense of oneness' with their organization.

TABLE 2: ORGANIZATION COMMITMENT

	SD	D	M	A	SA	WA
S1	6	24	29	7	13	1.56
S2	4	26	58	48	14	3.28
S3	0	16	36	93	5	3.58
S4	20	45	63	22	0	2.58
S5	13	27	62	39	9	3.026667
S6	0	15	29	78	28	3.793333
S7	4	35	50	58	3	3.14
S8	10	19	65	48	8	3.166667
S9	12	68	33	37	0	2.633333
S10	8	8	54	53	27	3.553333
S11	13	26	33	60	8	2.96
S12	12	39	24	39	16	2.653333
S13	8	18	39	84	1	3.346667
S14	11	27	51	57	4	3.106667
S15	53	62	21	11	3	1.993333

(SD: Strongly disagree, D: Disagree, M: Moderate, A: Agree, SA: Strongly Agree, WA: Weighted Average)

Criteria for interpreting results:

1-2   Low/Lack of organization commitment

2-3   Moderate organization commitment

3-5   High organization commitment

The following table shows the distribution of respondents with varying degree of organization commitment

	1-2	2-3	3-4
Respondents	96	54	0
	low	Moderate	High

C.   Psychological Contract

It represents the mutual beliefs, perceptions, and informal obligations between an employer and an employee. It sets the dynamics for the relationship and defines the detailed practicality of the work to be done. It is a very subjective concept which influences employee's beliefs and behavior in the workplace.

TABLE 3: EMPLOYEE OBLIGATION

	SD	D	M	A	SA	WA
S1	17	6	25	73	29	3.606667
S2	3	34	51	56	6	3.186667
S3	5	12	19	55	59	4.006667
S4	11	6	38	60	34	3.646667
S5	0	19	26	73	32	3.786667
S6	8	12	40	65	25	3.58
S7	10	26	42	54	18	3.293333
S8	7	19	19	56	49	3.806667
S9	7	5	26	65	47	3.933333
S10	18	14	28	51	39	3.526667
S11	14	34	22	52	28	3.306667
S12	0	4	28	71	47	4.073333
S13	4	11	33	62	40	3.82
S14	6	10	19	69	46	3.926667
S15	0	11	32	69	38	3.893333
S16	3	33	26	62	26	3.5
S17	2	19	48	69	12	3.466667
S18	8	22	56	57	7	3.22
S19	6	25	53	58	8	3.246667
S20	2	18	44	52	34	3.653333
S21	10	9	27	68	36	3.74
S22	2	8	48	65	27	3.713333
S23	10	7	32	64	37	3.74

(SD: Strongly disagree, D: Disagree, M: Moderate, A: Agree,

SA: Strongly Agree, WA: Weighted Average)

Employee Obligation

1-2   Low/Lack of Psychological contract

2-3   Moderate Psychological contract

3-5   High Psychological contract

The following table shows the distribution of respondents with varying degree of Psychological contract.

	1-2	2-3	3-4
Respondents	126	18	6
	Low	Moderate	High

Correlation analysis has been performed to examine the degree of association prevailing among the variables considered in the present study.

Correlation Analysis:

Before proceeding to the results of regression analysis, it is an implied condition to check the existence of multicollinearity or colinearity, the situation where two or more of the independent variables are highly correlated. It can have damaging effect on the results of multiple regressions. To examine the correlation between various variables, Pearson product moment correlation (r) was computed. A correlation matrix of all the values of r for the explanatory variables along with dependent variables was constructed and has been shown in Table.

TABLE 4: CORRELATION ANALYSIS

	Invol	Commit	EC	ErC	Age	EXP	CoChng	M	F	G	PG
Invo	1										
Commit	0.542*	1									
EC	-0.531*	0.564*	1								
ErC	-0.049	0.078	-0.241	1							
AGE	0.203	0.464*	0.453*	-0.003	1						
EXP	-0.077	0.185	0.012	-0.094	0.654*	1					
CoChng	-0.033	-0.11	0.066	0.599*	0.044	0.046	1				
M	0.041	0.121	-0.033	0.051	0.028	0.386*	0.341*	1			
F	0.412*	0.471*	0.033	-0.051	-0.028	-0.016	0.201	-1	1		
G	-0.224	-0.22	0.01	-0.014	-0.197	-0.501*	0.452*	0.527*	-0.527*	1	
PG	0.224	0.217	-0.001	0.014	0.197	0.501*	0.192	-0.527	0.527*	-1	1

Correlation is significant at the 0.01 level (2-tailed). (Invo: Involvement, Commit: Commitment, EC: Employee Obligation, Er C: Employer Obligation,

EXP: Experience, Co Chn: Company Change, M: Male, F: Female, G: Graduation, PG: Post Graduation)

Table reveals that there exists some significant correlation among the various components of Employee Engagement considered in the present study.

V. KEY FINDINGS

- Employee engagement matters as it impacts on companies' productivity, profit and achieving the aims and objectives of the organisation.

- Surveys suggest that the majority of employees are neither engaged nor disengaged, with only around 10 to 30 per cent of employees fully engaged with their work.

- In I.T industry employee engagement is found to be low.

- Engagement is low when employer and employee goals do not align.

- If employee demands are looked by the organization and are fulfilled they become more engaged to their work.

- Organizations do not want their employees just to work in the organization but they want their employees to grow with organization.

- A person should join job after completing his post graduation, with that he/she becomes more knowledgeable and engaged to his work.

- The degree to which effective implementation of any new initiative depends on the readiness of staff to engage with change. This is especially critical within the organizations.

- More women than men are engaged with their work.

- Employee engagement in today's context linked more with good working environment.

VI. CONCLUSION

Employee engagement matters, but the extent to which it can lead to a step-change in organisational performance is uncertain. In particular, even where there is a clear vision and understanding of what needs to be done, there can be significant barriers to effecting 'change on the ground'.

Increasing employee engagement is highly dependent on leadership and establishing two-way communication where people's work and views are valued and respected. There are thus ways in which any organisation can work towards better employee engagement without incurring high costs as long as there is the organisational determination to focus on this issue. Even in the absence of robust impact data, the principle of employee engagement is to be endorsed in terms of good practice in people management and the softer benefits this confers to organisations.

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Suggestions Strategy

Rajinder Kapil
CTIMS
rajinderindu@yahoo.com

Abstract- A good suggestion is an effective tool for productivity improvement in a developing country like ours, where the potency of the suggestions is yet to be fully realized and appreciated. Its potential is enormous and much depends on one's capacity of harnessing it. This paper is examining ways and means of exploiting the acceptance potential of suggestions. The study is based on the central tenets of simplicity, suggestion friendly, motivation oriented, gainful exploitation of suggestions and their effective implementation. Any suggestion system, like a sensitive plant, is very sensitive to the climate/ environment under which it operates. A conducive climate or environment increases the ingenuity and the creativity of the persons involved. The suggestions play a key role in the systems and therefore environment friendly suggestions are the demand of the day, and more so how comfortable the suggestions find themselves in the entire process, depends on the efficacy of its implementation, hence necessary climate and motivation should be provided to make the suggestion more useful and effective. The main virtue of suggestions is to bring in human being the value of moral building, truthful and dignified livings under social welfare atmosphere.

Key words: guidance and counseling, insinuation, intimation, indication implementation.

I. INTRODUCTION

Suggestion is a sequential process by which one thought or mental image leads to another by association. It is a psychological process by which an idea is induced in or adopted by another without argument, command or coercion. According to Oxford Dictionary & Thesaurus III (2001) suggestion (noun) means slight trace; hint insinuation of belief or impulse into the mind. It is counseling, prompting, urging, advice, counsel, offer, plan, proposal, recommendation, breath, hint, idea, indication, intimation, notion, suspicion, touch, trace. **Suggestions Strategy** is an icy world and the steps are slippery so carefulness is of extreme necessity while providing suggestions or while implementing them. While we think about some proposal, certain suggestions get generated automatically and various types of potential insinuations come to mind but have we ever thought as to which mechanism is working behind this exercise. An idea is normally floated that the suggestions should be given only when asked. It is also said that any foolish idea may sometimes generate a very valuable suggestion. Secondly when the suggestions are freely available, it becomes very difficult to choose the one for implementation, more so whose suggestion should be accepted, whether the suggestion has any applicable value, will it bring desired results, will it not create any hurdles or further complications are the questions which need to be given a serious thought about the suggest

II. RELATED LITERATURE

Hayes Claire & Morgan Mask (2011). The paper is exploratory in nature and used mixed method approach which is described as research method that combines qualitative and quantitative techniques, approaches and concepts. The paper aims to deal with the perceptions regarding counselors practices, policy context of guidance and counseling in Irish and UK Schools. **Krunic Tanja at.el (2007)** suggests the improvements in the conditions of Web Accessibility. The paper compares the working conditions of web with National Accessibility Standards. The authors have tested a sample of 200 web sites from 12 different countries mainly dealing with e-commerce. **Launikari Mika & Puukari Sauli (2005)** describes Acculturation which means to adaptation to a new culture and the process of change a person will have to go though to achieve this. It relates to a socio-cultural and psychological context. The work deals with the key objective of national integration policy in Europe. **Burdett Jane (2003)** finds the effective learning in groups. The paper explores the perception of university students. The five point Likert type scale was used and the data was analyzed using the statistical software package, SPSS version 9. Positive and negative perception of groups was analyzed.

III. OBJECTIVES-

i)   To stimulate creativity and to encourage an innovative approach.

ii) To infuse positivism in the entire system.

iii) To create a conducive climate to motivate and encourage the concerned.

iv) To bring about an improvement in every sphere of working life.

v)   To recognize the concerned for creativity and innovative ideas.

vi) To make the entire system and process very simple and implementation –friendly.

IV. SCOPE

Its scope under the technical and social atmosphere is appreciable and can be analyzed well within the existing environment and i) To increase the productivity. ii) To

reduce costs involved iii)To minimize the wastage of men, money, material and cycle time iv) To improve technology and services of individuals and the work life and vi)To bring about better safety standards, standardization and optimum utilization of men, materials and investments.

V. RESEARCH METHODOLOGY

Epistemology or the theory of knowledge provides us with the guidelines for the methodology to be employed and so they affect the research process. Methodology cannot be studied in a vacuum and it is to be linked to the knowledge domain. This is a subject of pure and descriptive research hence no data is required to be collected and analyzed.

VI. LIMITATIONS

Now the question arises that from whom the suggestions should be obtained. One must not take advice from: i) A super intelligent individual, ii)A procrastinator iii) A man who is always in hurry, iv) A false admirer.

VII. IDEA GENERATION

There are various idea generation tools, techniques, systems and methods such as Brainstorming, Brain writing, Breaking set, Buzz groups, Idea writing, Imagineering, Improve internal process plan, Lateral thinking, List reduction, Mind mapping, Morphological forced connections, Multi voting, Nominal group techniques, Opportunity analysis, Rich Pictures, Snowballing and Suggestion schemes etc. which are used as alternatives.

VIII. HIGHER PURPOSE OF LIFE

Suggestions must blend judgment with analytical reasoning since suggestions avoid personal adversities and impediments to the fulfillment of one's mission. Although Man lives in the present and free from the point of view of significance and other referral time concepts namely the past and future either get into or emerge out of it. The present paper is an effort to catch the space on the eternal suggestions road which could mean a real addition to the curiosity stricken man striving in the darkness of ignorance about the penetrating power of the suggestive branch of knowledge.

IX. NAVIGATION STRUCTURE: CREATIVITY AND IDEAS

Well before providing suggestions the consultant has to observe everything happening around with a microscopic eye and follow the golden rule of five W's and one H.

- What is actually done and is it necessary to do?

- Why is the activity necessary at all?

- Where it is being done? Can it be done at an alternative site?

- When it is being done? Can it be done at any other time?

- Who is doing it? Could it be done better by another person?

- How it is being done? Is there any possibility of doing it more economically in some other way?

X. QUALITY SUGGESTIONS ASSURANCE APPROACH

The problem-solving process is a natural and logical sequence for overcoming adversities, problems and improving the standard of decision making. Problems, no matter what size or complexity, can be best solved by proceeding through a sequence of steps. The methods also help to generate possible root causes and potential solutions and it will be necessary to apply the methods to obtain quality public life.

XI. SUGGESTIONS SHOULD BE AVOIDED IN THE FOLLOWING AREAS

- Suggestions demanded to questions which violated the guidelines of

- Corporate body must be avoided rather bureaucratic respect for guidelines and regulations must be made.

- Suggestions demanded to spurious questions.

- Suggestions to People who have made serious mistakes, or who are considering committing a crime must be avoided.

- Suggestions should be avoided if the offense is grave.

XII. PERFECTION

Perfection to any idea or situation is just a hypothetical idea in the ever changing worldly affairs in public life. It coincides with the infinity concept. Once the situation is found to be perfect the desired level undergoes a change and the man again start on the perfection search journey.**Tend to be a bit of a Perfectionist** A systematic study to these questions will lead the person to an idea for suggestions. Present and proposed suggestions should be empathically checked well before providing them to the needed person. It should have a positive effect and should bring in better results than before. In other words the suggestions in general should result in quantifiable savings. Further the plan of action or navigation structure so suggested should appeal to the person requiring suggestions.

XIII. ACKNOWLEDGEMENTS FOR GUIDANCE OBTAINED

For having obtained the suggestions one should be thankful to the person providing the suggestions and must express his gratitude in such a manner that he is really impressed for the great idea so obtained. He should also inform that the suggestions will be meticulous

implemented and would like to send the proper feedback. In the end he should express his further need for the professional advice by thanking once again for the splendid job.

XIV. CONCLUSIONS AND SUGGESTIONS

In conclusion, the researcher would like to highlight what stuck the most in the course of carrying out this work. It is tempting when reporting research to emphasize only the hard facts-what others have found previously in the literature. It appears that the common ground counselors share with clients is a battleground in which all are involved in the same battle against evil, a very delicate and intricate battle. The intellectual providing the suggestions need to transcend the state of confusion of the prospect. The person suggesting has to apply new ideology and promised to establish perfect societies. In the course Indological considerations based on History, Language, Culture and Environment would show new dimensions to the world of suggestions where the prayer is for the upliftment of the general masses. God rewards sincerity and if the mankind sincerely adopts an Indological way of life, achieve and implement the Vedic knowledge the human race shall be on the path of improvement, social achievements, mundane perquisites and obtain satisfaction & salvation in life.

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Values and Ethics: The firmware for Sustainable Growth

Harish Gautam

Doaba College, Jalandhar

Abstract-Growth always taxes natural resources & environment. Sustainable growth means to ensure growth without any negative impact on environment. We all are facing threat of global warming, as an impact of industrialization, greenhouse gases' emissions blown out of the engine of growth. In order to protect the environment, Governments, industry, supply chain and even the consumers all across the world are in the rally of going green. The sustainable growth is ensured through green production, green business & green consumption. In spite of all such efforts, there is subordination of environmental interest to individual interest due to lack of the value system. The present paper is an attempt to find how the individual's value system is a glue to fix & protect the environment.Further, paper emphasizes that Environmental Values and Ethics loaded during nurturing stage are like the firmware of themind & ensure sustainable growth for generations.

Keywords: Green Business; Green Consumerism; Sustainable Growth; Values & Ethics

I. INTRODUCTION

To grow in life is the biggest weakness of every so-called rational human being.One can come across people making big compromises & risks with life just to grow. It is common to see people crushing the emotions of those who care,only for self-growth.Similarly, the lust of science to grow has ensured growth of knowledge at the higher speeds than the wisdom. Science has developed the knowledge to exploit the nature for the benefit of humanity, without caring that nature cares for the humankind. Likewise, in the business world, by growth we mean the increased rate of profits of the business at any cost. However, with times changed, the meaning of 'growth' has also grown to 'sustainable growth'. Sustainable growth means to grow further without hampering life of earth and environment.

Like, we all want to see our kids growing at a fast pace.For this, we give them boosting food supplements to fulfill the needs of the body&helpour kids to grow; however, we may opt for slow growth without supplements if we come to know that such supplements have a chance of permanent damage to any organ of the child. Similar is the case with earth's environment, if we are having industrial growth but such growth is hampering our earth's environment; the cost of the growth is more than its benefits. As we should prefer wisdom to knowledge, similarly we prefer to have a sustainable growth,i.e. a growth that should be ecologically balanced and good for our environment.

In order to protect the environment, governments are taking various administrative actions. Like in India, the National Council of Environmental Planning and Coordination set up in 1972 was the focal agency in this regard. Keeping in view the sustainable principles, the Ministry of Environment and Forests, set up in 1985, formulated guidelines for various developmental activities. The Indian Government has taken some steps to protect our environment; some important provisions are included in our Constitution. As for exampleArticle 48A states: "The State shall endeavor to protect and improve the environment and safeguard the forests and wildlife in the country" Similarly, Article 51 (g) states: The Constitution expects that each citizen of the country must "protect and improve the natural environment, including forests, lakes, rivers and wildlife, and to have compassion for all living creatures".

Even some states of India, like Himachal, has taken the crucial steps in this regard. In Himachal, use of plastic bag is bannedbecause it is not biodegradable. Everyone in the state is aware and does not use plastic bags for shopping. While in other states, like Punjab, plastic bags are not banned but there is set of allowed microns of plastic in bag consumption. Moreover, shopping malls charge an extra fee for taking plastic bag; this is a major step in discouraging the use of plastic bag. As per research observations, it was found that people in both Punjab and Himachal are bound to follow the state norms, but they do so only out of binding but not with pleasure. Like, if any resident of Himachal visits some other state where plastic is not banned, he don't hesitate in use of plastic bag and throws it after use. Similarly, where plastic bag is charged,people behave responsiblyby either not using or bringing their own shopping bag for saving extra amount. Here also, if anyone gets a bag freeof cost, he does not mind in using it. The important research problem reflected by the behavior of consumer is dearth of values, ethics and vision of why they should not use plastic bag.

The improvement of sustainability of the world environment and its natural resources is dependent upon the proper development and inculcation of environmental values. The environmental values are those values, which help us to generate awareness among consumers & producers towards the environmental protection and the preservation of environmental resources for better future living.The development of environmental values helps us to be careful towards our environment and helps to learn and realize the importance of environment and its resources in our daily life. The development of sustainability is largely depend on the environmental awareness ,therefore it is very essential to inculcate some important environmental values, which help to protect the environment with pleasure and not by force. This software of environmental values & ethics can be loaded permanently on the minds of young people and will stay on their minds like firmware of mind forever. One can learn these environmental values in the family, in the society or in the school. If we want to enhance the sustainability of our

world environment and its resources, we should have to develop the environmental values among the young people.

II. REVIEW OF RELATED LITERATURE

Growth through Environment protection is multi-dimensional study. It involves review of literature for understanding the meaning of sustainable growth, role of corporate, consumer, government and other parties in ensuring sustainable growth.

A. Sustainable Growth

Human society is developing at fast pace, there is growing concern for the impact of this human development on natural environment. By Sustainable Growth/development, we mean 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (Brundtland, 1987).This definition recognizes that while development may be essential to meet human needs and develop the quality of life, it must happen without draining the natural environment.Further, sustainability protects both the interests of future generations and the earth's capacity to regenerate.Sustainable development is one of the vital encounters facing the world today. In the light of persisting global patterns of poverty and inequality, emerging issues like the impact of climate change and the current financial and economic crises, it is no exaggeration to say that, the world is at a major turning point.

B. Corporate Attitude

Corporate attitude to environmental issues have changed considerably over the years. Not only the companies are aware of the environmental issues but also seen acting very responsibly towards execution. Because of staggering pollution levels and the diversity of environmental concerns, a wide range of pressures is coming upon industry. These green pressure groups include the customer's pressure, government pressure (legislation pressure), investor pressure, community pressure, business-to-business customers' pressure and employees' pressure (Fischer, 1992).

The adoption of green marketing positioning by a firm is principally a response to the increased pressures by society for business to meet its comprehensive ethical and moral responsibilities, while adhering to the basic marketing concepts of meeting customer needs at a profit. In a survey conducted in the United States of 400 Midwestern consumers, 36 percent of the respondents were found to be "very likely" to change from one food brand to another competitive label which used a recycled carton; only 2.8 percent stated that they would be "somewhat unlikely" to make brand changes because of recycled packaging (Eisenhart, 1990). In many cases, mandatory environmental legislation is also forcing behavioral changes in consumers (Clarke, 2004).

The basic ideas behind environmentalism dictate that corporations have responsibilities that go beyond the production of goods and services. These responsibilities involve helping to solve important social problems, especially those they have helped create (Buchholz, 1991). It is not only that corporate houses understand but have also started acting on the lines of going green. Corporations such as McDonald's, Wal-Mart, Procter & Gamble, and Du Pont acknowledge that the environment must be protected and enhanced for economic growth to take place, and have taken action towards that goal. McDonald's has made a $100 million commitment to its consumers for recycling purposes. Wall-Mart encourages the purchase of environment friendly products and reports that the green labelling program, which they initiated in 1989, contributed to an overall 25% increase in sales for the year. Procter & Gamble has pledged to spend $20 million per year to develop a composting infrastructure (Lodge, 1991).

C. Consumers' Attitude

All across the world, sincere environment friendly consumers are increasingly concerned about environment protection. There is a journey called Green Consumerism, ensuring minimal damage to the environment by purchasing, using and recycling of eco-friendly products. Environmental awareness of consumers is widespread nowadays, and thereby, companies are enforced to enhance their environmental management (Hart, 1997). There are national and international regulations of environmental protection, such as Montreal Convention and Kyoto Protocol. The environmental consciousness of consumers (Chen, 2006) are the forces driving companies to engage in environmental management.

D. Governments' Attitude

A knowingly increasing impact affecting the corporate operations of companies is the policies of governments with regard to the environment protection, and the presence of both national and international environmental regulations (Rugman, 1998). In order to deal with waste, governments throughout have passed legislation to place a nominal fee specially on plastic bags given at the checkout stand of grocery stores, convenience stores, and drugstores. It may turn down as, there is opposition on the ground that paying for bag reflects, concept of affordabilityandnot concern for environment (Murdoch, 2010).

III. OBJECTIVES OF THE STUDY

This paperaims at understanding the meaning of Sustainable development and understanding different steps taken by government and corporate sector to ensure sustainable development. In addition to this, the paper is an effort to explore the various reasons for any failure in implementation of the said steps. These objectives are listed as follows:

- To explore various government & world organization's role in environment protection;

- To explore various lacunas& causes in execution of the environment policies; and

- Finally, the paper aimsto suggest actions for better implementation of the norms for sustainable development.

IV. RESEARCH METHODOLOGY

In order to achieve objectives of the study, both primary and secondary sources of data were used. For primary data collection, questionnaire schedule was prepared and got filled

in from 210 respondents based on convenience random sampling technique& online sources. The respondents consisted both males and females from population, mainly including students, working people and businesspersons. For measurement of constructs, responses were entered into a data sheet at the time of the interview, tabulate andanalyzed.

V. FINDINGS OF THE STUDY

As already discussed, today the global scenario is that everyone involving government, world-leading organizations, industry, and supplychains are in the rally of going green. No doubtgovernments and industry are making lots of efforts to formulate and implement the strategies to ensure sustainable growth. However, as it is said we need two hands to clap, similarly on the receiving end is the consumer, and we need to ensure that he also participate in leaps towards sustainable growth by reflecting his environment concern through consumption patterns. The study has found that in most of the cases either the consumer is not aware of the impact of his consumption pattern on the environment or his interestssupersede environmental concern. As per empirical results of the study, the following is inferences:

- As per the study, 81 percent of the respondents are aware of the ongoing environmental issues and they feel concerned about environment;

- 27 percent of the respondents agree to the fact that their consumption pattern affects the earth's environment;

- Regarding checking of mark for recyclable product merely 40 percent of the respondents agree to check the same while shopping;

- In response to questions related to use of plastic bags, 30 percent of the respondents connote that they do not prefer using plastic bag. It seems that during the schedule most of the respondents got the idea about plastic being dangerous for environment thus seems like have changed their answer to more socially desirable & responsible one. This was felt because most of the respondents said that they prefer using paper bag because it is natural. They had no idea about the bio-degradation feature of plastic and paper bag but still they manipulated the answer to show their concern for environment.

- In order to know the real response, indirect question was imposed asking if the respondent in his life have ever done langarseva (kitchen/canteen where food is served in a Gurdwara to all the visitors free of any charge). Eighty percent of the respondents agreed to this question. Further, ninety-four percent of such people agreed that they prefer using disposable thermocol plates being hygienic and no need for washing etc.

- The next important question asked was, if the respondents check for star rating while shopping electrical appliances. Ninety-one percent of the respondents agree to check for five star rating of electrical appliances like air conditioner because it ensures saving in electricity bill. In a hypothetical statement, seventy-two percent felt they would prefer to buy three star AC if the five star air-conditioner is twenty-twenty five thousand rupees expensive to normal AC.

- Further, in response to a question if they use nappies for their child. Sixty percent of the respondents were not having children of the age using nappy. While, Forty percent of others said they prefer not using the same at home. Last but very smartly once again 90 percent of the respondents said no to nappies, as they knew these are not environmentally friendly.

The results clearly depict that people tend to portray themselves as environmentally aware and concerned. The observations of the study reflect that the behavior of the respondents differ, they are not following their words. They seem to prefer individual interest to environmental values. They seem to have concern of affordability and personal benefits for consumption pattern and consumption decisions rather than concern for environment.

A. Role of Governments & World Organizations for Environment Protection

After the consumer's role, the available information about other parties involving governments, world leaders and corporate is explored. It is found that, World leaders at the 2012 United Nations Conference on Sustainable Development (Rio+20) endorsed their assurance to sustainable development, which embraces economic progress, social development, and environmental protection for the benefit of all. It has plotted a 3D picture of sustainable development with the dimensions of economic progress, social development and economic protection. Further, it has suggested a framework for embedding environmental sustainability into SDGs. The frame includes; rationale and overarching vision for the SDGs and second part is an integrated approach for embedding environment in goal targets(UNEP, 2013). The new set of goals should carefully consider and balance the three dimensions of sustainable development – environmental, social and economic. A fourth dimension, "peace and security" been suggested(UN System Task Team on the Post-2015 UN Development Agenda, 2012).

As per global leaders, good governance and sustainable development ensure the strong commitment of everybody: government, political, social and economic organizations where all commitmentsare made with keeping people and environment as the central focus. As reported earlier, there are many kinds of economic, social and environmental challenges which are occurring today. The indicators of Good Governance and Sustainable Development are shining, as there is a decrease in sex ratio, Ecological footprint (EF) and improvement in literacy rate, work force, labor force. Indicators of sustainable development like GNH, HDI and HPI have also increased. Still, there is a need to put more attention on the rule of law, participation, equity, effectiveness and efficiency, life security and environment. We can utilize our resources more so that we can lead to good governance and sustainable development.
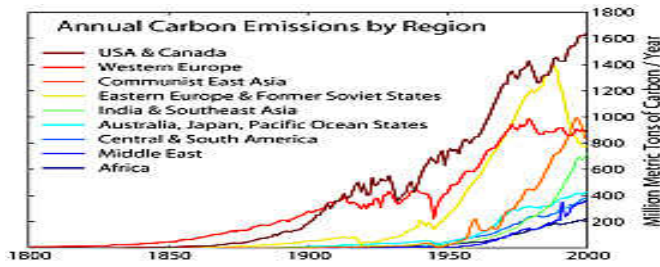
Source: Robert A. Rohde Carbonefy.com

Further, if we go back, the UNFCCC - the United Nations Framework Convention on Climate Change developed the Kyoto Protocol; an agreement negotiated by many countries in December 1997 and came into force with Russia's ratification on February 16, 2005. The Kyoto Protocol has committed to cut emissions of not only carbon dioxide, but also of other greenhouse gases, being:Methane (CH4), Nitrous oxide (N2O), Hydro fluorocarbons (HFCs), per fluorocarbons (PFCs), Sulphur hexafluoride (SF6). If participant countries continue with emissions above the targets, then they are required to engage in emissions trading; i.e. buying "credits" from other participant countries who are able to exceed their reduction targets in order to offset. The goals of Kyoto were to see participants collectively reducing emissions of greenhouse gases by 5.2% below the emission levels of 1990 by 2012. While the 5.2% figure is a collective one, individual countries were assigned higher or lower targets and some countries were permitted increases. For example, the USA was expected to reduce emissions by 7%. The chart gives an idea why different countries were apportioned different targets: USA & Canada were top most countries with highest emissions followed by Western Europe, East Asia, Eastern Europe, India, Australia, Central America, Middle East & Africa thus, the set target to cut emission was high for this region. India and China, which have ratified the Kyoto protocol, are not obligated to reduce greenhouse gas production now as they are developing countries; i.e. they weren't seen as the main culprits for emissions during the period of industrialization thought to be the cause for the global warming of today(Bloch, 2014). In India, Ministry of Environment & Forests has established Central Pollution Control Board. The board has purposed National Emission Standards for various plants viz. petrol chemical, oil refineries etc. that they are supposed to follow(CPCB, 2014).

VI.   DISCUSSION & CONCLUSION

The industrialization has led us to development. However, it is equally true that as a coin has two sides, the industrialization, on the one hand, has ensured growth, but on the other hand, it has proved to be a big challenge for environment, due to its emissions in air, water & atmosphere. Thus, for 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' concept called 'Sustainable Growth' has emerged.

As per this concept, there should be total environment protection in the whole supply chain. In ensuring environment protection and sustainable growth, various parties are involved, viz. governments, administration, industry, supply chain as well as a consumer. The paper explores the role of each element in the process of growth. As per data, government and various responsible organizations of the world like United Nations are sincerely making efforts to ensure the sustainable development. They intend to check that industrydoes not pollute the atmosphere beyond certain limits. There is Kyoto Protocol and many administrative checks to cut pollution emissions and care for environment.All involved in supply chain consisting of whole-sellers, retailers and transporters ensure that they focus on green business, like use of recycle process, energy-efficient stores& transportation system. Similarly, on the other end is consumption, the consumer is also showing concern for environment by following green consumption.

However, still it is explored that consumer is first concerned about his benefits and then towards environment. For his benefit, consumer opts for consumption of non-green product or pattern. This is an important hindrance in implementation of green consumerism after all the hard work and contribution by different elements involved. This gives an indication that there is some lacuna in the value system of the consumer & industrialists. The value system is very important for ensuring implementation of all strategies of sustainable growth. There is a need to cultivate and inculcate the environmental values and ethics among upcoming generation to ensure sustainable growth.

It is an established fact that the childhood is a learning stage in our life. If we want, our generations to follow the road towards sustainable growth; we need to give an early start, i.e. at the school levels. Then only it will load like a firmware on the mind of young people. Else, it will be like a volatile memory that they are going to forget when it comes the matter of their personal interest or for petty benefits. For example, in western countries, it is taught in schools to stop at red light; the child always follows this rule even in case of emergency they stop at red light. However, compared to this in countries like ours, we see many people crossing red lights depending upon if traffic police is seeing or not; child learns accordingly. Similarly, this rule applies in consumption pattern & values and ethics towards environment; we need to cultivate in young minds, then only the software of mind consisting of values and love for environment will load like firmware.

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Bitcoin: An Innovative Substitute of Financial Institutions

V. J. Rai
University School of Business Management
Desh Bhagat University
Mandi Gobindgarh, India.
profvjrai@gmail.com

Satinder Shah Singh
Gulzar School of Management
Gulzar Group of Institutes
Khanna, India.
write2satinder@gmail.com

Abstract: Bitcoin is a unique innovation of transferring money to long distances, across the nations and borders with no intervention of any financial institution and remaining relevant to the running economies. This is a peer-to-peer system of transferring cash electronically and allows online payments to be sent directly from one party to another without going through any financial institution. Its cryptographic system on which it is being designed makes it unique which is used to control its creation and transfer. In digital currencies the issue of double-spending is common in practice but its mechanism prevents this issue through its blockchain, a process runs by computational solution of a hard problem of every previously agreed upon transaction. The uniqueness in its system is making it a very strong substitute of financial institutions to bypass them as they can't avoid transaction cost. It is also becoming an investment substitute for gold because of continuous rise in its valuation. And also becoming a substitute to the currencies even as they have an inseparable association of inflation with them. This handy paper will shed light on every aspect of Bitcoin.

Keywords: Bitcoin; Cryptocurrency; Digital Currency; Macroeconomics; World Economy

I. INTRODUCTION

Bitcoin is a peer-to-peer online cash transferring system in which one party can send money to a far distant sitting another party or to a next door party without going through any financial institution. This system is supported by networking and cryptography, developed by Satoshi Nakamoto, a pseudonym for an unknown person or group of people who introduced it on 3rd January, 2009. It is a digital, decentralized and partially anonymous currency. It is not backed by any government around the globe or any other legal entity. This digital currency also named and referred as virtual currency and cryptocurrency alternatively as cryptography is used to control its creation and transfer. Conventionally, the capitalized word "Bitcoin" refers to the technology and network, whereas lower case "bitcoin" refers to the digital currency.

Bitcoins are used as form of payment because one can use bitcoin to pay for things. One can also transfer cash among people across the nations, without worrying about exchange rates or currency conversion fee. It is also being taken as a stock because of the finiteness of the total number of bitcoins in the universe. The value of bitcoins fluctuates as it is based on the law of demand and supply. The more people that want to use bitcoins, the higher their value. The value of bitcoin is increasing everyday as the supply of bitcoin is limited as its finiteness in the universe.

II. The Mechanism

Bitcoins are created and transferred through a process called mining, in which computer network comes into the picture and users who contribute their computing power to verify and record the payments into a public ledger called blockchain. And in exchange of this computing service to make transaction happen user ask for a tra\nsaction fee or a newly minted bitcoins. In this users send and receive bitcoins by using wallet software installed on their computer or by the app installed on their mobile phone device. Bitcoins can be earned by mining process or in exchange for products, services, or currencies. To understand it clearly we have divided it into three parts: Transaction

Generation of new coin

Authenticity & Reliability

A.   Transaction**:** Users who run this Bitcoin peer-to-peer application are provided with a unique Bitcoin address. The ownership cum possession of bitcoin is swayed by using pairs of digital keys. One key in each pair is the public key which identifies the owner of a particular bitcoin. Each owner transfers the coin to the next by digitally signing a hash of the previous transactions and the public key of the next owner. Acquired bitcoins can then be stored on an individual's computer or on mobile phone device in an encrypted "digital wallet".
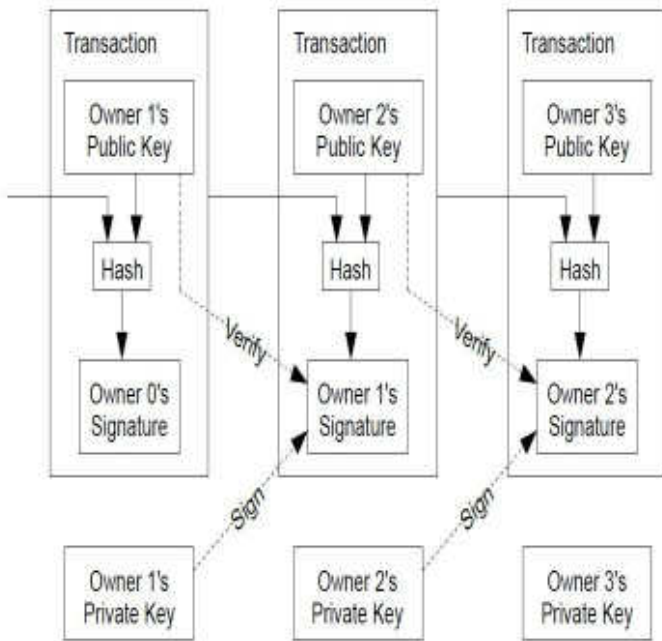
Figure 1: A flow chart diagram showing the transaction process of bitcoin. Source: https://bitcoin.org/bitcoin.pdf

Bitcoin addresses embody no personal information of the users to it, and are sort of anonymous. However, a user can be tracked through transaction history as it is embed into the blockchain, which is public to all users. Blockchain contains every transaction recorded in it which occurred in the Bitcoin's till date history and keeps on getting registered as and when it occurs. The wallet addresses are the strings of random alpha-numeric around 34 characters in length.

```
{"hash":"00000000000000f38...",
 "prev_block":"00000000000000c6d...",
 "time":1354114900,
 "difficulty":436527338,
 "nonce":282240624,
 "tx":[
   {"hash":"5ca...",
    "in":[
      {"prev_out":
        {"hash":"000...",},
      }
    ],
    "out":[
      {"value":"50.53620000",
       "scriptPubKey":"27a1..."
      }
    ]
   },
   ...
 ]
}
```

Figure 2: A schematic block in blockchain, represented as JSON (JavaScript Object Notion). Source: http://www.cs.princeton.edu/~kroll/papers/weis13-bitcoin.pdf

B. Generation of new coin: The bitcoin protocol requires that each and every transaction must be broadcasted to all the users of this network. Any of the users can use these broadcasts to maintain a ledger [an understanding synonym to blockchain] record of all bitcoin transactions and share his/her copy of ledger with other users on demand. However, the bitcoin protocol also requires that every new transaction/s added to the ledger must be escorted by a solution to hard computational

problems. The ledger then come into the form of a chain of transaction blocks in which each block is embodying a reference to the every immediate previous block. And this chain is known as blockchain. In return of registering every new successive block/s of transaction/s to the ledger after solving the associated problem with it a ledger keeper is deserved to claim a certain amount of newly created bitcoin/s as a reward. To encourage users to pay this computational cost, the process is incentivized by newly generated bitcoins and/or transaction fee, and so. This whole process is known as mining.

C. Authenticity & Reliability: The very obvious question comes into picture here is that according to bitcoin protocol any user can maintain a ledger and register transaction and can create a new block to acquire a newly minted bitcoin as reward, then every user will be doing so to have such reward and in such state n number of blockchains will co-exist along with a question onto which blockchain should trust upon? Then what will be the authenticity and reliability left for this system?
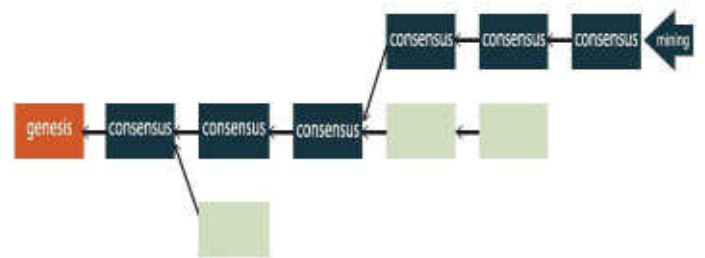
Figure3: An example abstract blockchain. The genesis block is on the left. Mining occurs on the longest branch of the branching tree. Other branches with invalid blocks are ignored. Source: http://www.cs.princeton.edu/~kroll/papers/weis13-bitcoin.pdf

This will be sorted out by the following rule: each ledger keeper keeps asking the other user he/she communicates with for their versions of the ledger. From among his/her own version and the other entire versions received, he/she only trusts the version with longest chain of the blocks without any invalid blocks in it which possess and build no consensus (figure 3).

The ledger keepers cum participants of this peer-to-peer network form a collective consensus regarding the validity of the recent or happening transaction by appending it to the public history of previously agreed-upon transactions and after the consensus a new block containing transaction and solution to the hard computational problem is added to the blockchain. The process involves the repeated computation of a cryptographic hash function.

Accepting the longest version only has some reasons and significant aspects in it which makes it authentic, reliable and valid. Firstly, it helps in building consensus among the users that on which version of the ledger to be trusted in a state where multiple versions of the ledger already co-exist in the network. Ledger keepers, also referenced as miners can claim their reward only if the version to which they have contributed remains the longest version, because only then the reward that one has claimed will becomes the part of the record and be trusted by other participants. As an inferential understanding, users who want to claim reward by exaggerating the ledger will then work on the longest version that they are aware of. If

multiple versions of the same length come into being then one or the other will soon take a lead due to the sheer chance and equal opportunity to every user and then the concentration of effort on the leading chain will further increase its lead.

Secondly, trusting the longest version prevents the issue of double-spending, a grey area in which every digital currency lose its uniqueness. The transaction of a bitcoin considers to be completed only once the transfer to another user will get recorded in a version of the ledger which is having a large enough lead over the other versions. With the digital currencies a kind of fear among the users has been associated with them that the person who paid the coin to a user might be dishonest and he/she would later pay another copy of the same coin to someone else, an issue called double-spending. But the copies of the ledgers in which the later, dishonest transaction is recorded would start with a lag as compared to the honest version as shown in the blank blocks of figure 3 that it has no previous consensus. And the other users of the network would be working to extend the longer, honest, version of the ledger. Thus the dishonest user would need to spend more computing power as comparable to the other users in order to have a reasonable chance of having his dishonest ledger overtake the honest one and becomes the accepted version. This is very unlikely as long as the total computational power being used in the network is large and well dispersed as compared to a dishonest individual. Under such self-surveillance system the recipient/s can remain tension-free about the payment which made to them that it will not overturned in the future.

III. BITCOIN VALUE & 21 MILLION CAP

The value of bitcoin is increasing by every passing day. At the end of the December 2013, as per the bitcoin website, the value of all bitcoins in the circulation was close to $14 billion (figure 4). Ever since its launch on 9th November, 2009, its value is soaring to unprecedented levels in every currency. As on April 15, 2014 its value soared to Rs 30,000 for a single bitcoin (figure 5). Bitcoins have seen a rapid rise in their dollar value in the past year; it soared to over $495/bitcoin as on 15th April, 2014 (figure6). The total market capitalization value of bitcoins stood close to $14 billion in December 2014 (figure 4).

The developer Satoshi Nakamoto has made bitcoin unique by fixing a creation cap to 21 million and made it finite in universe. However, this is not a limitation and will never be because bitcoins can be divided up to 8 decimal places (0.000 000 01 BTC) and potentially even to the smaller units if that is ever required in the future. As the average transaction size decreases, transactions can be denominated in sub-units of a bitcoin, such as millibitcoins (1 mBTC or 0.001 BTC).
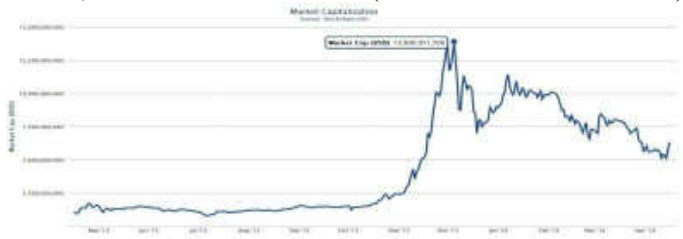
Figure 4: Market Capitalization value of bitcoins in circulation as on December, 2013. Source: blockchain.info

Figure 5: Value of 1 Bitcoin to INdian Rupee/s as on 15th April, 2014. Source: preev.com

Figure 6: Value of 1 Bitcoin to US Dollar / United States Dollar as on 15th April, 2014. **Source:** preev.com

IV. SUBSTITUTION PROSPECT

Commerce over the internet has come to rely almost exclusively on the financial institutions which are serving as trusted third parties to process electronic payments from one party to another. While the system is working well for most of the transactions it still suffers from the weakness of the anonymity of the identities of the transacting parties as both parties have to go through a third party channel called financial institution. And the cost of making and receiving payments increases as both the parties have to pay fee for having their service.

A. Bypassing third party: The unique mechanism of bitcoin to make and receive payments, to and from far distant sitting other party or to and from a next door party without going through any financial institution by remaining anonymous yet relevant to running economy makes it a substitute to the financial institutions who works as a medium among the two online transacting parties to handle their payment processes since long. This electronic payment system is based on the cryptographic proof system instead of trust, and allows any two willing parties to transact among each other without the need of a trusted third party. The system helps in saving the money of the people which used to go off as fee to the third parties to avail their services. And this way it bypasses the third party yet remaining relevant to the economies.

B. Investment substitute to Gold: It acts as an alternative to the gold for the purpose of investment as its rise in value by every passing day. And it has no exchequer on import bill even.

C. Currency Substitute: The high cost of physically securing, transferring the cash and verifying its genuineness make this mode impractical for high-value or for long distance transactions. The alternative left for both the parties is to hold the cash with third party such as bank to make payments. However, bitcoin is already working as a substitute to the third

parties and gaining popularity because of its innovative feature of bypassing third party and saving transaction fee amount.

Meanwhile, the inflationary impact of the currencies decreases their respective values by every passing day and the currencies lose its purchasing power by some percent every year. This is an inseparable feature of every currency running into the economy.

But bitcoin couples the benefits of anonymous payments of cash on one side which is based on secure cryptographic system. At the same time bitcoins can be transferred at a meagre cost as compared to the holding cost of physical currency and its ever increasing value curbs the inflationary impact on the currency on the other side because of its finiteness of 21 million bitcoins into the universe. And hence it becomes a very strong substitute to the currency also.

V.   FAVOURABLE ASPECTS

Bitcoin is a currency no like others. In a nutshell this is digital money which solves many of the problems of our current currencies.

A.   Negligible inflation risk: The biggest problem with the current currencies used around the globe is their inflationary impact associated with them which keeps on depreciating its value. Over a period every currency loses its purchasing power at a rate of few percents every year, mainly because governments keep on printing more money. This is basically a kind of tax imposed on one's accumulated wealth. With bitcoin one won't be facing such kind of issue because the system is designed to make bitcoins finite in number. Only 21 million bitcoins will ever be generated (mined). The generation process of every new bitcoin will be slowing down as the complexity of solving the problem is associated with it but its value keeps on increasing as demand of this is increasing and supply is limited.

B. Negligible bankruptcy risk: Already running currencies associated with their respective central authorities, depend on governments which fail occasionally. Such episodes either cause hyperinflation or a complete bankrupt state, which potentially can wipe out lifetime savings of the natives of the countries in a single day. As bitcoin is not regulated by any government there is no such collapse risk associated with it. It's a virtual global currency.

C. Safe, simple and economical: The headache with the traditional online transactions from both the seller and buyer's perspective is that the complications and insecurity associated that system though escrow mechanism is also being used but still it makes things complicated and slow. But with bitcoins buyers cannot demand the money back and sellers can safely ship the product or perform the service that client has purchased. The payment infrastructure between the accounts is comparatively simpler, safer and economical from both the seller and as well as the buyer's point of view as it is a peer-to-peer rather than done through intermediary and it helps in saving the transaction fee.

D.   Flexibility & Portability: One can carry a billion dollar worth of bitcoins on a memory card in his/her pocket and can travel across the nations. But one can't do that with cash or even with the gold.

E. Investment substitute to niche metal: Its continuous rising value has made it an exact fit-in alternative to the gold for the purpose of investment. This will bring the reduction in the demand of gold, which in turn will bring down imports and improve the balance of payments situation in the Indian context.

F. Bitcoins cannot be robbed: Nobody can steal one's bitcoins until and unless one has a physical access to a user's computer or mobile device to transfer the bitcoins to his/her account. Unlike the traditional currency system, where only a few authentication details are required to gain the access to one's finances, this system requires physical access, which makes it much harder to steal.

G.   Tax relaxation: As it is peer-to-peer cash transfer system there is no way left for third parties to intervene into the transactions of Bitcoins, and therefore, no viable way left with them to impose tax.

H. Intractability: One should not be afraid of any organization of being able to track the source of one's funds because of its anonymity feature. But this is a risk also.

VI. EYEBROW RAISING CONCERNS

The countries do have issues with bitcoins that bad things can be financed through anonymous transactions.

A. Intractability: The anonymity of transferring cash among the parties using bitcoins also invites crime. This feature empowers the bitcoin users to buy and sell drugs and other illegal items with a meagre risk of being tracked by authorities. And they can do this as they are empowered by the system by default. Bitcoin in this context resembles to cash which is used by criminals. But the transfer of bitcoins from one party to another can be tracked as the bitcoin protocol requires that each and every transaction has to be publically broadcasted to all the users of this network.

B.   Lack of expanded recognition: The lobby of bitcoin acceptors is still very small in count around the globe and this makes it unfeasible to completely rely on bitcoins as currency.

C.   Wallets can be lost: Banks reimburse one's balance if one's money got robbed away from banks. But there is no mechanism to recover stolen or lost bitcoins. Once one loses it he/she lost it. However, the bitcoin network supported by cryptographic proof based real-time mechanism doesn't show such concerns of losing the virtual currency, though technical drawbacks can affect the stored bitcoins. A mischievous mind can hacks into one's wallet where one uses to store his/her bitcoins by having a physical or online access, and it can be lost. But there's a way out also by storing on a disk simultaneously disconnected from internet. And even if the hard drive crashes one again have a solution. He/she can simultaneously store it on his/her backup drive/s. The coin will never go orphan.

D. No physical form: Since bitcoins do not have physical form, it would always have to be converted to currencies. Cards with bitcoin wallet information stored in them have been proposed, but there is no consensus on a particular system because it has

no central authority and countries are still in an anarchy state to provide legality to bitcoin.

VII. REGULATION / GOVERNANCE & INDIAN STORY

Bitcoins have the characteristics resembles to cash. These are anonymous in nature as in the case of cash.

Bitcoin users never want it to be regulated as it avoids tax because of no central authority backing it. It will lose its sheen the moment any tax imposed on it after getting tied into a regulatory knot as it costs about only a few cents to transfer $100,000 across the border from India with Bitcoin system as compared to some hundreds of dollars through a financial institution."

It's been roughly estimated of having 30,000 Bitcoins in circulation in India, with the support of some commercial establishments who use to accept payment in bitcoins. These include shops, restaurants, bars, salons and other establishments. However, bitcoin operators and exchanges had to suspend operations under the instructions of Enforcement Directorate as reported by many newspapers and also on their respective web pages. Still Bitcoin payment for online services is gaining momentum and some of the operators have resumed their bitcoin functions, in a hope that lobbying by organized groups will legitimize the trading in bitcoin as the number of transactions in Bitcoin (globally) per day has increased from 55,211 transactions in May 2013 (figure7) to 75,043 per day in April 2014 (figure 8).

Figure 7: Bitcoin transactions per day as on May, 2013. **Source:** blockchain.info
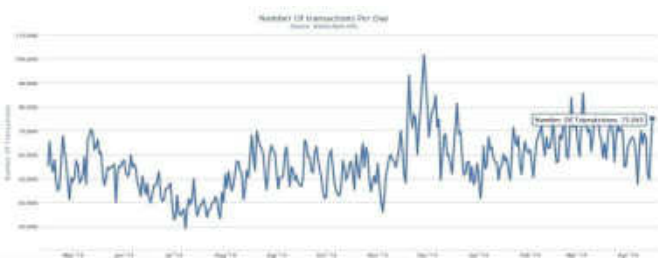
Figure 8: Bitcoin transactions per day as on April, 2014. **Source:** blockchain.info.

In India, there is still confusion about the legality status of Bitcoin. The central bank of India i.e. Reserve Bank of India had issued a cautionary notice warning to customers about the potential financial, operational, and legal, customer protection and security related risks of buying and trading in digital currencies.

As bitcoin bypasses the central bank of India, it raises the questions about how VAT and other taxes will be imposed during transaction, how it will adhere to FEMA (Foreign Exchange Management Act) regulations and other laws relating to import-export trade across borders? It remains worth examining that how government reacts to the popularity of a parallel system!

In the meantime, a Bengaluru based community of entrepreneurs i.e. Bitcoins Alliance of India (BAI), keeps on meeting to organize themselves and building strategies to lobby for the acceptance and use of Bitcoin in the India as they desperately want the government to legalize trading in Bitcoin in India. And for the purpose of the same they do have appointed the services of Nishith Desai Associates, a team of international Legal Tax Counselors, to work out on the feasibility of bitcoins in India. As per their website note cum press release, BAI says: "Our Bitcoins Practice Group examined the issue from techno-legal perspective and found that Bitcoins per se are not illegal in India. This is in consonance with international approach. US consider Bitcoins as legitimate payment alternative. US Senate Home Land Security and Government Affairs Committee and the Senate Banking Committee consider that virtual currency has legitimate uses."

VIII. CONCLUSION

The basic and main issue with the conventional currency is their invitation to the taxes, inflationary impact and securing/holding cost on them. But bitcoins are free from such defects by default.

Though bitcoins do have some concerns but all are having a solution of the same also. The biggest concern of illegal trade can also be tracked by breaking unique feature of intractability by acquiring some information and on the other side by making and maintaining a proper record of crucial & sophisticated supplies as these are physical in nature and obvious in nature to be recorded.

After looking on all the aspects we can say that its substitutional prospects have made it a parallel system to the fiat currencies. As this system avoid taxes and inflationary impact governments are unable to enjoy the privileges of taxes and kinds of fee on it. In such circumstances the users of bitcoins must have to embrace the governments, for bitcoins to get succeed.

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Venture Capitalism in India in 2013: A Comparison with Other Countries

Pallvi Rani
DAV College, Hoshiarpur
pallvidhingra06@gmail.com,

Harpeet Singh
C.T Group of Institutions, Jalandhar
harpreetsinghmahal@yahoo.co.in

Abstract: **Venture capital is defined as an activity by which investors support entrepreneurial talent with finance and business skills to exploit market opportunities and thus obtain long term capital gains. Venture capital is not a new phenomenon in the world; it is growing with a great pace. But it is still a new concept in India. Venture capital has played a major role in developing entrepreneurship in India by building up professional companies which compete globally. The Government of India in an attempt to bring the nation at par and above the developed nations has been promoting venture capital financing to new, innovative concepts & ideas. The emerging scenario of global competitiveness has put an immense pressure on the industrial sector to improve the quality level with minimization of cost of products by making use of latest technological skills. With too much money chasing too few deals, Indian venture capital is struggling. In this Paper, Role of Venture Capital in Indian Economy is discussed. A comparison is made of venture capital business in India with other countries. An attempt is made to seek the future prospects of venture capital industry in global scenario. A trend of venture is analyzed of venture capital investments rounds.**

Keywords: Venture capital; India; Global Scenario; Future Prospects and Other Sources of Finance.

I. CONCEPTION OF VENTURE CAPITAL

The dictionary meaning of Venture is adventure or speculation. Speculation is always risky. Capital is the money invested in a business. So venture capital is the source of finance where collected funds are invested in the risky projects and always high return is expected. Venture capital is an important source of equity for start-up companies. Venture capital can be visualized as "your ideas and our money" concept of developing business. Usually venture capital funds are invested in new enterprise. Major conventional sources of funds are Debts and Equity. But debts are provided to those who have sufficient resources to get things launched. They will cover living costs, office space rental. Venture Capital, defined as independently managed, dedicated pools of capital that focus on equity, or equity-linked investments in privately held, high-growth companies (Lerner 2009), plays a role in translating R&D activities into commercial outcomes and is therefore credited with a catalytic role in innovation (Christofidis and Debande 2001).

Venture capitalists provide funds at uncertain event like Research and development, Development of new process, technology, new product, improving the existing products. Venture capitalists also provide managerial assistance. The underlying assumption is that the entrepreneur and the venture capitalist would act together in the interest of the enterprise as "partners". Venture capitalists invest money from funds of capital provided by third-party investors. These third party investors can be individuals, or organizations (usually pension funds, university endowments and other similar investors who can make long term investments), that agree to invest a certain amount of capital into a fund for a set period of time (typically ten years).
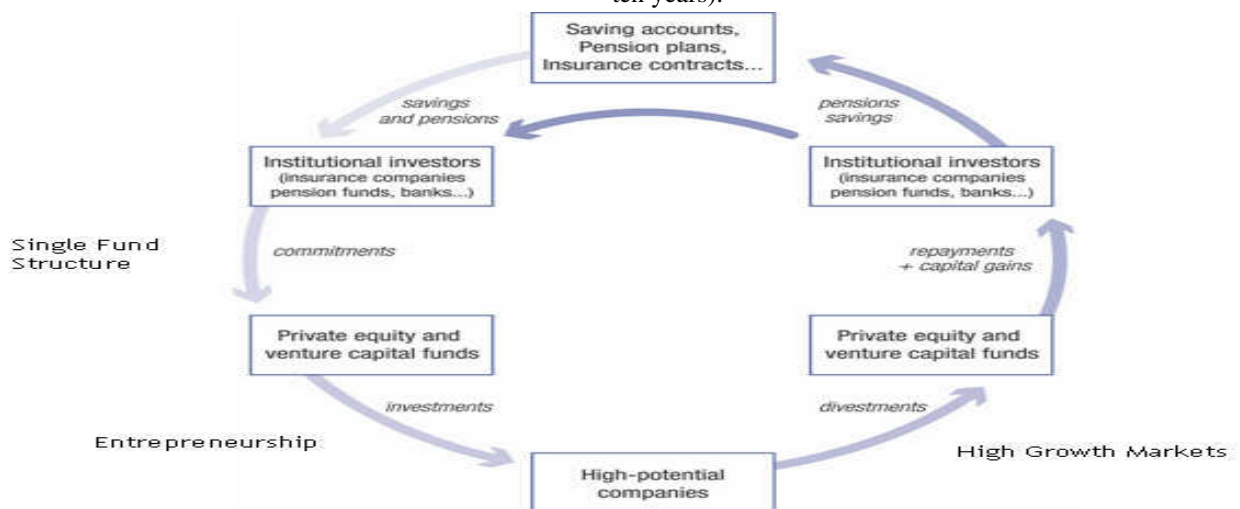
Fig .1 Investment cycle between investors, venture capital funds.

(Source: European Venture Capital Association)

II. RESEARCH METHODOLOGY

A. Objective of Study:

1) To understand the present status of venture capital industry in India in 2013.

2) To compare venture capital in India to other countries with special reference to year 2013.

3) To throw light on future prospects of venture capital industry in Global Economy.

4) To compare the other funding sources of finance with venture capital.

B. Research Design:

The research is an exploratory research. The major purpose of this research is description of the state of affairs as it exists at present.

C. Data Collection:

Secondary data is used for the study. Bulk of data will be collected from the secondary sources like various reports published by IVCA (Indian Venture Capital Association), Asian Venture Capital Journal and other institutions and agencies etc.

III. VENTURE CAPITAL INDUSTRY IN INDIA IN 2013

Venture capital is not a new phenomenon in the world; it is growing with a great pace. Venture capital industry growth rate holds steady in India. This industry is still at a nascent stage in India. Two decades ago, Indian companies were receiving low amount of venture capital. The scenario changed in late 1990s with the growth of India's IT sector companies. During five year period from 2000 to 2005, the industry growth rate in India was the fastest globally and it rose to occupy the number three slot worldwide in terms of quantum of investments.

Venture capital has played a major role in developing entrepreneurship in India by building up professional companies which compete globally. It has made smart money available for projects which cannot be funded by conventional methods like IPOs. The quality of entrepreneurs has improved considerably

Still Indian venture capital industry is far from reaching its full potential and growth is low in comparison to the other countries. As Private Equity firms invested $7.5 billion (over 384 deals) in India during the 12 months ending December 2013, representing one of the lowest levels of investment made in the last four years in both value and volume terms. According to analysis by Venture Intelligence, a research service focused on private company financials, transactions

and valuations, in 2013 private equity investment numbers, were down over

18.5% compared to the $9.2 billion (across 484 deals) invested in 2012. 154 investments worth about $2.3 billion, Information Technology and IT-Enabled Services (IT & ITES) companies topped in terms of both investment value and volume during 2013.

India's recent success story in the area of information technology has shown that there is a tremendous potential for growth of knowledge based industries. This potential is not only confined to information technology but is equally relevant in several areas such as bio-technology, pharmaceuticals and drugs, agriculture, food processing, telecommunications, services, etc. Given the inherent strength by way of its skilled and cost competitive manpower, technology, research and entrepreneurship, with proper environment and policy support, India can achieve rapid economic growth and competitive global strength in a sustainable manner.

VC activity in India was largely in line with 2012 levels in terms of deal value and volume. While the number of deals fell marginally by 2% compared to 2012, the amount invested increased by 13%. India saw revenue-generation stage investment decline to 63% of total investment in 2013, down from 82% in 2012. However investments made at a profitable during the year represented a third of total investment — more than double the proportion in 2012. This indicates both that investors continue to be cautious about the early stage, and are increasingly confident in making late – stage investments in companies as they scale. A slowdown in economic growth — to less than 5% at the end of 2013 –is, to the extent, impacting investor confidence and the impending Federal

Angel Activity funding is gathering pace in India. India's funding ecosystem is evolving at pace. As the number of people with high levels of disposable income increases, crowd funding is expected to generate more interest and angel funding is clearly becoming more established. Over the last 2 years, the percentage of angel and incubator participation in India — at 16% in 2013, up from 3% in 2011 — has been bettered in just one other hotbed: Canada, with 19% in 2013. Significantly in India the product development and revenue generation are the only two development stages that are attracting significant interest from angel investors and incubators, in contrast to other markets where the focus tends to be mainly on start-ups. The rise in angel funding has been recognized by government. It has produced new regulations that will help to lay the foundations needed to formalize this form of investment and help to ensure its future growth.

Key India VC statistics

	2010	2011	2012	2013
Invested capital (US$b)	0.9	1.5	1.6	1.8
Invested rounds	116	180	227	222
Median round size (US$m)	7.25	5.15	3.97	4.00
Number of VC-backed IPOs	6	2	2	1
Dollars raised (US$m)	532.5	46.4	19.5	10.9

Fig. 2 Key India VC statistics (Source: Dow Jones Venture Source, 2014)

IV. INVESTMENT ROUNDS INCREASE IN INDIA

- India bucked the declining global trend in VC investment activity in 2012. The number of investment rounds increased by 17% to 205, the third successive year of increasing activity.

- Total capital invested declined from US$1.7b in 2011 to US$1.4b in 2012. The figure for 2011, however, contained a few large investments with a combined value of between US$400m to US$500m, and if these are excluded, the year on-year comparison (see fig. 3) looks far healthier.

- Levels of the reported VC investment also probably understate the true level of activity because of unreported deals not captured in the data.

India VC investment 2006-12

* Number of rounds includes restart

Source: Dow Jones VentureSource, 2013

Fig.3 Year on Year Comparison for India VC Investment
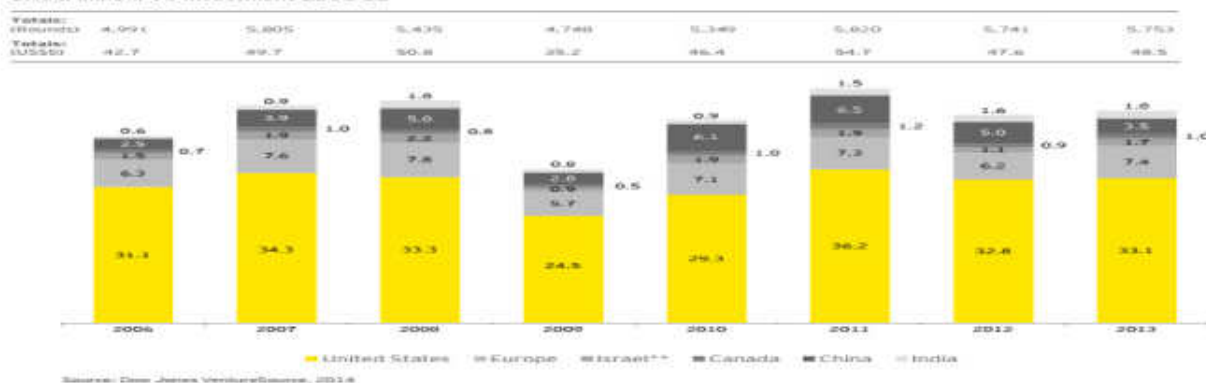
V. GLOBAL VENTURE CAPITAL INSIGHTS

2013 was a turning point for venture capital (VC) investment and proved as a solid year for the global venture capital industry (see fig. 4). As economic conditions improved in many markets, increasing levels of liquidity, coupled with strengthening investor confidence and more positive exit environment, resulted in a slight increase in the global total of VC investment compared to 2012. The US and Europe accounted for almost 85% of global VC investment, although overall market sentiment was inevitably affected by the continuing slow pace of global economic growth. The slowdown in China's GDP growth rate led to a decline in VC investment of more than 40% in both the number of deals and total value. However, recent improvements in forward looking indicators of Chinese economic activity point to a more optimistic outlook for 2013. A number of trends emerged or gained momentum in 2013. Angel investors are becoming more significant and better organized, expanding their presence at the start up stage as venture capitalists become more risk averse and shift their attention to later-stage investments. Technology has enabled new mechanisms such as crowdsourcing, which is changing the funding environment at the early seed stages. Corporate looking to fund innovation gaps or to reinvest surplus cash is pioneering new ways to collaborate with fast-growth businesses and with VCs. US economy accounts for 68% of the global venture industry. Europe accounts for only 15% of global VC activity. China, the third largest hotbed in the global VC rankings, had a poor year, in which the value of deals fell by US$1.5b, marking the lowest point for the country since 2009.

Global annual VC investment 2006-13

Fig. 4 Global Venture Capital Investment 2006-13

India, fourth in the global VC rankings, saw an increase in dollars invested in 13%, reflecting strong interest in its consumer services sector, although the number of rounds fell back slightly. Israel performed strongly with a US$0.6b rise in the value of investments- 55% up in terms of value and 18% up in terms of the number of rounds (see Fig. 5)

However, with these economies accounting for just over 7% of the global industry, such improvements, while highly significant in local terms, do little to move the

global needle. Canada, which accounts for 2% of global VC activity, also had an extremely strong year, with volumes up 23% and value up 14%. Mirroring the trends in investment, the number of total VC funds closed, as well as the dollar amounts closed, had been recovering in 2010 and 2011. In 2012, the trend reversed sharply, with the number of fund closings declining by 13% year-on-year to 280 in 2012 from 323 in 2011 and the amount closed falling from US$42.2b to US$29b, a year-on-year decline of 31%

VC investment by region 2013

Region	Invested capital (US$b)	Invested rounds	% change (amount invested)	% change (deals)	% of the global VC activity
United States	33.1	3,480	0.9%	-4.6%	68.2%
Europe	7.4	1,395	19.4%	5.7%	15.3%
Canada	1.0	176	14.4%	23.0%	2.1%
China	3.5	314	-30.0%	20.3%	7.2%
India	1.8	222	12.5%	-2.2%	3.7%
Israel**	1.7	166	54.5%	17.7%	3.5%
Total	48.5	5,753	1.9%	0.2%	100%

Source: Dow Jones VentureSource, 2014
**All-site Israeli companies

Fig. 5 VC Investment by region 2013

VI. PROSPECTS OF VENTURE CAPITAL INDUSTRY IN GLOBAL ECONOMY

- The open IPO window has created a strong tailwind for 2014, and it is hoped the improving economic picture will reverse the gradual deterioration seen in M&A exits since 2010, helping buyers and sellers to achieve better price consensus, close more deals and liberate cash for fresh investments.

- The double platform shift in information technology to smart phones and PCs to tablets, combined with the general move to mobility is expected to be an ongoing driver of investment opportunity.

- More generally, advances in mobile technology will drive significant change in sectors, ranging from health to automotive, generating further opportunities for investors who can read the changes in the landscape.

- Corporate venturing will continue to increase in importance — subjective evidence suggests a high degree of interest at every stage, from incubation through product development and profitable stages.

- The funding environment for entrepreneurs in Europe is more positive and better balanced than it has been for many years. There are more funds available from a greater variety of sources for early-stage ventures. There is a higher level of confidence to invest in later stages and more creativity in terms of geographic routes to value realization. This augurs well for fundraising and investment in 2014.

VII. COMPARISON OF VENTURE CAPITAL WITH OTHER SOURCES OF FINANCE

Venture Capital Financing is not like conventional financing (Such as equity financing and debt financing). If

a company wants to raise funds by issuing equity shares, the company is required to have already reached a certain level of activity as well as regular public reporting as per SEBI and stock exchange regulations. Moreover, such share holder might not be able to extend any managerial support to the company as they might not have such competence and expertise.

As per as loan capital is required, banks and other institutions that provide loan capital to entrepreneurs are primarily interested in safeguarding their own interest. Accordingly, their prime considerations are the security and the liquidity of their investments, which they access by examining the track record of entrepreneurs/promoters, quality of management team, cash generating capacity of the project and other such factors. The Lenders might demand guarantees, either personal or institutional. But the entrepreneurs might not be in the position to provide such guarantees. Moreover, the lenders might not be of any help to the entrepreneurs as far as management is concerned. Conventional Credit Institutions always remain passive in terms of providing managerial assistance.

The entrepreneurs are also expected to make periodic payments to the lending institutions in form of installments of the principal and interest. But this might not be possible for the entrepreneurs as cash flow to be generated by the project might not be enough to match the Loan payments.

On the other hand, a venture capitalist has different considerations while making investment decisions. Venture Capital funds mainly aim at promoting and developing new technology, new products and new entrepreneurship and management, there by getting high returns in the form of capital gains on their investments. Even if the Venture Capital firms participate in the loan

capital of a firm, it does not insist on periodic interest payments.

Venture capital loans can be secured and insecure, which gives the venture capital firm the option to subscribe to new equity shares on the terms fixed in the warrant. Venture Capital loans typically carry a higher rate of interest than bank term loans but rank below bank loans in terms of payment of interest and repayment of principal amount. The Idea behind a Venture Capital Firm is to profit if the enterprise grows accordingly, the Venture Capitalist focuses on business plans and chances of success of the project, which depend on several factors, including the quality and commitment of entrepreneur

Parameter	Sources of capital			
	Banks	Grants & Donations	Promoter equity	Venture capital
Quantum of finance	Limited - depends on credit rating and amount of equity in capital structure	Limited	Depends on the financial capacity of the promoter	Large - depends on company performance, social impact achieved and valuation
Financing need	Depends on type of finance - term loan or working capital	Project specific	Any business need	Any business need
Tenure of funding	Long term and short term	Long term and short term	Long term	Long term (6 - 8 years)
Repayment	Interest and principal to be serviced promptly	Not applicable	Own source - hence repayment has no timeline	By secondary sale of shareholding
Effect on cash outflows	Regular cash outflow to meet interest payments	Not applicable	No effect	No effect
Dilution of entrepreneur's shareholding	No equity dilution	No equity dilution	Not applicable	Equity stake to be given up by the entrepreneur
Loss of control in decision making	To a limited extent	No loss of control	No loss of control	Major decisions may have to be approved by the investor
Mentoring and business advice	Banks normally do not get involved in providing mentoring or advice	Limited	Not applicable	Investors play an active role in mentoring and advising post investment
Enhanced company visibility	Limited	Limited	High	High

VIII. CONCLUSION

The growth of India's investor community and the resulting increase in the amount of capital being invested in purely domestic opportunities provides India's VC industry with a degree of insulation from global shocks, and the outlook for the coming year is therefore relatively positive. Still Indian venture capital industry is far from reaching its full potential and growth is low in comparison to the other countries. India ranked fourth after US (First), Europe (Second) and China (Third) in the global VC rankings of year 2013 with an increase in dollars invested in 13%, reflecting strong interest in its consumer services sector.

Angel Activity funding is gathering pace in India. India's funding ecosystem is evolving at pace. As the number of people with high levels of disposable income increases, crowd funding is expected to generate more interest and angel funding is clearly becoming more established. Over the last 2 years, the percentage of angel and incubator participation in India — at 16% in 2013, up from 3% in 2011. Significantly in India the product development and revenue generation are the only two development stages that are attracting significant interest from angel investors and incubators, in contrast to other markets where the focus tends to be mainly on start-ups.

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Role and Implication of Information Technology in Tourism Business

Rohit Sarin
Dept. of Hotel Mangement
CTIHM,Shahpur,Jalandhar,Punjab,India
Principal.ctihm@ctgroup.in

Rohit Sharma
Dept. of Hotel Mangement
CTIHM & CT,Maqsudan,Jalandhar,Punjab,India
rohitrith@yahoo.co.in

Abstract-Information and communication technology continues to gain ground and become more relevant with a positive impact on the economy and business .The information technology has leap bounded in past decade specially the World Wide Web. It has changed the way how business is being done, providing better reach to markets, better management of global business, outsourcing of non-value adding services improved CRM and better inter-industry coordination.

IT relates to tourism business s in many ways and it has impacted all the sectors of tourism industry including destination management companies, hospitality or hotel industry, Travel Agencies and transport sector. Various high tech information and communication technologies are in use in the tourism sector around the world. They are used for tourism product development, marketing, distribution and training of tourism sector personnel. These technologies are so indispensable in order to find out and satisfy the ever-changing demands for tourism products.

The paper is an Endeavour to evaluate how and where information technology is utilized in tourism Industry and its various impacts on tourism business. For the purpose the secondary data on software marketed and used by industry through websites have been used.

Keywords: WWW; Intranet; TA; CRM; outsourcing

I. INTRODUCTION

The research, undertaken by Oxford Economics, shows that tourism industry directly contribution to the world GDP in gross terms US$2 trillion which is 2.8% of the world GDP, that way it is the third largest industry after oil and automobile. Considering total contribution i.e., direct, indirect and induced effect combined it stands at of US$6.3trillion that is above 9% (2011) In terms of employment generation, the importance of the sector is even more prominent. After education, Travel & Tourism is the top job creator with an average of 50 jobs after every US$1 million of expenditure.

In 2011, people employed in tourism sector directly were 98 million second only after agriculture sector. Taking total employment multiplier i.e., directs, indirect and induced effect into account, Travel & Tourism generated 255 million jobs in 2011, 1 out of 12 jobs in the world. This exceeds the jobs impact of automotive manufacturing, chemicals manufacturing and mining and is slightly less than education, communications and financial services.

As indicated tourism Industry consists of four major sectors;

1. Transport sector which includes air, water and surface transport like airlines industry, railways, car rentals, coach operators, cruise liners and ferries etc.

2. Accommodation sector which includes lodging industry like hotel, motels, resorts and all types of supplementary accommodation.

3. Intermediaries which basically perform the function of marketing and distribution of travel products like Travel agencies, Tour operators etc.

4. And lastly the destination management and marketing which is largely dominated by govt. bodies and public sector.

The use of information technology in this sector is mainly in the areas of

- Marketing and product distribution
- General business management
- Outsourcing of services and intra-industry coordination
- Marketing Research and information management.

II. ROLE OF INFORMATION TECHNOLOGY IN TRANSPORT SECTOR

Transport sector facilitates the movement of tourist and traveler from place of origin to destination region as well as intra-destination movement. An Airplane flies with the help of modern information technology equipment, which provides pertinent information to the pilot to communicate during emergency to the pilot of other airplanes and air traffic control stations. In-flight entertainment is also a product of information technology which includes video games and video films etc.

Airline industry widely use information technologies for better aircraft utilization, using IT software which allows the flight crew to take fewer steps to find the information they need which minimizes their workload in-flight. In flight catering solutions, data-base management of aircraft maintenance are some of the areas of IT based software applications.

Airlines worldwide are using e-ticket, which has facilitated the direct sales of airlines seats and also saving on ticket printing costs. Airlines are also experimenting with e-check-in through mobile phones.

For the buses/coaches and taxis, in many developed countries, they are equipped with radio communication systems for various uses. For example, the driver or the tour guide updates the Tour Company headquarters about the progress of the tour throughout the touring period. This communication ensures the safety of tourists. Fast and easy information flow is of paramount importance to build confidence in the traveling public. In recent years, the confidence built due to the use of modern IT has been demonstrated by a tremendous increase in the number of travelers worldwide.

Table I. Different Airlines Software's and its Applications

III. INFORMATION TECHNOLOGY AND

Name of the software and company	Companies employing the software	Application area of software
AbOvo, AbOvo rail,	European rail industry, Qantas, carrot airlines	Planning and Scheduling of flights &ground services at airports and for maintenance of aircraft.
Ad-Opt Technologies Inc.	Altitude, Mercury, Shift Logic	Crew planning
AIMS – Airline Information Management System	Global airlines, SAS, American airlines	Operations Control Including Aircraft Scheduling, Maintenance Planning, assignment and Flight Watch/Operations Control
Aerocaterers	Major European airlines	In-flight catering solutions
Afoofa	Various airlines	Airline CRS, Airline B2B Corporate Travel Solution, Airline B2C Internet Booking Engine, Airline Fares Management & Distribution Services, Airline Private Fare Data Base, Flight Switch - FAPIX
Airline Software Inc.	Singapore airlines, Malaysian Airlines	Spectrum - Aircraft Maintenance & Engineering, Flight Operations, Passenger Reservations & DCS, Passenger Revenue Accounting
Air Software Ltd., velocity	Major airlines of the world	aircraft performance analysis

HOSPITALITY SECTOR

In the accommodation sector also the contribution of IT is prominent. The tourism and hospitality industries have widely adopted information technology (IT) to reduce costs, enhance operational efficiency, and most importantly to improve service quality and customer experience

Not only has the use of CRS/GDS provided better sales and distribution of hotel properties. The websites provide e-brochures which help in tangibilizing the hotel services and provide customer opportunity to gather idea about the product at the same time customizing the services by pointing to individual preferences.

Use of PMS (property Management system) and intranet based software help to achieve better coordination between front office and other departments such as reservation, housekeeping etc. It has tremendously streamlined the work of billing and accounting as it is connect to all POS (point of Sales).

Use of information technology has helped to manage the reservation and sales of large hotel chains. It also provides data about the sales pattern which helps in designing effective yield management and marketing programmes thus optimizing the revenue.

Traveler after the trip often shares their experience online on various review sites such as placesonline.com or Holiday check. and blogs are popular digital platforms for travelers to express their feelings and to rate their experience. This provides information to hotel industry for improving the customer experience and at the same time is an important mode of word-of-mouth publicity.
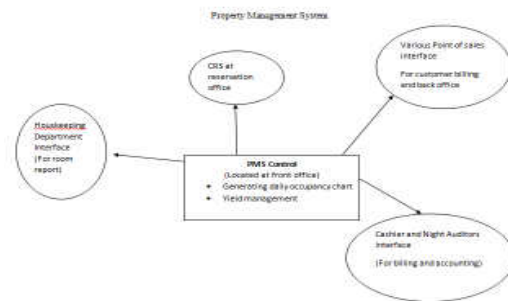
Fig 2.Property Management System

IV. APPLICATION OF INFORMATION TECHNOLOGY IN TRAVEL TRADE

Travel trade which consists of intermediaries such as Travel Agents and Tour Operators play an important role distribution of travel products. The most important application of IT in travel trade is GDS. GDSs are systems, which distribute reservation, and information services to sales outlets around the world. Unlike the CRSs used solely by an airline or hotel chain, GDS distribute

more than one CRS to users who are usually travel agents. Some leading GDS are Amadeus, Galileo, Sabre and World Span.This world leading GDSs are switches or simply computers that are connected on the one side to many different supplier systems and on the other side to many end users. The end users of GDS consist of travel agents with a reservation terminal to sell the airline seats and related travel products such as hotel rooms and car hire besides GDS also provides relevant information for itinerary planning weather forecast etc. The use of B.S.P has helped to streamline the account settlement between airlines and travel agent. BSP is a system designed to facilitate and simplify the selling, reporting and remitting procedures between airlines and Accredited Passenger Sales Agents, as well as improve financial control and cash flow for BSP Airlines. Use of GPS based mobile based software's has helped the tour operators to track and control the tourist group movement especially in formidable areas thus improving the security concern.

V. TREND IN ONLINE TRAVEL AGENCIES IN INDIA

According to A com Score study conducted in year2011 it was found that OTAs reach 45% visitors to travel sites. The same study report revealed that the number of visitors to travel sites has increased by 32% in the past year to 18.5 million visitors.

Indian Railways is the on the first position with 8.4 million visitors, an increase of 8% from the last year. Online travel agent secured the remainder of the four top spots in the category. Make My Trip reached nearly 3.9 million visitors (up 63%) followed by Yatra Online with 3.5 million visitors (up 82%) and ClearTrip.com with more than 2.1 million visitors (up80%). US-based Expedia Inc. secured the 5th position with 1.8 million visitors (up 12%).

Table I. GDS in Travel Industry

Name of GDS	Market share	Used by Airlines	Used by OTHERS
ABACUS	28%	ALL NIPPON AIRWAYS, CHINA AIRLINES, MALYSIAN AIRLINES ETC.	OVER 80 THOUSAND HOTELS ONLINE TRAVEL AGENCIES
AMADEUS	18%	AIR FRANCE, LUFTHANSA	90,000TRAVEL AGENCIES AND 144 AIRLINES
SABRE	21%	AMERICAN AIRLINES , AEROFLOAT	Schedules for 400 airlines 88,000 hotels 50 rail carriers 180 tour operators 13 cruise lines
Travelport GDS Includes Apollo, Galileo and Worldspan	38%	UNITED AIRLINES , KLM , BRITISH AIRWAYS	OVER 392 AIRLINES OTA, 60,000 HOTELS

VI. IT AND DESTINATION MANAGEMENT AND MARKETING

IT is now widely used in destination marketing; websites are used by state and national tourism promotion bodies which provide pictures and virtual tour of destination besides pertinent information about the destination. Geographic Information Systems (GIS) is now recognized widely as a valuable tool for managing, analyzing, and displaying large volumes of diverse data pertinent to many local and regional planning activities. Due to the complex nature of tourism planning issues, the potential of GIS in resolving these issues is increasingly acknowledged. GIS helps in Tourism Resource Inventories, Map production Identify most suitable locations for development, Measure tourism impacts, analyze relationship between resources etc.

VII. CONSUMER SURVEY REPORT

A questionnaire was designed to know the utilization of travel websites for tourism services booking and for travel planning. A total of 100 questionnaires were distributed out of which 87 responded. 3 questionnaires filled were invalid. So a response of 84 questionnaires was taken for data analysis.

A.   The main findings are:

43% of travelers do not use websites for travel planning and reservation purpose, they rely on travel agents and consultants for the same. They had high risk perception of online transactions. Out of the rest 57%, 26% used travel websites for the purpose of information gathering only. Rest 31% used Websites for service reservation purposes. Out of these 31% majority (89%) book hotels, 39% for booking airline tickets and 40% for package tours. The 57% percent who used travel portals/ websites reported: high satisfaction rate (72%) average satisfaction (11%) while 17% were dissatisfied.
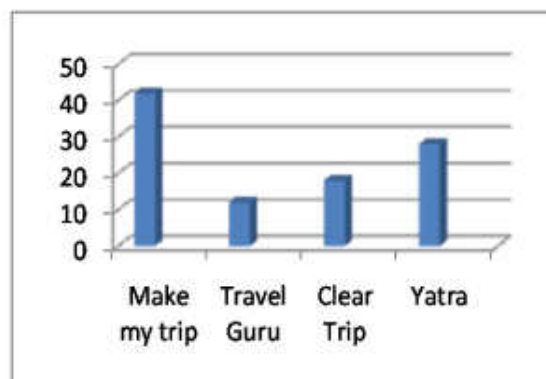
Fig 1.Preference on OTA in travelers of Doaba Region

VIII.   IMPLICATIONS OF IT

While the use of IT based application has automated the business processes, providing better reach, control and efficiency to business processes in tourism sector, it has created challenges for the industry as well, by changing the rules of business. This is specifically true for Travel trade. The websites based reservation system has provided direct access to airlines seats booking to potential passengers, thus decreasing the need for traditional travel agents. IATA has already smelled the change and it has abolished the practice of paying commission to travel agents for booking and asked them to charge the service fees from customers for the same. On the other hand it has provided opportunity in form of online travel agents business. However in long run as the people will get more internets savvy, this will make century's old business of travel agents redundant. The spread of world wide websites has given consumers more power. Now they can compare the prices and negotiate directly, plan their tours on their own by using travel portals.

Another trend which is quite visible is that with information technology tourist are more educated, destinations are able to market themselves far and wide, and this is helping in creating more demand for international tourism, new destination and new forms of tourism.

IX. CONCLUSION

Information Technology is gaining momentum at rapid pace. Everyone started believing to do their task at a click of mouse. The dominance of internet usage in the travel world show amazing results. Many browse internet to choose their prefer destination to travel. The World Wide Web has become buzz word in the age of information technology. It is also estimated we will surpass China in the usage of Internet. Research reveals that 67% worldwide use internet. In nutshell we can say modern day government cannot move single steps without money at the same time tourism industry and travel world cannot move forward without information technology. The synonym of comfort is Information Technology.

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Exigent picture of HRM faced in 21ˢᵗ century

Ivreet Kapur
CTIEMT
Jalandhar (Pb.) India
Ivy10sept@yahoo.com

Sunny Gulati
CTIEMT
Jalandhar (Pb.) India
sunny_glt@yahoo.co.in

Gurpreet Singh Virk
CTIEMT
Jalandhar (Pb.) India
er.gurpreetvirk@gmail.com

Abstract-This paper delineates and attempts to denote the budding meadow of human resource management in 21ˢᵗ century in a new-fangled glimmer of optimism and the challenges being encountered. Not to embellish but in today's vastly bloodthirsty world it has progressively befall one of the most imperative functions followed in an organization. HRM was primarily subjugated by transactional exertion, such as payroll and benefits paperwork, but due to globalization, companionship consolidation, technological encroachment and auxiliary explore, HR pays supplementary nervous tension on premeditated initiatives like mergers and acquisitions, endowment management, succession planning, workforce assortment, e-commerce, multiculturalism and enclosure. This has escort to an archetype shifts in the responsibility of proficient human resources in the organizations.

Keywords: HRM (Human Resource Management); Challenges; Globalization.

I. INTRODUCTION

Human resource is an overriding magnitude for the triumph of any organization. The inventiveness of diverse categories of natives and other inhabitants obtainable to the organization can be treated as human resources. In the in attendance multifarious upbringing no business organization can stay alive and nurture without appropriate human resources. Human resource management is a fundamental but idiosyncratic part of management fretful with people at vocation and their associations within the endeavor. It seeks to bring in somebody's company into an effectual organization of the men and women who staff the venture enabling each to make his/her best involvement to its sensation, in cooperation as a limb of a functioning cluster and as a personage. It seeks to make available associations surrounded by the venture that are advantageous both to valuable toil and human contentment. Business upbringing in our country is hot-blooded. There is detonation in opportunities brought frontward by globalization. However, this is also foremost to many interventions in stipulations of reshuffle, gyrate mergers, downsizing, etc. Research has without a doubt unnerved radiance on the sensation of these interventions is profoundly reliant on running the people interconnected issues in attendance in the entire progression. This gathering ensures that the human resource strategies, policies and practices are introduced and maintained that gratify for the whole lot with reference to employment, enlargement and well creature of populace and the affiliation that exists stuck between management and labor force obtainable. A confront is an impediment which presents a given guiding principle apparatus being implemented or precincts the line of attack in which it can be implemented. Challenges also radiate from the

dedicated temperament of vigor care services stipulation, state of affairs of work together with health and wellbeing concerns, communal constraints, chauvinism and unfavorable cultures. Managers may pay no heed to and endeavor to put in the ground tribulations concerning to human resources but these will not lie quiescent for the reason that of the very temperament of the

predicament module. Perchance most prominently organizations nowadays are beneath mammoth heaviness to be enhanced, quicker and more spirited than ahead of in early ages The most momentous inclination in the escalating globalization of the cost-cutting gauge and a mounting gung ho work milieu with a finest on merchandise and overhaul eminence. Organizational and exertion blueprint issues are roughly for eternity the foremost ones that should be addressed whenever momentous revolutionize is obligatory for the reason that of varying financially viable state of affairs, new technologies, innovative opportunities, impending recompense on somber domestic tribulations. In the after everything else decade, a world-shattering revolutionize has taken consign in business management carry out athwart the world as able-bodied as in India.

II. CHALLENGES FACED IN HRM

These avant-garde changes in the business management had drawn more rapidly diagonally an assortment of challenges and contemporary issues ahead of the management to espouse newer and pioneering strategies for haulage out their habitual business. Several of these issues and challenges are as follows:

A.   Globalization: This expression is not up-to-the-minute, as in this day and age it is supplementary brisk and omnipresent. It has brought in the tribulations concerning of amplified big business antagonism, augmented vagueness, fractious edifying issues, compensation issues (multi-currency, monies), etc. to vanguard. This influences the quantity and kinds of occupation that are accessible and requires organizations to steadiness a convoluted set of issues allied to administration populace in diverse geographic cultures, legal surroundings and business state of affairs.

B.   Workforce Assortment: The labor force is flattering progressively more assorted i.e. worldwide workplace and organizations are doing additional to concentrate on employee concerns and to capitalize on the reimbursement of diverse kinds of workforce. This is chiefly factual for multinational companies who have operations on inclusive scale and utilize natives of

poles apart countries, principled and enlightening backgrounds. The globe is sprouting into an acquaintance based economy where novelty is fetching centre juncture. In many ways, the efficacy of administrative center multiplicity management is reliant on the dexterous harmonizing act of the human resource managers.

C.   Hi-tech upbeat gradations: Highly developed know-how has tended to trim down the numeral of jobs that oblige petite dexterity and to augment the numeral of jobs that entail sizeable handiness, reallocate, poignant from toil to acquaintance toil. There is a exigent chore of adapting agency to brisk hi-tech changes with persuade the scenery of vocation and engender obsolescence. There is a colossal challenge to convey in

information technology and other expertise reception at all levels in organizations. Technological shifts and internet growth of in sequence know-how are creating more implicit human resources.

D.   E-Commerce: Electronic commerce capital to clutch out all the day to day functions of the organizations concerning to human as a resource all the way through the middling of internet or supplementary web technologies. This has brought a immense revolutionize in customer's outlook about their expediency, alacrity, value, eminence and services. Nowadays HR managers strive their unsurpassed to engage and enlarge human resources who have that knack to magnetize, trigger off, keep hold of and to dole out their ceiling patrons as promising. The populaces who formulate on-line businesses in the course of internet are painstaking more clued-up managers.

E.   Opinionated and Legal factors: The management cannot deal with the workforce unilaterally as it worn to do because it has to put up with by the convention and set of laws obligatory by the government from time to instance. The materialization of troubles on the industrialized obverse in the form of trade blending whereabouts, collapse of many employers to covenant moderately with workers, etc. strained the government to intercede in the HRM and to ratify various pieces of labor legislation. The chief defy or the conscientiousness of the human resource manager is to be hopeful of the changes and put in order association to facade those devoid of any go kaput in its customary execution.

F.   Societal Factors: Personnel managers have from the time when elongated realized the magnitude of haulage out their business in a communally germane and conscientious comportment. A business after all operates and being conceded out by the blessing of the widespread community to accomplish the requirements of the intact civilization. As firms do not maneuver in seclusion as if the claims ended by the manufacturers do not situate the assessment or the prospect of the inhabitants is not met, the providence of the business is robotically potted. Social impacts on the business encompass to be vigilantly evaluated prior to commission any stroke

programmed thus it becomes very exigent for the personnel manager to admittance the reactions prior to dispense and arrive out with confident upbeat ladder.

G.   Succession planning: It is a progression whereby an organization ensures that employees are recruited and urbanized to plug apiece means position surrounded by the perspectives of the companionship. Effectual, down to business succession planning foliage your organization well geared up for extension, the trouncing of a key member of staff, stodgy a new, desired job, employee promotions and organizational spruce up for opportunities as triumphant succession planning leads to bench vigor in the organization. Succession planning proves to be an enormously authoritative contrivance in rousing and retaining zenith leadership.

H.   Competency Mapping: This is a progression of indentifying the competencies mandatory to execute fruitfully a prearranged set down of errands or job at a agreed summit of instance. It breaks the given position or farm duties into its essential tasks or tricks and indentifies the competencies i.e. methodological, executive, behavioral, conceptual acquaintance, attitudes, skills, etc. It commonly examines two areas i.e. poignant acumen or poignant quotient, and strengths of the individuals in areas like configuration, headship and pronouncement building. Outsized organizations normally utilize some of the competency mapping techniques to comprehend how to successfully occupy the strengths and weaknesses of the workers.

III. CONCLUSION

As all the way through the middling of this dissertation the researchers have tried their paramount to lay down the overriding issues and challenges being faced by the HR managers of all the organizations. The HR purpose of 21st century India has completed a alteration from being in the wake of the scenes shore up attachment to flattering the decisive differentiator in industry. This has lead to companies customarily by means of their pioneering human resource techniques as their inimitable promotion intention to maintain up with the epoch in the arouse of a hastily altering toil landscape. All these issues and challenges discussed can be in use be bothered of by the HR managers as when they will vocation with HR practices i.e. unyielding enrollment & assortment strategy, empowerment, job spruce up, heartening workforce miscellany, nurturing ground-breaking thoughts, appropriate entrustment of clout and conscientiousness, etc into stroke proficiently. At the closing stages if the human resource manager's exertion ardently by observance all the practices in psyche, bloodthirsty recompense can thus be consummate, the worth of creature can be enhanced, organization effectiveness can be superior and thus the organization can prolong to endure.

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Working Of Depository System In India

K.K. Chawla
Principal CTIMS

I. INTRODUCTION.

"In the future wealth will not be held in gold, paper or plastic form but will be held in the form of magnetic dots in a computer. Alvin Toffler.

The capital market in India has undergone a radical change with the introduction of several programmatic measures for the liberalization & globalization of economy by the government. Over the last decade the Indian capital market has grown tremendously. There has been meteoric rise in the volume of the business. India has largest number of listed companies in the world today. There has been significant increase in the number of investors & population and substantial volume of trade. However this has exposed the investors to the great deal of risk of fraudulent interception of share certificates, delay in postal transit forgery of share certificate & signature on transfer deed by unscrupulous.

As a part of Capital market reform the introduction of depository system has paved the way for instituting infrastructure for eliminating the problems and risk involved in physical trading including clearing and settlement. Depository system is concerned with conversion of securities from physical to electronic form with scripless trading and quick settlement cycles. In this system transfer & ownership of securities takes place by means of electronic book entries.

Capital market will survive as long as the man has the urge to make money. In order to enhance one's wealth and return on investment, a part of investable resources have to flow to Capital Market. A lot of reforms have been introduced during the past few years in India, but retail investors need reliable intermediaries for transaction processing.

II. MEANING OF DEPOSITORY

Depository is an organization where the securities are held in electronic form.

Dictionary meaning of Depository is a place for keeping of things, which may be funds or securities.

Depository is an agency to which securities are deposited for safekeeping and dealing in them on behalf of owner. It holds electronic custody of securities & transfer of securities on settlement dates.

As per the Depository Act 1996, Depository means a Company registered under the Companies Act 1956 and Certificate of Registration has been issued under subsection 1 (A) 12 of SEBI Act 1992.

The Depository Act Define 'Depository' as an organization where securities of shareholders are held in the form of electronic accounts in the same way as bank hold money.

Depository can be compared to a bank as follows:

Bank	Depository
Functions through branches	Functions through depository participants
Allocates Account Number	Allocates Client ID numbers.
Issues Account Settlement	Issue of Statement of holdings & transactions.
Holds funds in Accounts	Holds Securities in Accounts
Transfer funds between accounts	Transfer Securities between accounts
Minimum balance required	Normally no minimum balance is required.
Charge commission on services	Charges: Account open & closing fee, Demat and Remat fee, Transfer fee, Custody charges.
Provide interest to account holder's	Provide interest through stock lending

The depository provides services to investors through its agents called Depository Participants (DPs). To avail the services of depository, the investors should open account with Depository participants.

III. DEPOSITORY SYSTEM IN INDIA

Depository system is concerned with conversion of securities from physical to electronic form, settlement of trades in electronic transfers and settlements. The government of India enacted Depository Act in Aug.1996 paving the way for setting up of depositories in India. There are two depositories working in India.

A. National Securities Depository Limited (NSDL)

It was started in February 1999 promoted by BSE, BOL, BOB, SEBI and HDFC bank.

The Depositories Act passed by Parliament in Aug.96 enables setting up of multiple depositories in the country. It is like introducing the competition between depositories to offer better services at low cost.

B. Central Depository Services Limited (CDSL)

It was started in February 1999 promoted by BSE ,BOI, BOB, SEBI & HDFC bank. Is is a public limited company under the companies act 1956

IV. OBJECTIVES OF THE STUDY

The present study will be carried out on the basis of the diversified objectives keeping in mind the depository system as a whole, depositories, depository participants, players & investors.

This study will evaluate the performance of the depository system as a whole.

V. NEED & SCOPE OF THE STUDY

From the available literature , it appears that no comprehensive study has been carried out in the recent past to evaluate the performance of the depositories and depository participants.

The focus of the study will be on retail investors, who are end users of the services.

The study will also incorporate various regulations issued by SEBI . So the scope of the study is comprehensive which expands to all players concerned in the study.

VI. RESEARCH METHODOLOGY

Both primary & secondary data have been used. Primary data from investors & depository participants has been collected .Secondary data has been obtained from the official communication of SEBI ,NSDL ,CDSL & DPs.

VII. REVIEW OF LITERATURE

Seventeen articles written by prominent authors on the various issues of the depository system has been discussed highlighting the various problems & experience of the capital market with the advent of this system as compared to the old system. Prominently Dr. Rao, P.Kallu, Sahu. M.S., Aggerwal, V.K. and Dr. Dixit .S.K., Dr. Vashisht and Tandon "s works relate to the study.

VIII. PARTICIPANTS IN THE DEPOSITORY SYSTEM

The entire depository system is called National Electronic Settlement & Transfer system NEST. All the transactions are carried out electronically and all the participants are linked to the depositories.

A. Company - The companies, which are listed with the depositories whose shares are available for trading under Demat mode.
B. Registrar of Company – Registration provides electronic connectivity between the depository & the company
C. Depository participants – They act as an interface between investors & depositories and act as a service provider for trading & settlement –Banks, financial institutions & brokers can act as DPs.
D. Clearing Members – They are the persons admitted, as members by clearing corporation these members have to open a clearing account with the DP.

E. Stock Broker – Those members who are registered & trade at stock exchange floor on behalf of the investors.
F. Clearing Corporation – These are custodians for bringing necessary funds & securities for settlement for executed trades.
G. Investors – The investors are the main beneficiaries for the services provided by the depository. They are the receiving & the giving ends & called beneficiary owners.
H. Banks – The account number of the bank is recorded for record the monetary benefits in the account.

IX. FUNCTIONS OF THE DEPOSITORIES

The main functions of the depositories are:

- Corporate Action : The depositories will track the benefit due to the clients in timely collection of right shares, bonus, dividend & redemption warrants etc.
- Book Entry Accounting: The depositories who accomplish the settlement work via computerized accounting system with the help of book entry only.
- Safe Keeping: The depositories are liable for sage storage of securities to be used as collateral to secure loan.
- Transfer & Registration: The depositories with the help of book entry do it actively.
- Funds Handling: The depositories do it by collecting funds from the issuing companies such as dividend and interest and distribution funds to the participants.

X. SERVICE PROVIDED BY NSDL & CDSL

The service provided by the depositories to the investors & depository participant's are-

A. Account Opening with depository – The investor can open the account with any number of DP'S & more than one account with the same DP. The list is available.
B. Dematerialization – It is the process by which physical certificates of the investor are converted into electronic form& credited to the investors account with his DP.T he investor has to fill Dematerialize Request Form (DRF) for his securities registered.
C. Rematerialization- It is the process by which electronic form of securities are converted into physical form. The investor who requests the DP, which forwards the request to the depository, the depository will intimate to the company who will print the certificate & dispatch to the investors.
D. Trading & Settlement – Bothe major stock exchange NSE & BSE has trading segment both in physical & DEMAT segment. After getting the order, after the transaction is over settlement is made within T+2 DAYS

XI. OBJECTIVES OF THE STUDY

A. Depository system in other countries - Depository system in the developed market like New York, London & Tokyo has not only eliminated the physical transfer of securities but also streamlined the growth in the daily share market. The full record is kept in the electronic book keeping. In USA, UK & Japan depositories are owned by commercial banks, financial institutions & brokers. The business is transacted through the brokers. The investors are to inform

their brokers about the buying and selling. In USA the trade is settled on T+1 basis.

Depository system in these countries is long back. India is working on the same pattern. The success of Indian can judged after long time.

B. Major Problems of Depository System-Some of the major problems of the nvestors' in depository system are –
1) Problem in selecting the best DP

2) Time involved in getting the shares demitted.

3) Demat business is not fully known to all investors.

4) On line trading is difficult for uneducated investors.

5) High fees is charged DP

6) Depository system is not applicable to all the companies.

7) Failed transactions are not reported by the DPs.

XII. RECOMMENDATIONS

To minimize problems faced by the investors the points need attentions so that the depository system can be made transparent.

1) The investors should be properly educated about the system.

2) The staff of the DP should be properly trained to serve the investor adequately.

3) There should be uniformity between the practices of all the DPs .

4) There should be mandatory for all he companies to get their share in Demat form.

5) Rules and regulations framed by the depository and SEBI should be strictly followed without any violation of the rules.

6) Custody fees for non-tradable securities should be abolished.

7) Electronic Clearing services should be provided to all the investors.

8) SEBI should be given more powers at par with the international security market.

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Track 5

Technical Session: 3

Corporate Social Responsibility, Education & Hospitality

Social Corporate Responsibility a Link Between Foreign Direct Investment and Development of Moderate and Extremely Poor

Mohd Imran Khan
Dept. of Mechanical Engineering
Jamia Millia Islamia,
New Delhi
imrankhan3107@outlook.com

Mohd Shuaib
Dept. of Mechanical Engineering
Jamia Millia Islamia
New Delhi

Mohd Javaid
Dept. of Mechanical Engineering
Jamia Millia Islamia
New Delhi

Abstract: **While policy makers place great importance on foreign direct investment (FDI) in advancing development in developing countries, the links between FDI, economic development, and development of moderate and extremely poor (MEP) remain tenous. We attempt to better understand these relationship by looking at the influence of FDI policy on these relationship and wants to correlate the corporate social responsibility as strategy to exploit base of pyramid market.**

Keywords-Foreign direct investment, economic development, Moderate and extremely poor, Base of pyramid.

I. INTRODUCTION

Globalization is coming together of the entire world in education, culture, and business and involves reduction of the barriers to trade and financial flows, and result in increased competition and expansion of trade. Competition bring new technology, skills, tools and techniques, and culture as foreign companies build new plants. Old machines and technology in the host country give away to new and improved machines, technology, and management practices leading to what Austrian economist Schumpeter [1] called "creative destruction". This results in mutual benefit- the foreign firms prosper as they capture new markets while at the same time generating the so called "spillover effects" for the host country. These range from local learning effects leading to manufacturing and business efficiencies to increased competition and introduction of new technology in the host countries. To achieve increased growth, market share and additional profits firms are attracted towards foreign direct investments (FDI) because many host countries offer cheaper sources of materials and labour, provide access to scarce physical resources, new technology or offer new untapped markets [2].

Globalization offers many opportunities for multinationals and also imposes many challenges to them. The ability to establish businesses worldwide via foreign direct investment (FDI) not only helps open up markets and serve these markets in a more efficient manner but may also enable firms to arrive at better focused business strategies to meet global demand. On the other hand, when firms fail to keep right business activities within their boundaries, they risk becoming "hollow corporations".

In recent years, developing countries have increasingly relied on private capital as a source of funding. Since the early 1990s, private sources of funding have made up over 75% of their external capital flows. FDI is the major contributing group to this funding, with its share going from less than 30% in the early 1990s to nearly two-thirds of the total by 1998 [3]. While there was a decrease in FDI in the first few years of the 21st century, 2004 started a new trend in accelerated growth, with 2007 having the highest level of FDI ever recorded [4]. Thus, it is important that we understand the effect FDI has on developing countries. Policy makers strongly believe that FDI is an important element of economic development in developing countries. In the final report of the 2002 United Nations-hosted conference on development, the following was stated:

Foreign direct investment contributes towards financing sustained economic growth over the long term. It is especially important for its potential to transfer knowledge and technology, create jobs, boost overall productivity, enhance competitiveness and entrepreneurship, and ultimately eradicate poverty through economic growth and development [5].

Beginning in the mid-1980s, many countries in the world started on a path to liberalize their FDI policies, and from 1993 to 2003, 94% of the 1,718 regulatory changes made by countries around the world were favourable to FDI [6]. Developing countries, in particular, have created an environment that is increasingly more amenable to foreign investors [7]. Government policy changes have made it easier for foreign investors to enter in more economic sectors and establish operations. Many restrictions on foreign equity participation and ownership have been removed. But the belief that indiscriminate entry of FDI will improve a country's economic development continues to be questioned by empirical evidence.

The conclusion reached after a vast number of empirical studies on the relationship between FDI and economic development is that we still do not understand the role of FDI in economic development. The relationships between FDI and factors that promote economic development, such as industry structure and performance [8] [9], technological spillovers [10] [11], and human capital development [12] [13], have been analysed. In nearly all relationships, the results vary widely; some studies show a positive relationship, other a negative relationship, and still other shows no relationship at all. Even with regard to the relationship between FDI and economic growth [14] [15] [16], one that, some argue, should be the most unambiguous, the results are mixed. Furthermore, studies that do show a positive correlation between FDI and GNP still

say nothing of causation [17]. Several reasons have been suggested as to why we continue to receive such mixed results. Some argue that our empirical method have been inadequate [18], which has provided an impetus in recent years for the use of more panel studies rather than the previously often used cross sectional study. While panel studies have allowed us to control for time-invariant differences and have increased our understanding of temporal relationships, but it has not eliminated the variance in results [19]. Additionally, the level of corruption can also influence the benefits that are accrued from FDI [20] [21]. Blackburn & Sarmah, [21] found that corruption is negatively associated with FDI inflow and economic development.

II. THE ROLE OF FDI IN ECONOMIC DEVELOPMENT

From a neo-classical economic perspective, FDI from developed countries is deemed an integral ingredient to the economic growth of underdeveloped countries, and economic development is best served when the state plays a limited role in controlling the market [17]. It is argued that developing countries benefit directly from FDI through an inflow of capital, tax revenues, and employment, and indirectly through spill over of the foreign investor's technology and knowledge to local enterprises and workers, and through access to foreign markets. Domestic suppliers, competitors, distributors, customers, and employees learn from their interaction with foreign investors, and their ability to compete globally is enhanced. It is also argued that entry of competitive foreign enterprises takes the competitive structure of the industry to a new levels. Local firms that survive in this increasingly competitive environment do so only by becoming more efficient and, thus, more competitive, raising the productivity of the local industry and, in turn the economic growth rate of developing country. FDI can be an important vehicle for the transfer of technology to certain local firms and for increasing the overall competitiveness of the industry, which will have a positive effect on economic growth [22].

On the other hand, FDI may crowd out local enterprises and actually be detrimental to economic development. Foreign enterprises are often significantly superior to domestic enterprises and either buy out or drive out domestic firms, leading to a concentration of power in the industry [23] [24]. The net effect is a decrease in competition and domination by foreign entities. Whether this occurs seems to depend on the level maturity of the local markets and type of sectors that FDI enters. Agosin and Mayer [23] conclude that the effects of FDI are not always positive and that FDI policy plays a role in determining the outcome. Koning's [25] cited that there may be negative spillover effect also because the technology gap was too large between host and home country of the enterprises. An additional factor that appears to influence the degree to which spillover take place is the absorptive capacity of the host. Glass and Saggi [26] believes that the larger the technology gap between the host and home country, the lesser the chance of technological transfer. This can occur for two reason: one, the host country is unable to absorb the technology due to inadequacies in human capital and physical infrastructure or, two, the multinational corporation may not

invest in the latest technology in the host country because of its perception of the lack of absorptive capacity.

Hence the empirical evidence continues to provide contradictory results. There are clear instances where FDI does contribute to economic growth, but not always. Whether FDI has a positive or a negative effects on economic growth depends on such things as the sectors it operates in, the ability of locals to participate and learn from foreign investors, and the ability and willingness of host governments to use with development in mind.

III. FDI's POLICY INFLUENCE ON INCLUSIVE GROWTH

Stiglitz [27] claims that a narrow focus on GDP growth often comes at the expense of other factors that are needed for human development, such as health and education. Ultimately, the purpose of development is to enhance the lives we lead and to provide us with the capabilities to achieve our legitimate aims in life. Stiglitz [27] argues that success in development "means sustainable, equitable, and democratic development that focuses on increasing living standards not just measured on GDP" [27]. For true development, Stiglitz [27] believes that not only are markets essential but also that government are equally important. And the role of government is to figure out what is right balance between markets and government, which is varied by country and over time. He goes on to say that potential areas for government involvement are in providing education, legal frameworks, infrastructure, a social safety net, and in regulating competition, banks, and environmental impacts [27].

IV. INTRODUCTION TO POVERTY AND VULNERABILITY AT THE BASE OF PYRAMID (BoP)

The extremely poor live on less than $1.25 per day, the moderately poor survive on less $2.00 per day, and together they constitute a market 2.6 billion people [28]. Considerable research has been undertaken on the social and economic experiences of people surviving on incomes below $1.25 or $2.00 per day [29] [30]. This research provide valuable insight into the spending habits, mind sets, and vulnerabilities of MEP and provides much needed context for assessing the ethical dimensions of targeting the poor as consumers. The vulnerable are less able to protect their own interests and are susceptible to being "swayed, moved or enticed in directions which might benefit others but which harm their interests" as a result of their unique circumstances. Individuals at the BoP are both cognitively and socially vulnerable.

The cognitive vulnerability of those living at the BoP is a feature of illiteracy or limited education. Poverty makes it difficult to attain education, even when it is provided at no cost by governments, because of the need of children to leave school to help support families, because of poor quality education, and because of the inability of illiterate or partially literate parents to support their children's education [29]. Educational opportunities are lost when young children are bartered, sold, or orphaned, as a result of the desperate poverty of their parents.

Social vulnerability is a result of poverty itself. Poor consumers spend to compensate for their penury and to feel a sense of belonging [31], drawing from Sen [32], argues "the psychological reality of the BoP is revealed in sub-normative choices, self-defeating preferences structures, and confused contradictions and preference reversals that block paths to self-improvement".

Barki and Parente [33] found that the poor have "a stronger need to compensate for a dignity deficit and low self-esteem" and "a high level of aspiration to feel socially included in society".

V. EXPLOITATION OF MEP BY MNCs

At the core of entrepreneurial activity is the exploitation of opportunities [34] [35]. BoP theorists argued that MNC managers neglect many opportunities because of "orthodoxies" in assumptions and practices [36] that lead them to neglect the BoP as a visible market. The "dominant logic" into which they have been socialized leads MNC managers to emphasize large unit packs, high margins per unit, and high volume sales [37].

To advance understanding of the ethics of BoP strategies it will useful to clarify the role of exploitation at the BoP in general and of the 2.6 billion MEP in particular.

In ordinary language usage, it is common to refer to utilization of resource as exploitation. In entrepreneurship, this use of the term is commonly employed in characterizing the identification and targeting of underutilized, previously unknown, or newly created, possibilities to create positive outcomes. In the case of BoP business ventures, the intended outcome is binary in that it is intended to be both positive for the MNC and for the customer.

Products and services marketed to the BoP may either improve the welfare of individuals or it may exacerbate the poverty of individuals. For example, affordable clean energy sources for a community may improve health and living standards. Companies such as D.Light are bringing clean energy through the sale of solar-powered LED lanterns into BoP markets in rural India [38]. However, tobacco products will typically cause a decline in welfare by harming health and diverting money from basic needs.

Consider an example of The Coca-Cola Company (TCCC) in Uganda. TCCC has developed a network of micro-distribution centres (MDC's) in African BoP markets that generate annual revenues in excess of $550 million [39]. TCCC relies on the MDC model as its main distribution channel in Uganda. Studies confirms that the MEP spend significant portions of their income on sugary products [29] [40]. However, there are at least two problems with targeting the MEP as new Coca-Cola consumers. First, there is a lack of relevant disposable income to consume the product in the first place. 17.6 million Ugandan's are MEP consumers, yielding between $1.50 and $3.50 of free monthly cash flow after accounting for expenditures on necessities such as food, housing, water and education [41]. Ugandans in this category would have to make important trade-offs in order to consume Coca-Cola. From a capabilities perspective, Coca-Cola is not in the best interest of MEP consumers in Uganda even though they are able to buy the product (Hammond et al., 2007) [41]. Second, Heller, Burt and Eklund [42] found significant association between soda consumption and dental caries among individuals over 25 in the United States, the world's richest nation. In entrepreneurship, this use of the term is commonly employed in characterizing the identification and targeting of underutilized, previously unknown, or newly created, possibilities to create positive outcomes. In the case of BoP business ventures, the intended outcome is binary in that it is intended to be both positive for the MNC and for the customer.

Harmful exploitation of MEP populations occur when MNCs take advantage of the cognitive and social vulnerabilities of the MEP in ways that violate or undermine their human rights. Such exploitation is an example of morally illegitimate MNC activity.

Morally legitimate business ventures that target the MEP should result in profitability of firm and empowerment for members of the MEP, rather than harmful exploitation.

Instrumental, or economic, corporate social responsibility holds that corporation should engage in pro-social or ethical conduct beyond what is required by law, only when doing so will improve the return on investment of the financiers of the organization[43]. Foreign companies doing business in any developing countries should empower the MEPs. Empowerment strategies takes the form of capabilities empowerment or functioning empowerment and facilitate the attainment of human rights such as subsistence and well-being, but its products or services cannot be made affordable, the venture fails as a MEP venture. In this case the company should continue to provide the services or product at the expense of their corporate social responsibility program. Also the government plays a large role in deciding how a FDI contributes to development of MEPs. Policy can favour either objectives of foreign investor to earn profit by harmfully exploiting MEPs or the objective of state to empower the MEPs by their upliftment.

VI. CONCLUISION

The effect of FDI on economic growth in developing countries is an important question and has been widely studied. While policymakers strongly believes that FDI is an important element in economic growth, past empirical studies are divided on how important FDI really is. In this paper, we suggest that while FDI may promote economic growth in developing countries, it is not a certainty. If brought in strategically, FDI can contribute to a country's development directly by providing capital and jobs, and indirectly through technology spillovers. If left to its own devices, however, FDI may increase industry concentration, drive out domestic firms, and not pass on advanced techniques and technologies to domestic investors. Foreign investors' primary interest is profit and not national development. Thus it is more likely that FDI will empower MEPs and BoP population only when FDI policy ensures that FDI aligns with and promotes development. However when a MNC engage the MEP as customers, they should support the attainment of human rights

in the goods or services that they provide at the expense of their CSR program.

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+Corporate Social Responsibility In Indian Banking Sector: An Assessment

Kritika Goel
Management
CT GROUP OF INSTITUTIONS JALANDHAR

Shveta Sharma
Management
CT GROUP OF INSTITUTIONS JALANDHAR

Abstract-At present, the world over, there is an increasing awareness about Corporate Social Responsibility (CSR). The contribution of financial institutions including banks to sustainable development is paramount, considering the crucial role they play in financing the economic and developmental activities of the world.. There is a visible trend in the financial sector of promoting environment friendly and socially responsible lending and investment practices. This paper the high lights the CSR practices in Indian banking and financial institutions and key findings of the study and a few conclusions. The main objective of this study is to analyze the CSR activities carried out by selected banks of India. An attempt has been made to analyze the existing CSR practices of Public Banks and Private Banks. It has been found that the selected banks are directly engaged in CSR activities mostly in the area of Rural Development, Education, Community Welfare, Women and Children. The analysis shows that, these banks are making efforts for the implementation of CSR, but are restricted within certain fields. There is a need for better CSR activities by the banks, which is possible by adding more and more social development issues link with corporate sector.

Key Words: CSR – Corporate Social Responsibility, Financial Institutions, Indian Banking, Public Banks, Private Banks

I. INTRODUCTION

The **World Business Council for Sustainable Development** in its publication Making Good Business Sense by Lord Holme and Richard Watts, used the following definition. Corporate Social Responsibility is the continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as of the local community and society at large.

This is the time of industrialization and commercialization of the entire service sector. All the Companies are moving forward for the profit maximization and the profit which they are gaining it is from the society so the companies must take it as obligation towards the society which is to be repaid in terms of social banking towards the benefit of society. This social Banking means to contribute for the society while conducting the work within the boundary of

ethics and that is called Corporate Social Responsibility. Corporate Social Responsibility (CSR) is the concept whereby the organisation considers the interest of society by taking the responsibility for the impact of their activities on customers employees, shareholders, communities and environment in all aspects of their operations.

II. PURPOSE OF THE STUDY

The Present study aims to evaluate the different dimensions of CSR by studying following objectives:

- To evaluate the concept of corporate social responsibility (CSR) in India.

- To know various CSR practices in selected Indian banks.

- To make comparative analysis of CSR practices of selected banks in the Indian banking industry.

- To give suggestions for enhancing the role of banks in promoting economically and socially sustainable business that will decide the direction of future growth.

III. RESEARCH METHODOLOGY

- Source of data: Secondary Data

- Type of Research Design: Exploratory

- Sampling frame: Customers, bankers and employees.

IV. REVIEW OF LITERATURE

A. NarwalMahavir (2007) *"CSR Initiatives of Indian Banking Industry"* In his study he tried to analyse the corporate social responsibility (CSR) initiatives taken by the Indian Banking Industry, which can help them to enhance their overall performance. The research is based on the survey questionnaire, administered to 33 public-private sector banks in Northern Haryana, including its capital Chandigarh, which has been analysed with the help of descriptive statistics and factor analysis. The findings of

the study suggest that banks are concentrating mainly on education, balanced growth (different strata of society), health, environmental marketing and customer satisfaction as their core CSR activities. The Indian banking industry is found to be adopting an integrated approach by combining CSR with the ultimate customer satisfaction.

B. Muniapan et al. (2008) *"Corporate Social* Responsibility: a philosophical approach from an ancient *Indian perspective"* In this study, an attempt has been made to explore the philosophy of Corporate social responsibility (CSR) from an ancient Indian perspective. In the Indian context, the origin of CSR can be traced from the Vedic literatures such as the Valmiki Ramayana, the Mahabharata (includes the Bhagavad-Gita) and the Puranas. However, in this study the authors will explore CSR philosophy from Kautilya'sArthasastra, which was also written in Sanskrit in the 4th century BC. This study is based on a qualitative research methodology which involves study, understanding and interpretation of ancient or classical text. By using the above methodology, the authors reveal some ancient lessons on CSR, which can provide guidance to corporate leaders today. In a nutshell, the Kautilya'sArthasastra provides an inside-out approach to CSR, which is development of the individual leader's self-conscience, contrary to the western approach that takes an outside-in perspective.

C. DasSudhir Chandra (2009) *"Status and direction of corporate social responsibility in Indian perspective"* In this study he tried to examine the contribution of center and state governments in social sector development and to demonstrate the strong sense of corporate social responsibility (CSR) models in an Indian perspective. The study is exploratory in character and falls under the category of "general review" aimed at gaining familiarity and achieving insights into the phenomena i.e. status and direction of CSR in India. The study concludes that the social sector remained a neglected area as, despite a rise in their revenue earnings, the states are continually in financial distress due to a more than proportionate increase in expenditure. The study also highlights the poor budgetary allocation for education, ineffective doctor-patient ratio, heavy interest payments/servicing debt and lesser governmental efforts to initiate the CSR as a most effective too

D. BhattacharyyaSekhar(2010) *"Strategic corporate social responsibility initiatives: a framework template developed from evidences from India"* In this article, the author attempts to capture the practice of SCSR in India, a developing country and an emerging economy. This article presents the state of affairs of SCSR in India based upon the reflection of CSR managers on the themes of the

nature of CSR activities, its characteristics and benefit

E. (Sharma Nishi 2011) *"CSR Practices and CSR Reporting in Indian Banking Sector"* In this study she tried to analyse the CSR initiatives taken Banking sector in India. The findings of the study is that the banking sector in India is showing interest in integrating sustainability into their business models but its CSR reporting practices are far from satisfaction. There are only few banks which report their activities on triple bottom line principles. As a matter of fact, the standards for rating CSR practices are less uniform in comparison to that for financial rating. Further, the study found that among the reporting banks also, some banks are just making false gestures in respect of their efforts for socio-environmental concerns. According to some critics companies, on socio-environmental concerns, having significant blemishes on their record riddle it and baffled real issues.

V. CSR INITIATIVES BY VARIOUS BANKS: AN ASSESSMENT

ALLAHABAD BANK	HDFC BANK
MAJOR CSR AREAS:	**MAJOR CSR AREAS:**
(a)Educational support.	(a) Educational support.
(b) Poverty eradication.	(b) Livelihoodtraining and support.
(c) Rural development.	(c)Vocational and technical education.
(d) Vocational training to unemployed.	(d) Micro financing
	KEY OBSERVATIONS:
KEY OBSERVATIONS:	The Bank has a well-knit principle on CSR and a long vision to empower thecommunity through socio-economic development of underprivileged and weaker sections of society. No separate report on CSR except a brief statement onCG report. No budget allocated for CSR spending. The banks annual report didnot mention anything on theimplementation of MoRD Guidelines for Rural Self Employment Institutes (RSETIs).
Though the Bank has its own philosophy on CSR but failed to publish any CSR report on Global Standard like GRI. Only a section is inserted on Annual report on social responsibility. The bank engaged in the	

socio-economic development, rural development and sustainable economic development of the country. It is also observed that no fixed Percentage of profit is earmarked for CSR spending. Further, the bank had implemented MoRD Guidelines for Rural Self Employment Institutes (RSETIs).	
CANARA BANK **MAJOR CSR AREAS:** (a) Rural Clinic Service (b) Rural Service Volunteer Scheme (c) Jalayoga Scheme (d) Rural Resource Development Centre. **KEY OBSERVATIONS:** The Bank framed a Social Banking Cell to fulfill the objectives of CSR which is something different from other financial institutions. CSR Report is not published separately except the articulation in Annual Report. Further, the bank had implemented MoRD Guidelines for Rural Self Employment Institutes (RSETIs). No fixed Percentage or any	**ING Vysya BANK** **MAJOR CSR AREAS:** (a) Educational support. (b) Environmental issues. (c) Financial support to vulnerable sections of society. (d) Community develop ment. (e) Adoption of Orphans **KEY OBSERVATIONS:** Banks have a long term vision on CSR. The Bank engaged in the CSR activities according to the BOD's direction. No evidence is found in Annual report about the separate CSR Report but a section is inserted on CSR. Further, the bank does not mention about the implementation MoRD Guidelines for Rural Self Employment Institutes (RSETIs). Moreover, no fixed budget is earmarked for implementation of CSR.

lump sum is earmarked for CSR spending.	
STATE BANK OF INDIA **MAJOR CSR AREAS:** a) Community Services Banking. (b) Rural Community Development. (c) Adoption of the Girl Child. (d) Research and Development on Education. **KEY OBSERVATIONS:** Having a strong philosophy on CSR, the Bank was acts as a responsible corporate Citizen. The bank is committed to nation building through Community Services Banking, apart from normal banking Operations. A separate section is given on CSR. Report on CSR on GRI standard is not yet published. Adoption of girl child is the unique activities of the bank. Another significant contribution of the bank is the funding for Research and Development on Education. The bank also involves in Micro financing and other community development activities. Bank	**SMALL INDUSTRIES DEVELOPMENT BANK OF INDIA** **MAJOR CSR AREAS:** (a) Sustainable banking. (b) Environment protection. (c) Social Commitment. (d) Stakeholder engagement. **KEY OBSERVATIONS:** SIDBI's CSR is based on our commitment and furtherance of responsible banking through both within the Bank and outside,in the MSME sector, enhancement of social welfare, capacity building of human resources of both SIDBI and the MSME sector as well as constant coordination and engagement with various stakeholders. The unique feature of the bank is that it has its own CSR policy keeping the benchmark of internationally accepted norms of Global Reporting Initiative (GRI) G3.A certain percentage of profit after tax is earmarked for spending CSR activities. The initiative for removing regional inequalities is the unique feature of the Bank including micro plus services and MSME development

spends a huge sum for the CSR activities but no fixed budget is allocated for CSR activities. Further, the bank had implemented MoRD Guidelines for Rural Self Employment Institutes (RSETIs).	
PUNJAB NATIONAL BANK **MAJOR CSR AREAS:** (a) PNB Farmer Welfare Trust (b) Farmers Training Centers (c) Model Villages (d) PNB century Rural Development Trust (e) PNB Swarozgar Vikas Santhan **KEY OBSERVATIONS:** PNB regards Corporate Social Responsibility (CSR) as an investment in society and in its own future. The aim of the bank is to create social capital. The Bank has its own report on CSR but fails to publish global standard CSR report. Moreover, no fund is earmarked for pursuing CSR activities. The thrust of the bank on CSR revolves around in sustainability, social	**BANK OF BARODA** **MAJOR CSR AREAS:** (a) Rural development. (b) Women's empowerment. (c) Vocational training. (d) Community Welfare. (e) Physically Challenged. (f) Poverty Eradication. **KEY OBSERVATIONS:** The Bank has a well-knit principle on CSR and a long vision to empower the community through socio-economic development of underprivileged and weaker sections of society. No separate report on CSR except a brief statement on CG report. Again, no fixed budget allocated for CSR spending. Establishment of large number of rural consultancy centre is the unique feature of the bank CSR policy. Another significant contribution of the Bank is the adoption of village for their all round development. The Bank has also set up Rural Development and

investment, education and health. The bank establishes two TRUST for the rural development and to foster financially inclusive growth in the economy. In addition, the Bank has laid emphasis on capacity building and training of intermediaries. The Bank has also set up Rural Development and Self Employment Training Institute (RUDSETI) as per the direction of the Ministry of Rural Development. Adoption of villages for development is the unique feature of PNB's CSR policy.	Self Employment Training Institute (RUDSETI) as per the direction of the Ministry of Rural Development.
BANK OF INDIA **MAJOR CSR AREAS:** (a) Educational support. (b) Environmental issues. (c) Financial support to vulnerable sections of society through micro financing. (d) MSME financing. (e) Dairy development. (f) Agriculture development. **KEY OBSERVATIONS:** Bank of India fails to publish report on CSR and there is no	**J&K BANK** **MAJOR CSR AREAS:** (a) Education for All Programmes. (b) Socioeconomic development of social groups. (c) Heritage preservation. (d) Environmental issues. (e) Financial support to vulnerable sections of society. (f) Promotion of tourism. (g) Community development. **KEY OBSERVATIONS:** Bank has its own philosophy on CSR. The Banks engaged in the CSR activities according to the BOD's direction. The bank engaged in the socio-economic

section on Annual Report except a statement on social banking and priority sector lending. One unique feature of the bank is that they extend 5% more on priority sector lending over and above the RBI directives during the last few years. Further, the bank does not mention about the implementation MoRD Guidelines for Rural Self Employment Institutes (RSETIs). Moreover, no fixed budget is earmarked for implementation of CSR. No separate report on CSR except a brief statement on CG report.	development, rural development and sustainable economic developme nt of the country. It is also observed that a fixed Percentage of profit is spend (i.e. 1%) on CSR. No evidence is found in Annual report about the separate CSR Report but a Section is inserted on CSR. Furt her, thebank does not mention about the implementation MoRD Guidelines for Rural Self Employment Institutes (RSETIs).

VI. MAJOR FINDINGS

- As per the instruction of the RBI, majority of its member commercial banks started new programmes on social and economic welfare of the masses, keeping parity with the guidelines.

- All most all the banks under study except Canara Bank, SBI IngVysya Bank, HDFC Bank, BOI did not follow the Govt.of India (MoRD) guidelines on setting up of RSETIs i.e. establishing of Rural Self Employment Institutes.

- It is further observed that all the banks and financial institutions under study are engaged in spending forsocio-economic development, rural development andcommunity development projects. Further, priority sectorlending, micro financing, MSME financing and project on environment excellence etc are common to all the financial and banking institutions.

- It is further observed that Adoption of Girl Child by S BI,ModelVillages by PNB, Adoption of orphans by In gVysya Bank, Retail Mobile MarketingVan for products of SHGs of Canara Bank, RishkawProjects of PNB, Heritage Preservation by J&K Bank etc are the unique feature of CSRactivities of commercial banks i n India.

- Another significant contribution of CSR activity perfo rmedby SBI and PNB are the funding for Research andDevelopment Grants to universities and academicinstitutions.

- Another feature of CSR activities which are observed from the information supplied in the annual report by the banking companies under study is the setting up of Rural Consultancy Centre.

- Bank of India declared the fact that they forwarded ov er45% of net adjusted credit towards priority sector. T heirCSR Strategy is not as unique as they still follow the earlier social banking concepts.

- The findings suggest that banks in India are increasing their activities under corporate social responsibility which is also impacting their business in the positive direction, apart from improving their image and goodwill.

VII. SUGGESTIONS

- Banks should organize specialized training programmes for employees to follow social and environmental friendly practices and include at-least one or two sessions in every training programme conducted by them regularly.

- Banks should motivate the employees to follow environmental friendly practices by giving financial as well as non-financial incentives

- Environmental and social concerns have today become major considerations for determining the viability of a project.

- Awareness of Green Banking in rural areas: As green banking is the need of an hour so it must be recommended in urban areas and localitiesetc where such projects does not reach the needy and the poor in the rural areas.

VIII. CHALLENGES

- Lack of Community Participation in CSR Activities.

- Narrow Perception towards CSR Initiatives

- Non-availability of Clear CSR Guidelines

IX. CONCLUSION

The business of 21st century will have no choice but toimplement CSR.The corporate& the Government should try to build up a relationship between the business and the society. The concept of corporate social responsibility CSR has so far failed to take deep root in India because of lack of coordination between the corporate efforts, Government and Non-Government organizational efforts. The corporate should be made aware about the changing nature of business due to globalization, transformation of market environment and deepening of competition .The CSR should not be merely a statement of intent. It should be made compulsory for the corporate operating in India. Further, appropriate authority should ensure mandatory requirement of a certain specific percentage of net profit for pursuing CSR activities every year and also needs to be instructed to publish CSR report annually as par specific format designed by the regulator.

While designing the CSR format the regulator should keep in mind the fact of CSR principles viz. care for all stakeholders, ethical functioning, respect to worker's rights and welfare, respect for human rights, respect for environment and activities for social and inclusive growth. For the Indian banking company whatever the CSR activities are happening are centered on education, rural upliftmentand helping the physically challenged. Some of the CSR initiatives, the major banking companies have undertaken are Education for all, Community development, Adoption of Children, Vocational training, Rural Development, Environment protection, Socioeconomic development of the vulnerable sections of society.

There is a need to promote a drive in banking Companies towards greater accountability on Corporate Social Responsibility (CSR). In order to attain the social objectives, there is a need for framing a CSR Policy in every banking company for prioritization of activities for social spending and allocation of separate funds for this purpose.

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Drivers of Corporate Social Responsibility Affecting Business Practices – A Theoretical Approach

Mohd Imran Khan
Dept. of Mechanical
Engineering
Jamia Millia Islamia, New
Delhi, 110025
imrankhan3107@outlook.com

Mohd Shuaib
Dept. of Mechanical
Engineering
Jamia Millia Islamia,
New Delhi, 110025

Mohd Javaid
Dept. of Mechanical Engineering
Jamia Millia Islamia, New Delhi,
110025

Abstract--Corporate social responsibility (CSR) have received much attention over the past decade owing to the significant attention given by governments and both profit and non-profit organizations to environmental, social and business practices of corporates. Corporate social responsibility has become one of the core components of corporate strategy and a crucial instrument to minimize conflicts with stakeholders. The emergence of a changing economic order has also made companies around the world to think about manufacturing and service sustainability. Realizing the importance of corporate social responsibility an attempt has been made to find out the key drivers of social corporate responsibility which promote CSR practices and the effect of CSR on business operation.

Keywords: CSR, Stakeholders, Drivers

I. INTRODUCTION

Corporate social responsibility (CSR) implies that businesses are responsible for assessing their wider impact on society [1][2][3] and regardless of specific labelling the concept has been applied to how managers should handle public policy and other social issues [4]. Accordingly, Waddock [5] opined that "…CSR is the subset of corporate responsibilities that deals with company's discretionary relationships with its societal and community stakeholders". These demands on businesses to address and responds to social concerns have become an instrumental aspect of the majority of modern business models [6]. One widely accepted guideline, advanced by Michael Porter and Mark Kramer [7], is to undertake CSR in a strategic manner by making social and environmental contributions only in ways that also enable tangible business benefits. There are various definitions of CSR, but most share the theme of engaging in economically sustainable business activities that go beyond legal requirements to protect the well-being of employees, communities and the environment.

Powerful social and political forces encourages organizations to act more responsibly. These include growing consumer demand for responsibly made products, challenges to organization's reputation by nongovernmental organizations (NGOs), industry codes of conduct, assessment and rankings of CSR performance, pressure from socially responsible investors.

II. DIVERS OF CSR

A. CSR as a global brand insurance: Global brand exist in multiple markets, including the financial services, telecom, and fast-moving consumer goods markets. Many firms, such as Unilever, have clearly started to focus more on building strong global brands than on building multiple (strong) local brands [8]. A strong corporate social responsibility (CSR) record is expected from these global brands [9]. The implementation of CSR policy may generate a trusting relationship between the company and stakeholders that causes stake holders to become committed to the organization through actions such as customer loyalty, stockholder capital investments, and supplier investment [10][11][12]. In global marketplace, a firm's social and environmental track record and its treatment of employee are considered to be very important trust issues [13].

However, it is frequently stated that global brand do not have strong CSR records, and they are accused of predatory behavior [14]. Building up CSR reputations is difficult for global brands, as global brands have to build local CSR reputations through local CSR relationship while also demonstrating global social responsibility [15]. Moreover, the CSR practices of global brands are typically perceived as being self-interested, which may reduce their effects on brand equity (BE) [16] [17]. Specific examples have shown the relevance of CSR for global brands. BP's considerable problems with their local oil operations in the Gulf of Mexico near Louisianan had strong global repercussions for the global BP brand [18]. Coca-Cola was faced with customer protests in the UK and USA because of what was considered to be poor environmental record in India and allegations of human right violations in Columbia [19]. Moreover, the global presence of brands and their operations may even cause the CSR policies of strong, highly visible global brands to backfire. For example, Nike has sought to associate itself with the right, needs, and aspirations of the socially disadvantaged such as African Americans, women ,and disabled through brand endorsement by athletes such as Michael Jordon. However, anti-sweatshop movement believes that Nike is hypocritical, as Nike has been accused of exploiting young female migrant workers in the developing world to produce its products and only using its promotional CSR towards sale [20]. Similar arguments appear in the study by Wagner, Lutz, and Weitz [21], who point out the negative reactions of consumers toward reactive CSR strategies that try to mitigate harm after an irresponsible action has been reported. The Nike case also points to a complicating issue,

namely that CSR involves activities that focus on multiple stakeholders, including customers, employees, shareholders, and community in which the credibility of CSR policies will play a pivotal role in the efficient implementation of CSR initiatives. Firms, therefore, need to understand whether and how their multi-faceted CSR efforts have an impact on their global BE.

Within the popular marketing literature, it is generally acknowledged that CSR should positively affect customer's brand perceptions [22]. Importantly, Holt et al [23] argue that social responsibility is an important driver of global brand evaluations. However, the driving role of CSR with customers for BE depends on the credibility of such policies. Multinational companies that market global brands are often accused of seeking to maximize their corporate profits without much regard for the need of the poorer and weaker societies in which they operate.

Within the marketing literature, there is ample evidence that customer beliefs concerning CSR affect individual customer outcomes such as brand preference, brand loyalty and positive word- of-mouth. Evidence is also provided by Hoffler and Keller [24] and Keller [25], who report that corporate social marketing can enhance customer brand metrics such as brand awareness, brand image, brand credibility and brand engagement. In the same vein, Du et al. [26] reports that visible CSR leads to stronger brand identification, brand loyalty, and brand advocacy. This type of customer loyalty connected to CSR acts as an implicit brand insurance, which is particularly valuable for global brands that are subject to changing social expectations, affluence, and globalization [27].

B.   CSR as a tool to enhance Reputation of corporation: CSR can also enhance corporate reputation, which in turn allows firms to secure business contracts and better target specific customer groups [28].

A firm's corporate reputation is enhanced through the positive actions firms take, the programs they implement and the other tangible things that firms do, rather than by increasing advertisement or more effective corporate communication management [29]. Corporate reputation protection is concern either evidencing firms' efforts to meet stakeholder expectations. , while enhancement goes beyond purely evidential basis to encompass embedded practice. Conversely, corporate reputations are jeopardized by irresponsible supply chain practices which can "directly harm business contracts, marketing, and sub-sourcing, and damage the corporations brand and the trust they have established with their business customers" [30].

C.   CSR as a Marketing Tool: CSR is an increasingly important concept in the field of marketing [31] [32]. CSR activities are likely more effective in boosting the impact of marketing on performance in highly competitive market than in markets with low competitive intensity. CSR activities in highly competitive industries likely have a greater impact on the relationship between marketing

capabilities and firm performance than similar activities in industries with less competitive intensity.

Looking in greater detail at each of the four central marketing capabilities, (i. Pricing capability (the ability to obtain optimal revenue from customers. [33]); ii. Product development capability (the processes by which firms develop and manage goods and services [34]) iii. Distribution capability (the ability to establish and maintain channel of distribution that deliver value to end-user customers [35]); iv. Marketing communication capability (the ability to manage customer value perceptions [36])) in highly competitive markets where competition for the best price is often fierce, firms with strong CSR activities drive customers' attention away from merely looking at price [37], thus resulting in larger margins than the competition. Therefore, CSR likely has a stronger impact on relationship between pricing capability and firm performance in more competitive markets. In industries with intense competition, marketing managers need to differentiate their product offerings [38]. As such, CSR initiatives may serve as additional product differentiators because they add value to core product attributes (McWilliams & Siegel, 2001) [39], resulting a greater impact of CSR on the link between product capability and firm performance when competitive intensity is high. Furthermore, we predict that firms under intense competition can also leverage CSR to increase the impact of their distribution capability on firm performance. For example, lowering the carbon footprint of a firms' distribution network or engaging in "fair trade" may serve both as an additional differentiator as well as potential cost saver. Finally, the greater the competitive intensity of market, the more crucial the firms' reputation will be [40] [41]. Thus CSR activities likely have greater impact on the link between marketing communication capability and performance in highly competitive markets than in less competitive markets.

D.   CSR as a tool to tap market of moderately and extremely poor (MEP): Base of pyramid (BoP) proposition (Prahalad & Hammond; Prahalad & Hart)[42][43] holds that transnational corporations (TNCs) can exploit neglected entrepreneurial opportunities while simultaneously alleviating poverty by serving billions of previously ignored customers living in poverty. Parhalad [44] describes the BoP as an invisible market of four billion people living in less than $2 per day, waiting to be tapped. London and Hart [45] describe it as a huge base of potential customers earning less than $1500 PPP (Purchasing Power Parity) per year. BoP strategies are recommended as win-win market opportunities that allow TNCs to do well by doing good. It is claimed that pursuing BoP strategies "means lifting billions of people out of poverty and desperation" (Prahalad & Hart,) [43] and enhancing the "dignity and choice" of the poor via access to more goods and services[44]. At the core of the BoP proposition is the idea that socially responsible TNCs can simultaneously improve their profitability while benefiting the global poor. But, as will be argued, the validity of this claim depends on the specific BoP business venture, the ethical framework that is utilized to analyse the

venture, and the theory of corporate social responsibility that is employed.

Product and services marketed to the BoP may either improve the welfare of individuals or it may exacerbate the poverty of individuals. For example affordable clean energy sources for a community may improve health and living standards. Companies such as D. Light are bringing clean energy through the sale of solar-powered LED lanterns into BoP market in rural India [46]. However, tobacco products will typically cause a decline in welfare by harming health and diverting money from basic needs. An essential features of the BoP ventures is the promise of benefitting BoP populations. There are at least two way of characterizing the benefits to BoP populations in general, and the MEP in particular, the business venture may bring increase utility through the satisfaction of desires, or increased achievement of human rights via the capacity to function well [47].

Fig.1 The Economic pyramid

III. CONCLUSION

In this paper, we analyse the key drivers of corporate social responsibility which affect the different dimensions of firm's policy of doing business. Studying CSR for global brands is highly relevant, as global brands are frequently blamed for not having strong CSR records. Firstly we find that CSR positively affect global BE. Secondly, CSR towards community and towards customers does not have a significantly larger effect on firm's global BE than the other CSR efforts. In case of second key drivers we observe that many firms are using CSR practices not only for protecting reputation, but also for enhancing reputation. The study of third key driver sheds new light on the intersection of competitive environment, marketing and corporate sustainability. The finding illustrate that CSR become a significant moderator of the link between marketing capabilities and performance only in industries of high competitive intensity. In case of fourth driver it is commented that when TNCs engage the MEP as a customer, they should support the attainment of human rights in the goods or services that they provide. However the TNCs have different competencies, experience, and knowledge of different markets. Not all TNCs are well suited to serve the MEP market. Some TNCs may be in better position to

partner with NGOs and government to appropriate technology for health care, drinking water, electricity or improved sanitation. After all it was concluded if CSR practices is implemented at ground level it will return good competitive advantage, and help in increased market share in addition it will help in building a better society.
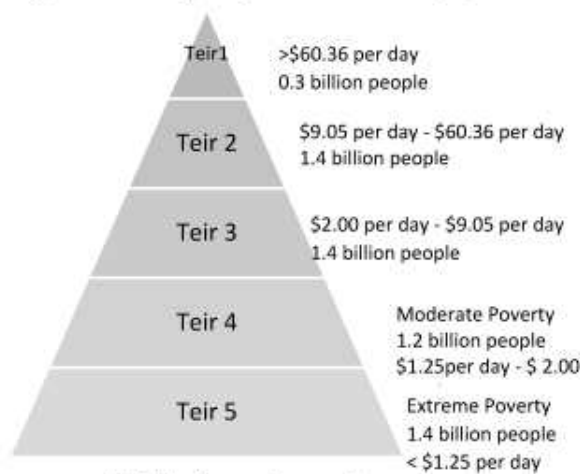
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Enablers of Knowledge Sharing in organization: A Brief Review

Mohd Shuaib
Dept. Of Mechanical Engineering
Jamia Millia Islamia,
New Delhi
Shuaib89141@gmail.com

Mohd Imran Khan
Dept. Of Mechanical Engineering
Jamia Millia Islamia,
New Delhi

Mohd Javaid
Dept. Of Mechanical Engineering
Jamia Millia Islamia,
New Delhi

Abstract-Knowledge sharing (KS) is critical to organizations that wish to use their knowledge as an asset to achieve competitive advantage. Knowledge Sharing (KS) has now become an essential part of Knowledge Management (KM). The main aspect of knowledge sharing is to multiply knowledge. Knowledge sharing is an important consideration for today business environment for success of many organizations. Knowledge sharing has been emerging field of research in the few last years. The present paper addresses the need of exploring the field of knowledge sharing. The study presented is an attempt towards identifying important enablers of knowledge sharing relevant to organization.

Keywords: knowledge sharing, knowledge sharing enablers

I. INTRODUCTION

In today's economy, knowledge is considered to be the most strategically important resource [25][26]. The effective management of this resource is, therefore, one of the most important challenges facing today's organizations [16][27]. The sharing of knowledge between employees and departments in the organization is necessary to transfer individual and group knowledge into organizational knowledge, which leads to effective management of knowledge. Knowledge sharing (KS), a key enabler of knowledge management (KM), is always considered as a competitive strategy to sustain organizations core competence and competitive edge [5,6,7,8]. Knowledge is according to [11] a critical organizational resource that provides a sustainable competitive advantage in a dynamic economy. However, to gain this advantage the focus should not simply be on recruiting staff with specific knowledge, skills, or abilities, but also on sharing knowledge between experts and novices which are already part of the organization [11]. According some authors, "for hundreds of years, owners of family business have passed on their commercial wisdom to children, master craftsmen have painstakingly taught their trades to apprentices and workers have exchanged ideas and know-how on the job". However, in the contemporary business world, knowledge sharing fundamentally means that employees

contribute to knowledge application, innovation and ultimately the competitive advantage of the organization [11]. Also, researchers and practitioners focus on knowledge sharing and various enablers work together to success knowledge sharing across the organization because knowledge management alone cannot lead organization to success [12]. The main objective of KS is to distribute the right knowledge from the right people to the right people at the right time [33]. There are two types of statement regarding KS practices in KM: one is people-driven, written by authors from management, and the other is technology-driven, written by authors from an engineering background [13].Sharing knowledge between units and people can create significant learning benefits and is a ''powerful mechanism for improving an organization's productivity and increasing its survival prospects'' [14].

II. LITERATURE REVIEW

[42] Define knowledge sharing as the activities that involve transferring knowledge whether tacit or implicit knowledge from one person, group or organization to another. Not only that through knowledge sharing organization can improve their efficiency, reduce training cost and reduce risks due uncertainty. This is because through knowledge sharing, organization can reduce their budget in training and any others seminar because the organization only send a few people and they can share their knowledge with their colleagues. Other than that, knowledge sharing also can be defined as an individual shares their knowledge, information, ideas, suggestion and exchange with people in the organization itself [43]. According to Connelly and Kelloway[38], knowledge sharing is a set of behavior that involves in exchange information assistance to others. There are some theories that have been used for researcher to predicting the factors that influence knowledge sharing, such as social cognitive theory and theory of reasoned action have been used for researches in predicting the factors influencing knowledge sharing. For example [43], they used economic exchange theory to examine the role of monetary rewards to encourage

knowledge sharing in organizations. Knowledge sharing is not well defined in the literature, partially because the research areas have not been very active. Further, as per Davenport and Prusak [26] knowledge sharing occurs in organizations when members ask for knowledge from other members to solve their problems. Knowledge sharing plays an essential role in the organizational process because it helps an organization to transfer new ideas or solutions [24]. Knowledge sharing in order to integrate knowledge takes place from one individual to many others at once. On the other hand, knowledge sharing as part of knowledge production takes place more in the form of group discussions, working together to solve a problem: employees define the problem together, shares their views and opinions, share information to find a solution together [23]. Since the authors of the present study are not only interested in knowledge integration, but also knowledge sharing that is facilitated by trust among the group members, open communication between staff, reward system, and influence of leaders, this paper considers knowledge as both part of knowledge integration process and part of the knowledge production process.

III. IDENTIFYING IMPORTANT ENABLERS OF KNOWLEDGE SHARING RELEVANT TO ORGANIZATION

A.   Trust: Trust is defined as the degree to which an employee believes that sharing knowledge will benefit them and they will not be exploited by any party in the organization. Trust is the highest human communication and it is the blood of any organization. When someone has a high level of trust they will work efficiently .Trust between individuals should be started by physical interaction like face-to-face interaction [8, 32, 33] KS is impossible without mentioning the word trust. Unsurprisingly, trust has been recognized as being ''at the heart of knowledge exchange'' [16] and the gateway to successful relationships [36]. Several researchers have found that trust is a 'need to have' quality in business interactions and teamwork activities [37] High levels of trust are key to effective communication .Mutual trust throughout an organization is one of the most important factors of KS, as trust among employees enables them to more freehandedly share and acquire knowledge and retrieve specific resources [2].

B.   Top management support and Leadership:

Top management support is considered one of the important potential influences on organizational KS [38]. Leadership has to play critical and effective role in motivating employees to share, by encouraging them, giving them confidence and making them part of

decision making. This would ensure a high level of commitment and hence help in achieving effective knowledge management, which will not only deliver competitive advantage but sustain it too. Top management or leaders should be involved in promoting a corporate mindset and culture that emphasizes cooperation, coordination and knowledge sharing across organization [44]. For knowledge sharing, the process of leadership of the organization must take steps to motivate employees to share knowledge. Motivation from leader enhances knowledge sharing among employees [39]. KS does not happen automatically in team, and the team's leader has an important role to play in making it come about. Leaders of team play significant role in nurturing a healthy work atmosphere for their subordinates [1]. We observed from the findings that the top management in service organizations significantly influences the employees to share needed and relevant information among team members with the help of various participative activities and information and communication technology. Actually, leadership at all managerial level is required to develop a desired culture in order to enhance knowledge sharing in organizations [19,20].

C. Motivation and Reward

[29]survey of Knowledge Management Officers (KMO) noted that motivating employees to share is the primary challenge and KMOs expressed frustration at the lack of practical models to engender such motivation.[31] showed that the optimality of the rewards systems in producing knowledge sharing among employees is dependent on the KM strategies pursued i.e. codification or personalization. Accordingly to Hung, [40] one aspect that influences people sharing their knowledge with others is economic reward. The idea stated that without strong personal motivation, people are unlikely to share their knowledge. Motivated employees poses greater affective and continuance commitment and lower employee turnover intentions. [30] Research on intrinsic and extrinsic motivation for knowledge sharing suggests that intrinsic motives are much more powerful enablers of such sharing than are extrinsic (e.g., monetary or administrative) stimuli. An appropriate incentive and reward mechanism enhances employees‟ motivation to share knowledge [4,16]. An employee feels motivated to share knowledge once he or she has a good relationship with another person [9], or social relations have proven to be helpful [10]

D.   Training and Development

Training may be referred to planned and systematic activities to modify attitude, knowledge or skill behavior through learning experiences to achieve effective

performance in an activity or range of activities [45]. To intensify knowledge sharing, organizations must continue structured learning via effective training and development of its staff [35][34]. Investment in people signals to the employees, the values and commitment of management to skills and knowledge development of employees. A recent Accenture study showed that, contrary to popular fear, investing in the development of the executives engenders stronger commitment to the organization's values and intentions to stay on.

E. Organizational culture

Organizational culture can be defined as the shared, basic assumptions that an organization learnt while coping with the environment and solving problems of external adaptation and internal integration that are taught to new employees as the correct way to solve those problems [17]. Each organization has its own culture, which gradually develops overtime to reflect the organization's identity in two dimensions: visible and invisible [18]. Culture defines the core beliefs, values, norms and social customs that lead individuals in their behavior within the organization [21]. Corporate culture can have an impact on the attitude of the employees contributing within a system. Recent study shows that mutual trust among employees is needed in order for knowledge to flow freely with a company.

IV. DISCUSSION

The main discussion of this paper brings enablers of knowledge sharing indentified by the literature and through work culture in organization. The work has shown that the majority of the enablers are concerned with employee's issues. Knowledge sharing enablers is an attempt to remove the complexity of knowledge sharing as in business activity. However, it has been seem that emphasis should be placed not on technology, but on how to best enable employee to participate in knowledge sharing.

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Corporate Social Responsibility: Opportunity of Accelerating Social Innovation & Craft Future Business-Society Relationships

Simranjeet Singh
P.G Department of Commerce
Mata Gujri College
Sri Fatehgarh Sahib, Punjab, India
simran2611@yahoo.com

Prince Rohit
Department of Commerce
Guru Nanak College
Budhlada, Punjab, India
princerohitca@gmail.com

Abstract—CSR in India is just coming into existence. It is still one of the least understood initiatives in the Indian development sector. In 21st century CSR would be used as competitive tool. The purpose of this study is to develop a better understanding of corporates use of CSR to accelerating social innovation, business-society relationships. In this research paper we focus on how CSR would help corporate to accelerate social innovation, how new CSR law help in crafting future business-society relationships. Investigation finds that CSR would helps society through SIAP (Social Innovation Accelerating Programme), improve business-employees relations by following workplace practices, training; safety, health and wellness, and helps to corporate building good image, creating intangibles assets.

Keywords—Corporate Social Responsibility; Business-Society relationship; Social Innovation.

I. INTRODUCTION

In India corporate sector play important role in economic development & GDP share. Given the economic and industrial importance of corporate sector, they also have a considerable role and impact when it comes to environmental issues—such as pollution and social issues—such as income, working conditions and the working environment. Therefore, in light of the current emphasis on companies' responsibilities—often termed Corporate Social Responsibility (CSR)—and the impacts of CSR, corporate sector play a key role. Companies Act 2013 provides a new provision which giving impact on corporate India CSR policy. According to clause 135 of bill, that deals with CSR provisions companies with 500 crore net worth or 1000 crore turnover or 5 crore per year profit will have to constitute CSR committee having three or more directors and allocate at least 2 % of their three year annual profit towards CSR activities. It is expected this will increase the CSR amount by approximately 20000 crore, and apply on 16000 companies.CSR is the decision-making and implementation process that guides all company activities in the protection and promotion of international human rights, labour and environmental standards and compliance with legal requirements within its operations.

As the specific understanding of CSR, we used approach: (a) protection of physical environment, (b) improve the working environment and (c) labor standards/working conditions, including standards and systems, and (d) donations to the community in normal and in disaster events. CSR is defined in two ways as an overall analytical and descriptive understanding of CSR. We used: "an umbrella term for a variety of theories and practices all of which recognize the following: (a) that companies have a responsibility for their impact on society and the natural environment, sometimes beyond legal compliance and the liability of individuals; (b) that companies have a responsibility for the behaviour of others with whom they do business (e.g. within supply chains); (c) that companies need to manage their relationship with wider society, whether for reasons of commercial viability, or to add value to society." (Blowfield and Frynas, 2005, p. 503).

II. OBJECTIVE OF STUDY

The following objective guided the work:
- To gain understanding the role of Indian Companies in social sector innovation & craft future business-society relationships.
- Investigate the new CSR provision as an opportunity for companies.

III. LITERATURE REVIEW

The Corporate Social Responsibility (CSR) movement has gathered great momentum over the past number of years (Crawford and Scaletta 2005). CSR is a broad concept and it is still looking for a common definition.

A. Definition's

De Davis and Blomstrom (1966) Social responsibility refers to a person's obligation to consider the effects of their decisions and actions on the whole social system.

Baker (2003) CSR is about how firms manage business processes to produce an overall positive impact of the firm on society.

The World Business Council for Sustainable Development (WBCSD) defines, CSR is the continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as of the local community and society at large.

B. CSR Pyramid Theory

One of the most used and quoted models is Carroll's Pyramid of Corporate Social Responsibility. Carroll (1991) has proposed a comprehensive definition embracing four kinds of social responsibilities for business: economic, legal, ethical and philanthropic. The pyramid of CSR is a tool for measuring the level of CSR at the firms based on how they fulfill their responsibilities towards the society.
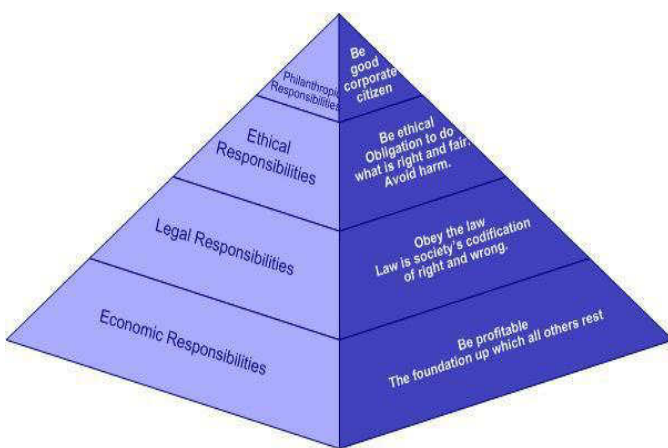
Carroll's CSR Pyramid

Figure: CSR Pyramid Model

C. CSR and Public Relation

Dalia and Rosa, (2009), The Role of Public Sector in Corporate Social Responsibility Development in Lithuania. This study emphasizes to analyze the concept of Corporate Social Responsibility and to identify the main driving forces of CSR development in the public sector, and the main barriers to this way. The questionnaire was prepared for the survey based on the main assumption about the role of the public sector in promoting CSR and revealing the mandating, facilitating, partnering and endorsing role of local governments in CSR development in Lithuania. Also questionnaire related to the main barriers of CSR development and measurements to overcome these barriers were incorporated in this study. The finding shows the Lithuania local bodies play a minor role in partnering, mandating, facilitating and endorsing CSR in the country and the main barrier for CSR in the country is the lack of information and knowledge, lack of financial resources, human capacities and

resources that to be active leaders in promoting the idea of CSR in society.

D. CSR and India

Indira, and Siddaraju, (2009), Do Corporation have Social Responsibility: A case study of TVS Motor Firm. This study mainly focuses on the CSR objectives of TVS firm and its capacity to identify social issues, social relevance of the issues addressed and the implementation strategy. Primary data was collected from the beneficiaries located in Sindurally, Dodadahally, Byathahally, Chikkakanya and Doddakanya village of Sindhuvally Grama Panchayath Mysore taluk and local Panchayat member and secondary data was collected from the records of TVS Firm. It can be observed that promotion of human development and protection of environment are the major issues addressed by these firms through CSR institutes. This study explain different area that TVS do CSR activities like Agriculture's awareness programs for farmers and some activities for optimize amount of product such as soil testing.

Saboji, and Indira (2011) An analysis of corporate social responsibility of Indian firms. The globalization of the world economy and the related trade liberalization affected on the rapidly transforming Indian society. Corporate social Responsibility (CSR) refers to the relationship between business and society and corporation acting in the economy. The purpose of this study is to evaluate the CSR in India. Therefore Infosys Technologies Ltd has been selected. Art and culture, Education, Healthcare and Rural up liftment initiatives have been chosen to identify its CSR performance. For measured the status of CSR in India is the study conducted by Karmayog (2008). Based on the CSR activities the necessary and, sufficient conditions were fixed for a company to reach different levels. Then explain of CSR initiatives in Infosys firms.

IV. RESEARCH METHODOLOGY

This is fact finding study. For this study we use Secondary data collected from books, reports, internet, news papers, journals, articles, research papers, investigations, we undertook a literature review in which we assessed the knowledge in the field of CSR.

V. FINDINGS

A. The role of Indian Companies in accelerating social innovation & craft future business-society relationships:

The world is in the midst of an un-precedented churn. Political upheaval, economic volatility, technology disruption and climatic changes have made the poorer starta of society more vulnerable than ever before. Over 30% of India's population of 1.2 billion is living on less than $ 1.25 per day. There is growing sense that old paradigms of government aid and private philanthropy are simply inadequate to meet critical challenges of India in 21st century. What's needed are innovative solutions that foster sustainable economic growth. There has been a phenomenal surge of interest in social

innovation globally as a way to achieve sustainable economic growth.

1) Social Innovation is helping solve some of the world's most pressing problems with new solutions, such as distance learning, mobile money transfer, livelihood training, techno-farming and healthcare. Social Innovation Accelerating Programme (SIAP) followed by companies/firms helps social enterprises apply innovation to take a leap into large-scale impact. SIAP comprises the six ingredients:

a) Mindset for sale-Involves a deep diagnosis to understand the organisation's readiness for an accelerating journey.
b) Co-created innovation challenge-Once the larger challenge and innovation goal are identified, the SIAP team co-owns the goal with the organisation.
c) Capability for insight, the real blocks to scale-Consumers are important, for e.g. why someone from a poor community will pay for the product? Fresh insights emerge when a team does a deep dive into a challenge area, with an open mind, willing to unlearn and relearn.
d) Capability to prototype-Ensure that insights get covered into ideas, ideas into prototype, and prototypes into learning and execution.
e) Organisational capacity building (people, resources and operations) - Once the right insights are found, an appetite is created and the organisation finds its strength to scale.
f) Access to growth capital- Based on the nature of the model, organisations are linked to new business opportunities, institutional funding, beneficial platforms and government schemes.

Even as corporate social responsibility is soon to be made mandatory in the country, companies are now approaching PR (Public Relation) agencies to help them design a CSR programme that would do the needful while keeping their parameters in mind. CSR programs here are now taking on a more organised form.

2) Businesses engaging in community relations or community involvement typically conduct outreach to the community aiming to prevent or solve problems, foster social partnerships, and generally contribute to the community quality of life. A key priority for a socially responsible business is to develop and maintain strong and mutually beneficial relationships with its community. Businesses that take an active interest in community well-being can generate community support, loyalty and good will. This is often referred to as building your "social license to operate", an important business objective for any business. A few key areas which any business might wish to consider include the following activities:

a) Accessibility-An important community involvement objective is to ensure your premises, products and services, and communications are free of barriers, enabling all people to use them independently, regardless of one's ability, gender, age, ethnic background, etc.. It means that everyone can actively participate in community life and can be recognized as having something to contribute.

b) Social Hiring- Social hiring is a commitment on the part of an employer to proactively recruit employees with employment needs. Companies seeking to make a direct and meaningful contribution to poverty reduction and economic and social inclusion may be interested in opportunities to hire people who face labour market barriers because of a physical, mental or developmental disability, mis-matched skills, lack of work experience or skills, long-term unemployment, lack of credential recognition, age, culture or language, etc.

c) CSR and Health-Health Sector clearly stands out as a leader, when discussing the CSR issues. There are numerous epidemic diseases and other serious diseases in the world which needs close attention, both from public sector and private sector (i.e. HIV/AIDS, Avian Influenza, and etc.).Schedule VII of the new company act 2103 consist special activity regarding Health (Combating HIV-AIDS, malaria and other diseases).This will uplift the public-private partnerships (PPP) to take healthcare programmes, private sector players to come out of 'their comfort zones'.

d) Stakeholder Engagement-Stakeholder engagement is the process of listening and talking to your stakeholders – typically employees, customers and community members about their issues, concerns and needs, and also the business' important directions and significant decisions. This will help to better meet their needs and help you to develop more robust and lasting business outcomes. Basically, stakeholders are those who have a direct or indirect stake in your organization and its decisions and activities. Stakeholder engagement can help you improve communication, facilitate buy-in on projects, generate community support, and tap into additional information, data and ideas.. It can secure your "social license to operate".

B. Investigate the new CSR provision as an Opportunity for companies:

The new law to allocate 2% of profits to Corporate Social Responsibility (CSR) spends, which kicks in form April 1st 2014, is therefore an opportunity for companies barring a few exception to alter the old order of rhetoric, symbolic gestures and craft a new, meaningful future in business-society relationship. It's an opportunity for companies to create or shore up a bevy of intangibles- reputations, brand image, trust or the capacity of innovate to build partnerships all recognised as critical drivers of value creation in today's complex and fluid business environment. Intangibles do not manifest on balance sheets and P&L statements. They are not adequately measured. Yet, Intangibles are overshadowing tangibles assets as source of strength and sustenance in difficult, trying solutions.

CSR therefore can be seen as an investment in intangibles. Human resources in an area in which the CSR intangibles construct can have a considerable sway. It would make employees better citizens, at their homes and in the communities they live in, make them better workers and managers on the shop floor, in the field with customers and

stakeholders, in R&D labs. These employees would become a competitive advantage of companies.

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Dynamic Shifts in Learning

Yashika Grover
CT Institute of Management & Information Technology
Jalandhar, India
yashika_g2005@yahoo.com

Harmanpreet Kaur
CT Institute of Management & Information Technology
Jalandhar, India
harmanpreetkaur005@gmail.com

Abstract- Present organisations are working with people from various cultures and this will become more common in future. To stay with the dynamic world, learning is an approach which will not only help achieving goals but also improving performance. The use of electronic gadgets and other technological devicescan make learning interesting and interactive. But there is lot to be done in this field. This paper will discuss some of the emerging concepts in learning and training employees.

Keywords—Learning, training,corporate training, e-learning.

I. INTRODUCTION

Corporate training continues to transform and remould optimum best practices and drifts that prove to be effective. The training and development (T&D) sector will be shaped in the year ahead by some current and upcoming trends. Needs, goals of the organization should be kept in mind while designing a training program. The word training will be covered with the word learning in the times to come. Mere compliance with legislation and giving training is not enough. Learning culture is increasingly important to organisational success.

Right time of training is an important aspect to get good results. But an important question that needs attention is finding the effective method to impart training especially in organized sector or to skilled employees.

Developing an effective employee training or learning program is vital to the long-term success of any business. Training programs provide diverse benefits for employees, but only if they are vigilantly planned and accurately implemented. Clear perceptive of policies, on job functions, goals and company philosophy lead to escalate motivation, morale level and the productivity of employees, and higher profits for the business. Training is a means to a peculiar end, so we possess goals in mind during the evolution and carefully administer stages of your training program and will accommodate in creating a clearly defined and effective program.

Due to worldwide challenges, corporate training techniques have undergone huge change. There are new benchmarks available and par excellence practices for corporate training that result in more effective and efficient training programs. Some of these include positive augment and better use of technology to build up training initiatives. Acknowledging learning styles coupled with individualized and personalized digital training have made learning easier and more effective for organizations.

Training is the planned intervention that is designed to enhance the employee's performances which will eventually benefit the organization in numerous aspects. Training is related to the skills an employee must acquire to improve the probability of achieving the organization's overall business and academic goals and objectives. Pragmatic training given to employees may assist with reduction of anxiety or resentment, which employees have experienced on more than one occasion during their employment careers.

Technology should be a resource used to create impactful training customized according to a learner's preferences. There has been an increase in the usage of mobile tools for learning, culminate that mobile is no longer a nice-to-have for learning programs but a strategic part of any comprehensive learning plan. We've reached a point where training professionals need to begin looking at technology and asking not, "When should I do this?" but "How can I start to transition assets to newer toolsets?" This simple shift will help get to the root issue: media habits have changed, and outdated approaches will generate increasingly poor results. This paper discusses some of the issues and techniques that will be prevalent in the corporates in the time to come. It does not mean that the old methods of training and learning are outdated but with some interesting changes they may also be adopted. The convenience of trainer and the level of trainee should be considered while selecting a learning program.

II. CORPORATES EMPHASIZE ON TRAINING PROGRAMS

Many companies are already operating with lean staff, due to attenuation and not supplant staff, and also retrench during the last few years as a result of a difficult economy. In this environment, we focus on retaining workers and providing them cross training to be more efficient. It's a culture of doing more with less. Many corporations are accomplishing that the investment in corporate training pays off and delivers a better ROI than constantly recruiting and hiring new staff due to high turnover.

III. FOCUS ON EXTRINSIC AND INTRINSIC INCENTIVES

Corporate training has been driven towards a more scientific approach by using psychology and considering motivation. The goal is to create opportunities to work with the specific personal goals. It's a tangled and consumer focused approach than top down, and with today's

technology, it is a more efficient way to communicate the goals for training.

IV. TRAINING EXECUTIVES SHOULD STRESS ON TRANSPARENCY

Organizations need to become more open about their policies and practices of every activity of organisation. Employees expect greater openness from executives about performance auditing criteria that brings changes in corporate strategy, career advancement opportunities and helps in selecting the program and even managing succession. Transparent system will have positive impact on learning behavior of an individual.

V. GAMIFICATION TECHNIQUE

Gamification is applying game principles to non-game situations, helps in learning and getting trained to work and to perform the tasks and is very appealing to the Gen Y and Gen C workforce. For gamification, one must have a monetization strategy meaning what business goals are trying to meet, what kind of performance is needed and how to achieve them. After this the inclination is more on Content mastery and job performance. In any learning, learners should become fluent with the content on which they being trained, so that they actually translate that knowledge into actual job performance. The benefit that comes here is that the learner can easily play and replay as many times as he wants to so that he has the vast knowledge and can be counter-productive to the business goals. Next is making sure of learning and its implication of game reward system decipher to real world. The rewards that they would be earning through game should have an actual sense of what they would be achieving if the similar performance is achieved veridical/substantially. Finally one must tie the game's learning to the real work, so that the leaners can acquire information of how to integrate their gamified skills with the company's existing tools.

The concept is to make learning fun, and to challenge the learner (termed a player) to continue to learn through quests and competition. Progressively organizations are making use of gamification programs for corporate training.

VI. INTERACTIVE METHODS

There are many ways in which training sessions can be separated and keep trainees attentive and involved, like quiz, group discussions, role plays , case studies etc.

VII. CLASSROOM OR INSTRUCTOR-LED TRAINING

Instructor-led training remains one of the most popular techniques for a trainer which uses power point presentations, overhead projectors, blackboard or whiteboard, etc. These can be tailor-made to grab learner's attention. Trainers can make the session more interactive by using such aids.

VIII. COACHING PROGRAMS WILL DRAW GREATER SCRUTINY

Coaching will continue to be a key tool in administrating leadership development, but there will be lesser empty checks as organizations expect to see clear success criteria as part of any engagement to get real return on this type of development investment.

IX. DEMAND FOR BASIC SKILLS TRAINING IS EXPECTED TO RE-EMERGE

Due to recession and other constraints, programs focusing on developing basic skills often took a back seat to highly focused training modules designed to meet specific short-term needs or business challenges. There will be a renewed demand for training programs designed to build for accomplishing better communication ability, critical thinking, collaboration and creativity, all of which are crucial to improve employee productivity.

X. GLOBALIZATION WILL OUTLINE MORE LEADERSHIP PROGRAMS

Some organizations have long had a global dimension for leadership development ambition, most companies find they must play catch-up or lose ground in an progressive and integrated, aggressive global marketplace. For leadership employees must be trained in dealing with high performance teams.

XI. COMPANIES WILL TURN TO TRAINING TO BUILD EMPLOYEE LOYALTY

Organizations having more employee instability and turnover, senior management will turn to human resource personal and the training & development to build closer and better relationships with high-performing workers and to use development as a means to improve retention and engagement.

XII. HIGH-POTENTIAL PROGRAMS FOR ENTHUSIASTIC EMPLOYEES

The process for selecting candidates for high-potential programs up to now has typically been tactful and low key. This is becoming more open, however, desiring success individuals volunteer enthusiastically for any kind of leadership development offering.

XIII. LEARNING WILL REMAIN TO GO MOBILE

Blended learning approaches that integrate the best of Web learning programs and social media—accessible via both web and mobile devices—will make development opportunities highly flexible options for end users.

XIV. ONLINE OR E-LEARNING

Materials that are offered electronically which uses web-based training, videoconferencing, web meetings, e-videos, e-surveys ; Which makes there learning more easily available to them at their respective places. This method also creates a great zeal to learn as it a bit different from previous learning methods.

XV. BLENDED LEARNING APPROACH

Blended learning is a common concept that results in great learning success. It is a better training method because it has face to face discussions with modern concepts and with the expected content that the learner needs to be trained for. It requires good amount of resources, the organizational culture, technology and most important the skill that your staff can adapt easily.

The blended learning approach is simply acknowledging that one approach does not fit all employees when it comes to training them. Simply, blended learning means using more than one training method to train on one subject.

XVI. JUST-IN-TIME LEARNING OR AUGMENTED LEARNING

Just in time learning is an on demand learning technique, which can be done manually as well as electronically. Manually would be just by understanding the non availability of the skill with the person and providing him the required skill through study of his behavior. Electronically can be achieved by a self assessment technique where a person gets to know about his deficient skill and tries to overcome it by using the menu driven information system (availability depends on organization) that could allow him to find various answers, shared work libraries and push technology which allows them to learn through reminders and encouraging a belief of what they can do.

The concept of just-in-time (JIT) learning systems is to deliver training to learners when required. Trainees can use web-based classes, video games, quizzes, and other tools in gathering information they need to solve problems, just update their skills or ways of how to perform tasks. JIT learning creates instantaneous value and easily adaptable with JIT learning, learning management system and has become more flexible and convenient.

XVII. SHIFT FROM GROUP BASED TRAINING TO PERSONALIZED PERFORMANCE

This is a structured form of group work which has a prominence for solving problem and sometimes even acquiring knowledge which is led by an effective trainer which could lead to profound learning and pre-eminent thinking. The key elements for having a desired result is to have a positive alliance of those who are a part of the team/group endow interest in working concomitantly and second element is of distinctive liability that individual work is appreciated and evaluated instead of the group/team and make their thinking more visible.

This means that employees can learn to do something as and when they desire to, or they can analyze something they have been already taught. This concept of performance support is one of the most exciting developments for businesses, as it holds out the promise of drastically improving employees' productivity.

XVIII. KNOWLEDGE MANAGEMENT

Knowledge management is type of learning organization which has information for organizational resources and helps in identifying strategies and processes design and identify and capture the structures, organization intellectual assets. It is a competitive asset and is relied on work done in artificial intelligence and expert systems. Its basic objective is to enhance internal collaboration, capture and share best practices, to have customer relationship management, to enhance web publishing. It is also related to cognitive science, computer supported collaborative work, technical writing, document management, semantic networks, and performance support systems. Usually this is a consulting which can be achieved in-house through knowledge management programs.

It is now seen as a key for winning and aggressive and much better advantage. In order to solve crucial problems of the near future, we will not only have to improve the skills and knowledge of individuals, but also the collective intelligence of groups. The development of "learning communities" and "communities of practice" is a part of this trend.

XIX. VIRTUAL ORGANIZATIONS

Virtual organizational should be resilient and amenable. They should be equivalent to a learning organization that is proficient to fabricate, procure, relinquish and possesses knowledge to reorient the behavior for new knowledge. This helps in active learning and convention of knowledge management which helps them to avoid mistakes while performing the same task in factual. Learning assists the progress by creating learning communities and knowledge management process.

Overall, corporate training has become more effective and has the result of improving adoption of new corporate initiatives faster and with less defiance to change. Appointing a training consultant who understands the best practices available and how to utilizing this corporate training trend is important to the success of the training program.

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Educational Management Information System

(Integrating Information Tools and Technology in Education System)

Brij Bhushan Nanda
School of Information Technology
APEEJAY Institute of Management Technical Campus
Jalandhar, India
brijbhushananda@rediffmail.com

Harmandeep Kaur
School of Management Studies
APEEJAY Institute of Management Technical Campus
Jalandhar, India
harmandeep.kaur@apjimtc.org

Abstract— An Educational Management System provides tools that are used for management, delivery, control and assessment of various types of learning management system. It is an integrated system of technology and education system. EMIS is designed to collect and analyze data on the educational system to improve planning, resource allocation, monitoring, policy formation and decision making as well. A robust EMIS integrates with systems from human resources, accounting and sales so that impact of Learners Educational programs can be easily identified and quantified. EMS involves mixed media training, automating the selection and administration of Courses, assembles and delivers educational content and measures educational effectiveness. It includes Learners information system (LS), Library information system (LIS), Trainer information system (TIS), Customer Relationship Management system (CRM) and Administrative information system (AIS). Its design is based upon various models like Traditional, Distance and Blended educational models. EMS like Adobe E-Learning Solutions and also highlights its effectiveness by presenting a case study of a university system. Course management systems or learning management systems provide software for the management and delivery of learning content and resources to students. The future aspects of EMS include new features that are currently being developed to track Virtual Classroom attendance and Presenter Slide-views as graded compliance activities within MOODLE(Modular object oriented dynamic learning environment).

Keywords— EMIS, LMS, CRM, TIS, MIS, MOODLE

I. INTRODUCTION

Education Management Information System is the outcome of integration of various information tools based on technology and various educational models. Its main purpose is to provide information which is used for improving the management of education at all levels. The value of information for management purposes is increasingly recognized in the business environment and by government bodies. The development of an effective EMIS is a complex and expensive undertaking under the best of circumstances. During emergencies, it is even more challenging because multiple organizations are generally involved in the provision of education, making it difficult to establish common data requirements and to co-ordinate data collection from the various organizations. For such integration, it is important to consider the needs of all the groups that will rely on the information, including central ministry planners, officials of other national ministries (for example, finance), regional and district education officials, donors, and NGOs. Ultimately, for EMIS to be effective as a planning and management tool,

national needs, not donor requirements, must be the primary force behind the development of the system. Despite the difficulties associated with the development of an EMIS, emergencies may provide an opportunity for establishing a better functioning EMIS than was in place before the crisis. Its design is based upon various models like Traditional, Distance and Blended educational models (Fig 1).
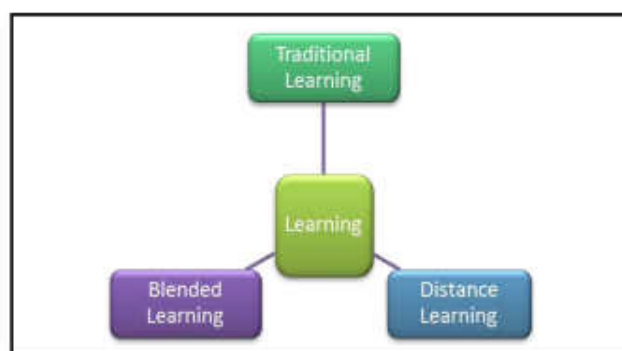
Fig. 1: Educational Models

- Traditional Educational Model

In this model, learner has to go to school, college or other physical space to get education. Use of information technology and communication technology e.g. presentations; can be thought of as an implementation of e-Education within traditional education model.

- Distance Educational Model

In distance educational model, an instructor and learner are separated by time, location, or both. Education or training courses are delivered to remote locations. It doesn't follow the traditional classroom method.

- Blended Educational Model

Blended educational model combines multiple models in education, like use of print-based and online materials.

II. OBJECTIVES

- To study the concept of Educational Management Information System.

- To understand the role of information tools and technology in EMIS.

- To study the various tools and software used for its implementation.

- To understand its architecture and various benefits.

III. KEY FEATURES OF EMIS

- School data collection tool for capturing students, teachers, data and other basic school management functions.

- Report manager module for printing all reports.

- Data manager module for data collection and Management.

- Executive dashboards for monitoring and evaluating education in a zone or Region.

- EMIS school online module for schools to access the EMIS data of their school and other downloads.

- Data posting and publishing module for posting data to the EMIS online solutions.

IV. VARIOUS INFORMATION TOOLS AND TECHNOLOGIES USED IN MIS

In modern age, education is not limited to the paper books. With the advancement of technology, new innovative methodologies are adopted to impart better and practical knowledge to students. On the other hand, to run an organization in highly competitive and dynamic world, it is important to integrate the traditional systems with the technology to get better results. The whole education System is based on information. To collect, process and present such information, various data processing tools ranging from simple models like MS Excel and MS Word to various comprehensive tools are used in EMIS. Such tools are backed by various technological platforms as depicted in the Fig.2.

Fig. 2: Technological platforms

V. CASE STUDIES

A. MOODLE (OPEN SOURCE)

Moodle is a learning platform designed to provide educators, administrators and learners with a single robust, secure and integrated system to create personalized learning environments. Moodle is built by the Moodle project which is led and coordinated by Moodle HQ, an Australian company of 30 de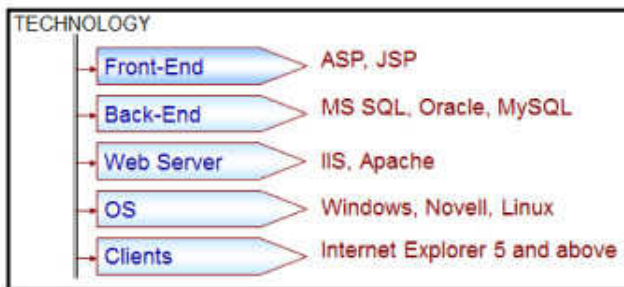velopers which is financially supported by a network of 60 Moodle Partner service companies worldwide. It provides the most flexible tool-set to support both blended learning and 100% online courses. A course in Moodle is an area where a teacher can add resources and activities for their students to complete. It might be a simple page with downloadable documents or it might be a complex set of tasks where learning progresses through interaction. The course page is made up of central sections which contain the tasks and (if desired) blocks to the side. The course teacher has control over the layout of the course homepage and can change it at any time.

It is based on a social constructionist approach to education that integrates a host of tools for online content creation and collaboration with a varied set of social and communication tools that support teacher-student, student-student, and teacher-teacher interactions. Moodle allows learners to contribute to and collaborate in the learning process, while also being flexible enough to support outcomes-based learning and teaching. Students can be enrolled manually by the teacher, automatically by the administrator, or they can be allowed to enroll themselves. Students can also be added to groups if they need to be separated from classes sharing the same course or if tasks need to be differentiated.

MOODLE is designed to support both learning as well as teaching needs. It is an open source and multilingual software. Moodle currently has over 83,008 registered sites worldwide, with over half a million courses, almost 60 million students and over one million teachers. There are 175 registered Moodle sites larger than 5,000 users.

B. ThinkNEXT "Smart Campus" (PAID SOURCE)

"Smart Campus EMIS Solutions" automates every operation in a University, Group of Colleges, College or a School. These solutions are designed to automate all the internal and external processes of an institution and also help in improving communication among Parents, Students, Faculty, Management, and Alumni. (Fig.3). ThinkNEXT Smart Campus not only uses Web Technologies, but also other advanced technologies such as Biometrics (Fingerprint), Smart Card, Barcode, SMS, Auto-SMS through short code, Multiple SMS Gateway, Windows based Technologies, Webcam Integration in various Modules, WAP (Wireless Application Protocol) and others to facilitate educational, operational and managerial services 365x24x7 to Managements, Directors, Principals, Staff, Students, Parents, Alumni etc. by extensive use of Wi-Fi, Intranet and Internet based technologies anytime anywhere in the whole world through Role based access control. All software modules of ThinkNEXT Smart Campus can handle also multiple colleges (Group of Colleges), Universities etc. through one centralized database. ThinkNEXT Smart Campus is not just an integrated collection of Software Modules but it also represents to most advanced techniques of Educational Systems so that any educational Institute/University can be a BRAND at National/International level. It is a system in which every educational institution can find innovation at every step.
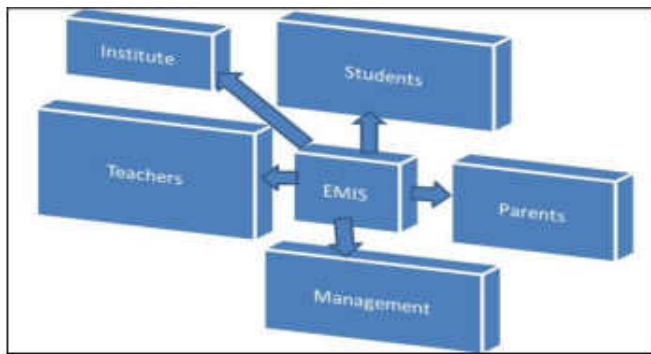
Fig. 3: Beneficiaries of EMIS Solutions

Various modules included in Smart Campus software are enlisted in the Table I, below:

TABLE I. MODULES OF SMART CAMPUS

• Role based Access Control
• Enquiries Management
• Registrations Management
• Admissions Management
• Documents Verification
• Seat Confirmation
• AICTE Supported Fingerprints Management (Biometrics)
• Communication
• Accounts (Smart Card, SMS, Auto-SMS, Online)
• Hostel/Bus Pass (Webcam)
• Campus Gate Administration (Biometrics, Smart Card)
• Mess Management (Biometrics)
• Hostel Management (Biometrics)
• Transport Management
• Communication Package (Circular, Office Order, Notices, Minute of Meeting etc.)
• Multi-Institutes Support
• Student Attendance Management (Online)
• Student Attendance Shortage Alerts
• Teacher Time Table (Online)
• Student Time Table (Online)
• Notice/Circular/Office Order Management
• SMS Integration (Students, Staff, Parents, Groups, others)
• Single SMS
• Common SMS (Enquiries, Registrations, Admissions, Staff etc.)
• Custom SMS (Attendance, Sessional/House Exams, Final Results, Library Books etc.)
• Group SMS
• Library Management (Smart Card, Barcode, SMS, Auto-SMS, Online)
• Exam Results Management (Windows/Web)
• E-Library (Books, Journals, CD/DVDs, Newspapers, E-Books, E-Journals, Search, Advanced Search, Alphabetical Search, Account Status, Fine Status)
• Faculty Feedback (online)
• Staff Attendance (Biometrics, Online)
• Notice board (Smart Card, Online)

VI. ARCHITECTURE OF EMIS

Educational Management Information system is a comprehensive system consisting of various sub-systems. It includes Learners information system (LS), Library information system (LIS), Trainer information system (TIS), Customer Relationship Management system (CRMS) and Administrative information system (AIS) as depicted in Fig.4.

A. Learners Information System (LS)

LS is the information system responsible for managing Learner's data at the organization. It is a system for maintain the registry of learners in order to provide a standardized registration system, to track learner's progress/performance, to provide information for better program planning and supervision etc. Atypical Learners record in the LS may include the Learner's ID, Social Security No., Name, Age, Gender, Address, E-mail, Username, Date of Birth, Trainer, Job description, Organization and Department. But LS is not an e-Educational system because it should not be able to provide information on Learner's previous educational records, his/her educational preferences or a development portfolio of transferable skills.

Fig. 4: Architecture of EMIS

B. Library information system (LIS)

LIS is responsible for managing and automating libraries within organization. The database records in these libraries reflect the managerial tasks performed by the librarians in order to manage the library effectively. A typical record will include ISBN, Name, Authors, Keywords and data like section, a list of all books, a list of available books, , a list of borrowed books, who is borrowing, when the books are due to return, and so forth. But LIS by itself do not serve the educational purpose. Learners should be able to access fully available digital libraries as a part of the educational process.

C. Trainer Information System (TIS)

TIS manage and automate managerial activities related to instructors, Learners, Courses and the interactions between them. A typical TIS database record includes 1) Trainer data: ID, name, departments, courses data; 2) Course information: course ID, name, description, instructors; 3) Trainer's Personal Data: ID, social security no., name, age, gender, address, e-mail, username, date of birth, trainer, department and 4) Learner's Data which is same as the instructor's data but with customised data about one's job. TIS's main objective is to organize trainer's and organizations managerial activities, but the educational process is not a part of its main goal therefore it is not considered e-Educational.

D. Administrative Information System (AIS)

Administrative Information System manages financial issues related to any organization. Although AIS may encompass issues of selling courses but such financial issues of the organization have nothing to do with educational process.

E. Customer Relationship Management System (CRMS)

CRMS entails all aspects of interaction that an organization has with all its clients, whether it is sales related or service related. In context of education, Customer Relationship Management System keeps track of student's feedback about: courses, organization, trainers, educational facilities and may take up suggestions for improvement. This system acts as a feedback mechanism but doesn't work as an educational process.

All these different sub-systems together make a comprehensive system called Educational Management Information System. A sophisticated EMIS might be able to correlate performance data with training data to see whether correlates with on-the job performance. EMIS registers users and trainers, tracks courses, records data from learners, provide access to educational facilities and provide reports to management.

VII. FRAMEWORK OF EMIS

All EMIS work is composed of three basic components: (Fig.5).

A. The right PEOPLE, motivated to perform and skilled in their work.

B. The right PROCESSES that reduce duplication and reinforce accuracy and accountability.

C. The right TECHNOLOGY, appropriate to the state of the country, and the reliability of its infrastructure.

In most development work, the combination of the people (leadership, managerial, and technical) and process (administrative requirements, timelines, job skills, and funding) are frequently the most difficult to align with the goal of EMIS, namely: providing quality education information in a timely, cost-effective, and sustainable manner, at all administrative levels, and to support selected operational functions. What ultimately drives EMIS success is being able to answer the questions that education stakeholders raise, and providing consistently understandable answers. Therefore, while new technologies are making certain factual information more readily available, there remains a key requirement to develop the capacity for interpretation and analysis of these resulting "facts." Making information accessible to a broad audience, with varying levels of preparation and numeracy, is the continuing challenge of any EMIS effort.
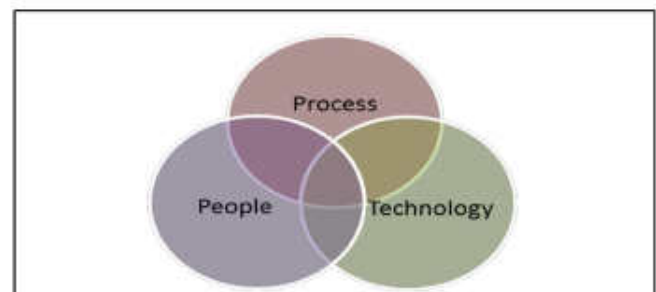
Fig 5: What EMIS Requires

VIII. BENEFITS OF EMIS

Various benefits that are provided by EMIS are as follows:

- It informs decision-makers.

- It helps in identifying issues to be addressed by planners.

- It supports policy planning.

- It provides information for general planning.

- EMIS provides tools for education sector management.

- It provides Information to other users e.g. ministry or Regional Offices, the Media, Public Offices Bearers, Researchers, and more.

IX. CONCLUSION

The current education system is no more restricted to the activities of imparting education only. To make students fit for the dynamic world, it is important to involve them in various other activities apart from education, but this increases the burden on the institute. The dual responsibility, imparting world class education and managing the whole institute, calls for an integrated management system. EMIS has emerged as a one-step solution for all the problems. It integrates all the management information systems working in an organization and directs them in one direction in a systematic way. To work with abundance of data, it requires technology to share the burden. Once information tools and technology are used with education, it simplifies the data management of the whole education system.

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QUALITY CONCERN IN HIGHER EDUCATION OF INDIA-AN OVERVIEW

Anita Rani

CT College of Education, Maqsudan Campus,
Jalandhar (Punjab)
ani-art@sify.com

Abstract-Education in broader sense is a way to think reasonably, act purposefully, live peacefully and behave properly. It removes the barriers of caste and class, smoothening out inequalities imposed by birth and other circumstances. From tradition to modern society role of education is very challenging. The Indian higher education system is one of the largest systems in the world. There are new challenges of management and regulation being faced by institutions and universities which require serious attention, both at the institutions in the public sector and also those in the private sector now growing at a fast pace. As a result, the old structures of management established in pre-independent India and working during most of the twentieth century are now required to undergo drastic changes. Besides, the demands of the society for equity and accommodation cannot be neglected any more. Institutes for higher education are providing opportunities to no. of students in India and abroad as well. To enhance quality concern in higher education we have national level bodies/agencies. Presently, there are three agencies that evaluate quality of institutions and / or programmes through an external quality assurance in the country. These are: the National Assessment and Accreditation Council (NAAC) set up by the UGC in 1994 to accredit institutions of higher education; the National Board of Accreditation (NBA) established by the All India Council of Technical Education (AICTE) in 1994 to accredit programmes in engineering and related areas; and the Accreditation Board (AB). Apart from it, Indian Education system has already established linkages with international agencies Commonwealth of learning, SAARC and other UN organizations by coordinating programes at national and international level. All these agencies ensure quality in Teaching, infrastructure, administration, research, students, learning resources and managerial functions etc. The Right to Information Act, 2005 imposes new requirements of transparency on the higher education institutions. Transparency in functioning helps them to build confidence of the various stakeholders. Transparency brings the institutional governance and administration into focus. There is a need for training and development of academic administrators and support staff in the universities and colleges throughout the country in a structured manner. The activity need not be confined only to the development of generic skills but also should focus on development of specific skills required by different groups of academic administrators in the system.

I. INTRODUCTION

Education is a liberating force. It is also a democratizing force, cutting the barriers of caste and class, smoothening out inequalities imposed by birth and other circumstances. This statement is fully applicable in the present global environment.

A new pattern and design have been developed during last 15 years in our country. Now people realize that that education is an important variable to transform a developing nation. Among various levels of education, higher education has pervasive and influential impact on development, since it empowers the individual with necessary skills and competence for achieving important personal and social goals and thereby contributing to the social development. Higher education provides an opportunity to reflect upon the critical social, economic, cultural, moral and spiritual issues facing humanity. Indian Education system stands on an experimental basis since independence. It is the outcome of several Education commissions set up by the government.

Education in ancient India was highly advanced as evident from the centers of learning that existed in the Buddhist monasteries of the 7th century BC up to the 3rd century AD Nalanda (Perkin, 2006). In these centers, gathering of scholars- - gurukula-- used to be engaged in intellectual debates-- parishads-- in residential campuses. A few of these centers were large and had several faculties. Till the eighteenth century, India had three distinct traditions of advanced scholarship in the Hindu gurukulas, the Buddhist viharas, and the Quranic madarasas, before the British set up a network of schools to impart western education in English medium (Perkin, 2006) The first such college to impart western education was founded in 1818 at Serampore near Calcutta. Over the next forty years, many such colleges were established in different parts of the country at Agra, Bombay, Madras, Nagpur, Patna, Calcutta, and Nagapattinam. In 1857, three federal examining universities on the pattern of London University were set up at Calcutta, Bombay and Madras. The existing 27 colleges were affiliated to these three universities. Later, more universities were established. At the time of independence in 1947, there were 19 universities and several hundred affiliated colleges (CABE, 2005a).

After independence, the Government of India has spent lot of money on higher education. In 1998, a world conference on higher education, organized by UNESCO, where 182 countries participated and resolved that development of higher education should be one of the priorities. But in real practice higher education in India has been suffering from various problems. India is having one of the largest systems of higher education in the world. The no of girl students are increasing in the

university education over the years due to the world social uprising and empowerment of woman. The evolving social and political climate in the country also has its impact in shaping and expending these changes in the compositions of workforce after the process of globalization. The sex composition of the workers has also been changing earlier, women were engaged in agriculture and related traditional industries like plantations etc. Now there are increasingly occupying white collar and executive positions. At present, India is experiencing low growth aprx. 9% long term average and spreading unemployment which has been principal source of concern on the economic sense. To achieve full employment no. of jobs should be raised by education in vocational stream and entrepreneurial line should be developed to create environment for enlarging our economic activities. All these rapid changes are brought in the era of Globalization. The term 'Globalization' means expression for describing the spread and connectedness of production through Communication technologies across the world. It has resulted in intertwined economic and cultural activity. With this global network social, political, economic and particularly information and knowledge networks are connected and result is advancement and changes in higher education.

The changes in higher education scenario in India are utterly fast, are phenomenal and continue to be inevitable. Private participation in professional education (especially management education, which is the most sought after option) has brought changes in the perception of the society in general and students in particular, from such education being a welfare activity to a business activity. Thus, as in other fields, the market forces have started dictating and would determine whether private institutes of higher education (also some time called as 'capital fee colleges', now known as 'self-financing institutes') as brands and students as consumers will survive, excel or go under. The study explores the expectation and perception of undergraduate and post graduate management students regarding quality and support services in their institute. It seeks to provide an insight to the responsibility bearers, entrepreneurs and policy makers of higher education by highlighting the differential perceptions of students at both the levels and would thereby aid in ensuring an impeccable higher education system. Higher education is critical to India's aspirations of emerging as a major player in the global knowledge economy. The global competitiveness of Indian industry and also its employment generation potential is clearly dependent on availability of required skills and trained personnel. But as several recent studies have revealed the overall state of Indian higher education is dismal and therefore poses a severe constraint on the supply of qualified manpower. Despite remarkable progress in reforms covering a number of sectors and sub-sectors of the economy, there is little informed debate on reforms in higher education. Higher education in India has expanded rapidly over the past two decades. This growth has been mainly driven by private sector initiatives. There are genuine concerns about many of them being substandard and exploitative. Due to the government's ambivalence on the role of private Sector in higher education, the growth has been chaotic and unplanned. The regulatory system has failed to maintain standards or check exploitation. Instead, it resulted in erecting formidable entry barriers that generate undesirable rents. Voluntary accreditation seems to have no takers from amongst private providers and apparently serves little purpose for any of its stakeholders. Higher education in India covers all post-secondary education beyond class twelve in different subject areas including all professional streams such as engineering and technology, medical, agriculture etc. It comprises three levels of qualifications - Bachelor's or undergraduate degree programmes, Master's or post graduate degree programmes and the pre-doctoral and doctoral programmes [Master of Philosophy (M.Phil.) and Doctor of Philosophy (PhD)]. Normally a bachelor's programme in India requires three years of education after twelve years of school education. In some places honours and special courses are also available. These are not necessarily longer in duration but indicate a greater depth of study. The bachelor's degree in professional field of study in agriculture, dentistry, engineering, pharmacy, technology and veterinary medicine generally takes four years, while for architecture and medicine, a bachelor's degree takes five and five and a half years respectively. There are other bachelor's degrees in education, journalism and librarianship that are treated as second degrees. A bachelor's degree in law can either be taken as an integrated degree programme lasting five years or a three-year programme as a second degree.

II.   WHY HIGHER EDUCATION?

If this question is so, then it is fair to reply that in India no. of universities has gone up from 20 in 1947 to 250 in 2002 and no of colleges from 591 to 8529 during same period. According to UNESCO World report Education Report 2000, at present, there is only one college for 11,000 students and one university over 4.7 lakh of students in the age group (17-23), which means that only 6.9% of the eligible age group only one getting the benefit of higher education. But in Thailand it is 19% and 41% in Argentina. Thus it is very much essential to expand our education up to 20% of those who are eligible to receive post graduate and graduate education in our country. A large no of private sector educational institutional institutions are gradually entering the area of higher education and consequently it is being commercialized. Now money power has replaced merit as the criterion. Quite a majority of eligible youth in India deprived of a chance to contribute to the nation building process because they do not have the means to pursue higher education. This is violation of constitutional rights of the Indian youths. India has not been able to achieve its

objectives to commit at least six percent of its Gross National Product on Education. If we look upon total expenditure on education in India that is 3.99% of GDP in (2001-2002). In (2002-2003) ,Govt. of India allocated Rs 2125 crore for the secondary and higher education against Rs 1920 crore. Higher education in India has always seen as a burden on national budget. The Govt. policy statement says that the state governments are to meet 90% of its expenses in education sector. In spite of these efforts most of the colleges and universities lacks basic facilities like libraries, laboratories. A research study says on development of higher education reveals that India's position is 76 out of the 94 developing countries of the world. It is also interesting to know that 68000 Indian students went to America for higher education in 2003. Whereas only 7791 foreign students were coming over India for Higher education during the same period. Till the late 1990s, the expansion of higher education largely took place through affiliated colleges. By then, many promoters of private unaided colleges began to realize that the regulatory mechanisms of the affiliating university and state governments were inhibiting their growth and did not allow them to fully exploit their market potential. The promoters were not able to make money from their educational enterprises. Such institutions explored the possibilities of wriggling out of the control of the state governments and the affiliating universities. Some of the institutions took the deemed to be university route to get the degree granting powers. Though, universities in the country are either set up by an Act of Parliament or State Legislature, however, certain institutions are also given the status of a deemed to be university in terms of section 3 of the UGC Act, 1956. Earlier this provision was used sparingly to declare premier institutions offering programmes at advanced level in a particular field or specialization as a deemed to be university to enable it to award degrees. Indian Institute of Science at Bangalore and Indian Agricultural Research Institute at Delhi were the first two institutions to be declared as deemed to be universities in 1958 for education and research at advanced level in the field of basic sciences and agriculture respectively.

A.   Distance education providers- Distance education in India had its genesis in the early 1960s. It started as correspondence education -- a supplementary method of education to meet the growing demand for higher education. Since then it has expanded rapidly, particularly over the last two decades. In 2005, there were 12 open universities [including the Indira Gandhi National Open University – (IGNOU)] and 106 dual mode university distance education institutes / centers in the country, catering to over 2.8 million students. Each year, nearly 1.3 million students register for various courses in these universities. (Garg et al, 2006). This was considered as an economical and a quick way of increasing enrolment in higher education.

B.   Self-financing courses in public institutions- Since the 1990s, there has been an acute resource constraint in public financing of the higher institutions. This had put a brake on the expansion of the public university system. Enterprising public institutions had no option but to start self-financing courses to meet the student demand. Higher education institutions charge the students tuition fees not only to cover the operating costs, but even generate surplus from self-financing courses. The courses were obviously offered in subjects having a demand in the market, such as engineering and technology, medicine, teacher education at the undergraduate level, computer applications and management at the postgraduate level.

C.   Foreign education providers- There is a craze for foreign education evident from the trend of a large number of Indian students going abroad for studies. Sensing a huge unmet demand for professional education, a number of small operations have sprung up in different parts of the country.

III. QUALITY CONCERNS IN HIGHER EDUCATION-

Indian Education system has already established linkages with international agencies Commonwealth of learning, SAARC and other UN organizations by coordinating programes at national and international level. The quality concern in higher education is also an agenda for discussion that should be taken seriously. Reports of various commissions and committees demand quality in higher education. **"Challenges of Education- The Policy perspective 1985"** states that the whole process of higher education is warped and disoriented and has become dysfunctional providing largely unemployable young men and women. This is serious issue that is concerned with quality. Quality concerns in higher education assume greater importance in the context of the General agreement on Trade in Services (GATS). GATS consist of a legal framework of regulations covering 16 services across 12 classified sectors including education. The trade in services in the education sectors occurs through four distinct modes of supply- Cross border supply, Consumption abroad refers to education, Commercial presence, Movement of natural persons across boundaries to provide education. Under GATS India has to allow the opening of foreign universities campuses on Indian soil and admit Indian students to their courses. Indian Universities can also open their campuses on foreign soil and admit their students too. In India quality concerns is being realized that there must be a balance between "quality and quantity" that drives the educational development in the most of the cases in opposite directions. This shift in accent from quantity to quality has obviously brought in a new implications and expectations in the role of higher education. **Quality concerns can be seen in --**

- **Curriculum,** which demands practical/vocational/professional/job oriented flexible and modular courses.

- **Infrastructure,** which should be strengthened with great deal of facilities like lecture halls, well equipped laboratories, adequate library resources, high speed terminals to access internet, facilities for sports, recreation facilities for special living facilities with good environment.

- **Concern for Teachers,** It includes quality and knowledge of teachers, high intellectual capabilities, self confidence, good communication skills, and professional development of teachers.

- **Concern for research,** It focuses upon research in various disciplines like education, industry, business, science and technology, mass media, literature etc in universities and colleges.

- **Concern for Students,** which includes necessary competencies in higher education like cognitive competencies, meta-cognitive, social, effective dispositions through seminars, workshops, personality building programmes and communication skills.

- **Concern for Management,** that should focused upon fair selection of managerial persons, emphasis on long term growth and avoidance of political interference, clear and fixed aims.

IV. CONCLUSION

Enrolment in higher education for the country as a whole increasing over the years, it varies widely across different states in India. These differences are not only linked to variation in government expenditure on higher education, but also to the per capita income, percentage of people below poverty line and the extent of urbanization in different states. The cost for higher education is to be essentially borne by the government or taxpayers (as grants), parents or their substitutes (as tuition fees), students and / or individuals (by availing loans or doing part-time work) and donors (individuals or institutional). Donation for higher education is not a universal phenomenon and plays an insignificant role in financing higher education in most countries. This is mostly found in the USA and the UK, and in a limited way in a few elite institutions with wealthy alumni in other countries. University Grants Commission (UGC) is the apex body for higher education in India. It is also the main funding agency of the central government. Whereas, around forty two technical institutions are funded by the central government directly, all others are funded through the UGC. Bulk of the expenditure on higher education is on revenue account and the capital expenditure is a negligible proportion of the total educational expenditure. Quality varies widely across institutions. Despite the general deterioration of quality, some institutions like IITs, IIMs, a few university departments and some affiliated colleges have maintained high standards. The deterioration of quality is most glaring in the state universities in general, and at the undergraduate level in affiliated colleges in particular. Conventional postgraduate education is also facing crisis and performs extended "babysitting" function because of lack of job opportunities for the graduates in India (Jayaram, 2006). India's standards of higher education compare unfavorably with the average standards in educationally advanced countries. Presently, there are three agencies that evaluate quality of institutions and / or programmes through an external quality assurance in the country. These are: the National Assessment and Accreditation Council (NAAC) set up by the UGC in 1994 to accredit institutions of higher education; the National Board of Accreditation (NBA) established by the All India Council of Technical Education (AICTE) in 1994 to accredit programmes in engineering and related areas; and the Accreditation Board (AB). In India, NAAC is organized as an Inter-University Centre under the UGC; NBA is under the AICTE and AB under the ICAR. Accreditation agencies are financially dependent - almost fully on the government. Even the cost of peer team visit is borne by the government grant. The Right to Information Act, 2005 imposes new requirements of transparency on the higher education institutions. Transparency in functioning helps them to build confidence of the various stakeholders. Transparency brings the institutional governance and administration into focus. There is a need for training and development of academic administrators and support staff in the universities and colleges throughout the country in a structured manner. The activity need not be confined only to the development of generic skills but also should focus on development of specific skills required by different groups of academic administrators in the system. A coordinated plan for the same through empanelled training providers could also be considered. Higher education institutions could be encouraged to earmark a specific budget for this purpose each year. Each institution could have a training cell or a suitable mechanism to identify the training needs and conduct and arrange programmes for the same. The key to improved institutional governance is the simplification of internal procedures on a continued basis, which needs special attention. The institutions can be benefit by sharing of the best practices on improved institutional governance. The higher education institutions in both public and private sectors need to work together with research laboratories and the industry for the

development of manpower in identified high technology areas. This would facilitate technology transfer when such highly skilled manpower migrates from the universities to the businesses

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Hospitality and Tourism Education and Training" -The Growth Story of National Council for Hotel Management and Catering Technology

Rohit Sarin
CTIHM, Shahpur,
Jalandhar

Rohit Sharma
CTIHMCT, Maqsudan,
Jalandhar

Aashish Atal
CTIHMCT, Maqsudan,
Jalandhar

Ramnik Kaur
CTIHM, Shahpur,
Jalandhar

Abstract-Vocational Courses like Tourism and Hotel Management courses run by universities and Institutes should focus at providing practical knowledge, skills and attitude relevant to the industry demand. However it has been found that little attention has been paid by these to the meaning and relevance of tourism education at institutes keeping in mind industries' demand. The purpose of this study is to examine the role of education and training in making student Industry ready and to identify the gaps that does creates problem in preparing students to meet the industrial standard. At the same time it also analysis what can or needed to be done to overcome these issues.

Keywords: Tourism Education, Training, professional growth, institutions, Curriculum and NCHMCT

I. INTRODUCTION

Today Tourism is considered as one of the main economic activity which is grown at a rapid rate in the last five decades at a global level. Tourism in recent years has maintained a global growth rate of around 5% (UNWTO). It is the third largest Industry in terms of its contribution to GDP. The direct contribution of Travel & Tourism to the world economy grew by 3.1% in 2013, contributing US$2.2 trillion to world gross domestic product (GDP) and 101 million jobs.1.4 million additional jobs were generated directly in the sector in 2013, and in total, 4.7 million new jobs were created as a result of tourism activity. The total contribution of Travel & Tourism to employment grew 1.8% in 2013.(WTTC Report) Due to gap between demand and supply, tourism industry faces the persistent challenge of recruiting and retaining a skilled labour force. Labour turnover is nearly double that of other industries and the skills gaps among tourism staff, skill shortages in particularly managerial/supervisory staff, are greater than in any other industry. (Martin, Mactaggart, and Bowden, 2006). India's tourism industry is experienced a strong period of growth which is derived by the burgeoning Indian middle class

and high spending foreign tourists with coordinated government campaigns to promote 'Incredible India'.Travel and tourism industry in India is one of them most profitable industries in the country and credited with contributing a substantial amount of foreign exchange. As during 2006, four million tourists visited India and have spent US $8.9 billion. In India the disposable income has gone up by 10.11% annually from 2001-2006, however where much of that is being spent on travel. Indian tourism Industry has also helped the growth in other sectors like horticulture, handicrafts, agriculture, construction and even poultry. India's ranking as per Travel and Tourism Competitiveness Report 2009 by The World Economic Forum:

II. CONTRIBUTION OF TOURISM INDUSTRY TO ECONOMY

In India tourism is the third largest export industry after Software and precious gems industry. With a contribution of 6.23% to the country's GDP and 8.78% of the total employment of the nation its economic significance is more pronounced. India witnesses about more than 5 million annual foreign tourist arrivals and 562 million domestic tourism visits. Indian Tourism Industry generated about US$100 billion in 2008 which is expected to increase to US$275.5 billion by 2018 at a 9.4% annual growth rate..The foreign direct investments (FDI) of Indian hotel and tourism industry which contributes to the Indian economy inflows are US$ 2.1 billion from April 2000 to March 2010, according to the Department of Industrial Policy and Promotion (DIPP).

The number of Foreign Tourist Arrivals (FTAs) in India during 2012 increased to 6.58 million from 6.31 million in 2011. The growth rate in FTAs during 2012 over 2011 was 4.3% as compared to 9.2% during 2011 over 2010. The growth rate of 4.3% in 2012 for India was better than the growth rate of 4% for the International Tourist Arrivals in 2012.

Table I Category of World Economic Forum

World Economic Forum	Category	Rank
Travel and Tourism Competitiveness Report 2009	Best tourist destination & for its natural resources	14th Rank
Travel and Tourism Competitiveness Report 2009	Cultural resources, World Heritage sites, rich fauna and flora and strong creative industries	24th Rank
Travel and Tourism Competitiveness Report 2009	Air transport network India	37th Rank
Travel and Tourism Competitiveness Report 2009	long-term (10-year) growth	5th Rank

The share of India in international tourist arrivals in 2012 was 0.64%, India's rank in international st th tourist arrivals declined to 41 , in 2012, from 38 in 2011. India accounted for 2.82% of tourist arrivals in Asia and the Pacific Region in 2012, with the rank of 11.The Ministry of Tourism plays a crucial role in formulating national policies and programmes as well as coordinating and supplementing the efforts of the State/Union Territory As regards the domestic market, the Ministry aims to popularize the existing and various new tourism products. Total hotel rooms in India,(Dept. of Tourism) is 1.7 billion with the annual growth rate of 8%. The report says 19,800 students are trained by various HMCT institutes which just meets 89% of the demand. According to the same study more grievous problem is that 40% of these graduates join other jobs.

Hospitality education today has become a popular career option and the National Council for Hotel Management Catering Technology and Applied Nutrition (NCHMCTAN) receives four times more applications than its fixed intake. India has almost 150 institutes in the approved category, including both public and private sector. There are 09 food craft institutes, which offer short term courses. These hospitality institutes generate 14,000 graduates, of which 4,000 are diploma and certificate holders. A survey by the Tourism Ministry indicates that there is a demand for 2.03 lakh skilled hospitality professionals every year of which 66 % is at skill level and 34 % at managerial level.The Ministry of Tourism has developed a master plan to increase intake in existing institutes. More craft and skill-level programmes have been introduced, while hospitality education has been broad based to include hospitality vocational courses at ITIs, polytechnics, at 10+2 level of CBSE and introduction of specific tailor-made skill testing and certification programmes.

In addition to this, the Certified Hospitality Trainer Programme aims to provide employment to meritorious students at IHMs from within its system and honouring them with the best of wages the industry has to offer. By the end of the 11th five-year plan, the target is to have 49 Institutes of Hotel Management and 31 Food Craft Institutes, plus a tourism management centre in the south. But there's a need to standardize the quality of hospitality education. And, students must be cautious of some of the hospitality institutions in the private sector before seeking admissions in them.
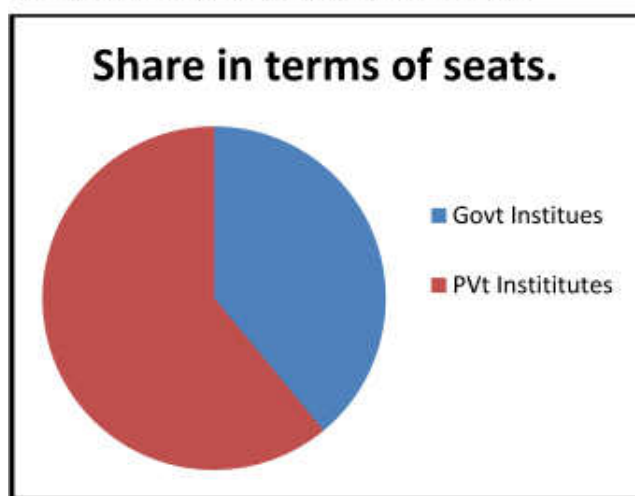

Figure 1. Sector data includes pvt NCHMCT institutes also.

III. COURSES FOR TOURISM

The top agencies throughout the country - Mercury Travels, SITA, etc. - usually take in college graduates as junior staff. But according to a career prospectus, it is advisable to have a diploma either in Public Relations or Advertising. Post graduate course in Travel Management can be pursued by graduates who may prove to be advantageous in providing managerial and administrative options in the industry.

- After Class XII (any subject) graduation in travel and tourism
- After Class XII (any subject) graduation in any subject (Public Relations/ Advertising) courses is relevant .This can be followed by masters in travel management.
- After Class XII (any subject) on the job training with a travel agency and certification course for IATTA / UFTAA / FIATTA

IV. SOME REPUTED INSTITUTES FOR TOURISM COURSES

IATA/UFTAA 4-level career development programme.

University of Delhi, New Delhi.

Kurukshetra University, Haryana.

Agra University - Agra.

Banaras Hindu University, Varanasi.

Bangalore University, Bangalore.

University of Madras, Chennai.

University of Calcutta, West Bengal.

Goa University, Goa.

University of Mumbai.

University of Poona, Nasik.

IITTM, New Delhi.

Himachal University, Shimla

Skyline Business School

Sita Academy (Travel & Tourism Management 1 year course)

Sri Venkateshwara University,Tirupati (Tourism and International Ticketing).

Chennai University, Chennai

V. EDUCATION SYSTEM AND MODELS

The increasing size and sophistication of the tourism industry has brought increasing pressure for a substantial upgrading of the professionalism and on-the-job capabilities of all its employees. There is a clear recognition that education and training is a lifelong learning process, a major challenge currently facing tourism is to attract and train the many young people required for entry level positions. In response to this challenge, a broad range of education and training programmes have been established.Institutions, both vocational and technical, have formed the traditional backbone of training for the industry. They are typically two to three years in duration, and lead to a diploma in various specialized areas. Examples of these include bartending, food and beverage preparation, hotel

sales and marketing, and motel operations. The major strength of their graduates is their ability 'to get the job done' very soon after entering the workforce. Even so, in certain areas (notably food production) a period of apprenticeship may be required.

At the undergraduate level, the hotel school model is the best-established approach. Perhaps the most internationally recognised programme of this type is located at Cornell University in the United States. Other well-regarded programmes, based on somewhat similar models, are at the University of Nevada at Las Vegas (USA), the University of Guelph (Canada), the Hague Hotel School (the Netherlands), and the University of Surrey (UK). Their most distinguishing characteristics have been their emphasis on preparing individuals to manage hotel and resort properties.

A general management with a tourism focus model of programming seeks to broaden the educational experience of students while still providing a strong industry orientation. its core emphasises general management education, but also includes the liberal arts, languages and mathematics as programme requirements. Rather than having students concentrate on more advanced courses in a particular functional area of business (as in a traditional management programme), this programme is structured to enable students to understand tourism by taking a number of courses related to its subsectors. In order to obtain some of the operational knowledge and skills provided by hotel schools, tourism programmes frequently include a number of practical work terms as an integral part of the learning process.

A second approach that is commonly taken is to adapt an existing MBA programme to include a tourism concentration. Here the core courses provide the student with a well-rounded grasp of management principles and their application. The tourism concentration provides an opportunity for students to immerse themselves in applications of management principles to specific areas (such as tourism marketing); and various other courses (such as tourism policy, tourism and the environment, destination management, tourism and the community, and tourist behaviour and management). While the traditional education system focuses on the training of those who are not yet employed, there is a parallel need to upgrade the skills of those currently in the industry, many of whom have not had the opportunity, or the privilege, of an extensive formal education. These individuals fall into two main categories, each having its distinctive training needs. Front-line staff requires skill-training programmes designed to ensure they know what must be done, and how best to do it. Such programmes are commonly termed standards and certification programmes. Initially, they rigorously define the skill sets required to perform each frontline job effectively. They subsequently teach these skills, and then test the ability of the individual to perform the required tasks. Those demonstrating the required ability are then certified in their trade.

VI. INDUSTRY PROFESSIONAL'S EXPERIENCE

Over 2,000 graduates emerge every year from hotel management institutes and almost all of them are recruited on campus by major hotel chains who are only too well aware of the imminent talent crunch in the hospitality sector. In reputable upscale hotel chains a trainee starts on a basic salary of Rs.8,000-10,000 which within five years is likely to swell into a remuneration package of Rs.25,000-30,000 plus liberal perks.Trained chefs who are at the heart of all catering operations, whether in a hotel or restaurant, can do even better earning Rs.10,000-15,000 per month as trainees and graduating to the position of executive chef with pay packets of Rs.1-2 lakh per month in five star hotels. With incremental globalisation, career opportunities in this field are not limited to India. International hotel chains which offer phenomenal pay packages have recently shown great interest in Indian hospitality professionals.

Moreover, given a few good breaks, a qualified chef could start her own restaurant. That's the experience of 20-something Kainaz Messman, who broke several glass ceilings when she inaugurated Theobroma, a patisserie-cum-restaurant in south Mumbai, in 2004 after graduating in kitchen management from the Oberoi Centre for Learning and Development, Delhi.

"Seven to eight years ago, the role of a chef was limited to gastronomy. Today a chef not only supervises the kitchen, she is often the star attraction and main draw of a restaurant. In India too, this is becoming the norm with many chefs having become celebrities," says Messman, whose pastries, brownies, desserts, chocolates etc fly off the shelves as soon as they arrive.

Born into a "foodie family" — her mother ran a pastry business from home — Messman's passion for cooking prompted her to enrol in the Institute of Hotel Management, Catering and Applied Technology, Mumbai in 1998 after completion of her Plus Two exam. In 2001, she was selected from among 24 applicants from across the country for admission into the post grad diploma programme in kitchen management of the Oberoi Centre for Learning and Development, New Delhi which enabled her to receive invaluable training in the group's chain of hotels across India. After graduating in 2003 she was inducted into the Oberoi group's Uday Vilas Hotel, Udaipur as a pastry kitchen executive.

According to Messman, technology has started playing a large role in kitchen management, so a chef must keep herself abreast of the latest kitchen technologies and techniques. "One has to constantly learn to progress. Recently, I went to France to learn to make chocolates, croissants and macaroons. I worked for a patisserie in Paris and later a chocolaterie. It was an amazing learning experience," says Messman who plans to promote a chain of patisseries and start a school as well.

VII. ABOUT THE DEGREE COURSE

The Bachelor of Science programme in Hospitality and Hotel Administration is offered jointly by the National Council for Hotel Management and the Indira Gandhi National Open University. The Three-Year programme equips students with all the required skills, knowledge and attitude to efficiently discharge supervisory responsibilities in the Hospitality sector. The programme also involves in-depth laboratory work for students to acquire required knowledge and skills standards in the operational areas of Food Production, Food and Beverage Service, Front Office Operation and House Keeping. The programme imparts substantial management inputs in area such as Sales and Marketing, Financial Management, Human Resource Management, Hotel and Catering Law, Property Management, Entrepreneurship Development, Computers with special focus on Tourism Studies.

VIII. JOB PROSPECTS FOR HOSPITALITY GRADUATES

1.	Management Trainee in Hotel and allied industry
2.	Guest/ Customer Relation Executive in Hotel and other Service Sectors
3.	Kitchen Management/ Housekeeping Management Trainee in Hotels
4.	Flight Kitchens also offer opportunities for career building
5.	Executive multi skilled in Fast Food Chains
6.	Hospital and Institutional Catering Executives
7.	Faculty in Hotel Management/ Food Craft Institutes (after earning industry work experience)
8.	Cabin Crew in National and International Airlines
9.	Catering Officer or Chef in Cruise lines
10.	Marketing/ Sales Executive in Hotel
11.	Executive in Tourism Development Corporations and Resort properties
12.	Hospitals catering and food service

IX. EXPECTATIONS FROM THE INDUSTRY

By 2020, Indian Tourism Industry is expected to contribute Rs 8, 50,000 crores to the GDP according to the World Travel and Tourism Council. Which means that every man, woman and child could become richer by Rs 7,000. Yet India is to realise its full potential from tourism. Tourism industry in India holds tremendous potential for India's economy which eventually provide impetus to other industries, create millions of new jobs and generate enough wealth to help pay off the international debt. This is the main reason that today it is included that Tourism is amongst the Core Sectors of the Indian Economy.

Other Reputable institutes:

- FHRAI Institute of Hospitality Management, Greater Noida

- M.S. Ramaiah College of Hotel Management, affiliated with Bangalore University

- Dina Institute of Hotel Management, Pune.

X. Conclusion

This paper has discussed about the current scenario of tourism and education sector and future scope of professionals in the industry. The entire study suggest suggests that the quality of educators and the quality of the educational material they use as being among the most important determinants in the success of a tourism education system. It's been further identified a number of issues affecting the success of efforts to prepare educators. Structural issues involve a range of contextual factors that create somewhat unique problems. These include the late arrival of tourism as a field of education and training, a lack of industry consensus on the need for education, the diverse nature of tourism/hospitality education and training, the multiple educational demands of a rapidly growing industry, the lack of institutional structures to support tourism education, a shortage of positions of tourism educators, and the lack of advanced level programmes to properly train tourism educators. Though NCHMCT have contributed its share in designing and structuring of the courses and modules still it needs to sort a range of professional issues that must be taken into account by individuals interested in pursuing a career in tourism education. The most significant of these are the lack of clear career path for tourism educators, and the conflict between the demand for a strong academic training as well as practical experience. These combined; create powerful forces that impact heavily upon both current and future educators. In addition, the need to develop a specialised disciplinary expertise, while achieving a broad interdisciplinary understanding of tourism, must be addressed by the committed educator. All of the foregoing, combined with pressure to gain international experience, while at the same time demonstrating a strong local commitment, creates strong pressures on the young instructor/ scholar. These pressures, added to a lack of well-developed supporting teaching materials, creates a serious challenge for administrators who seek to support the educational goals and efforts of future faculty members.

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Emergence of India as a Lead Market for Frugal Innovation and Identify the Major Driving Factors Towards Frugal Innovation

Mohd Shuaib
Dept. Of Mechanical Engineering
Jamia Millia Islamia,
New Delhi

Mohd Imran Khan
Dept. Of Mechanical Engineering
Jamia Millia Islamia,
New Delhi

Mohd Javaid
Dept. Of Mechanical Engineering
Jamia Millia Islamia,
New Delhi

Abstract-Innovation in emerging markets offers fertile ground for theory development. In recognition of the growing trend in "frugal innovation" discourse among practitioners particularly in emerging economies, we parse "frugal innovation" into "frugal" and "innovation" separately and present the underlying meanings towards understanding "frugal innovation" in historical and contemporary contexts. Access to "lead markets" is generally regarded as an important driver for the increasing globalization of innovation since these are considered to be early indicators for emerging customer needs. Frugal innovation is an important consideration for today business environment for success of many organizations. Frugal innovation has been emerging field of research in the few last years. The present paper addresses the need of exploring the field of frugal innovation. The study presented is an attempt towards identifying driving factors of frugal innovation.

I. INTRODUCTION

The buzzword in the 1990s used to be 'globalization'. In the second decade of the 21st century, the word that has gained sudden prominence, and with reason, is 'innovation'. The President of India has declared 2011–20 to be the 'Decade of Innovation'. From academia to industry, everybody is busy chanting this new mantra as though it were some sort of magic word, the mere pronouncement of which would rid one of all problems. In simple terms innovation' is the conversion of information into valuable knowledge and ideas and subsequently into a significant benefit that may take the form of new or improved products, processes, or services"[1].According to Nunes and Breene , [2]Frugal innovation involves designing solutions specifically for low-income market segments. Zeschky, Widenmayer &, Oliver [3] define frugal innovations as "good-enough, affordable products that meet the needs of resource-constrained consumers". India has been home to a series of disruptive and potentially game-changing innovations in recent years. Termed as "indovations" by the business press such innovations – e.g. GE's handheld electrocardiogram (ECG) Mac 400; the world's cheapest passenger car, Tata Nano; or Vortex's solar-powered Automatic Teller Machines (ATMs), Gramateller – may be regarded as products characterized by their affordability, robustness in dealing with infrastructural deficits, and (at least) "good enough" quality in a volume-driven market. Lead markets have been traditionally thought to exist in economically highly developed nations with high levels of per-capita income, customer sophistication and advanced physical and institutional infrastructure, to name but a few factors [4]. These factors have been considered important as they often induced innovations from firms seeking (new) business opportunities. Generally, only industrialized countries were regarded to be able to finance the high costs of research & development (R&D) efforts. [5]

A lead market can be defined as following

"A lead market is a national market, which primarily on account of the size of its domestic demand, its access to technological capabilities and its embeddedness in the global economy provides key innovation impetus to a particular category of products."[5]

Innovations are often motivated by resource constraints; forcing firms and users to think out-of-the-box and create solutions which can circumvent limitations imposed by the infrastructural and business environment. "Mangalyaan", the recently launched Mars mission of India forcefully documents this [34]. With a total cost of about $75 million this high tech product is reportedly less expensive than a passenger airplane. frugal innovation has emerged as a distinctive strength of the Indian innovation system while frugal innovation is not the preserve of India, and a growing community of analysts are tracking the development of the phenomenon worldwide, a number of factors have aligned to create the conditions for high–impact frugal innovation in India.

II. INDIA'S EMERGENCE AS A LEAD MARKET FOR FRUGAL INNOVATIONS

In this section we provide anecdotal evidence for emerging "global innovations" in India. Apart from attracting Off-shored engineering services, especially in the information technology sector [20] India is seen as attracting firms for functional, less expensive products with frugal engineering [19, 21]. The evolution of the value

chain in India has moved ahead to frugal innovations [23], a relatively new and still-emerging phenomenon, sometimes also referred to as the "Gandhian innovation" or "constraint-based innovation", for which the innovation value chain is generally, but not necessarily always, completely located in India [24, 22]. According to Beise [4], "Innovations that have been successful with local users in lead markets have a higher potential of becoming adopted world-wide than any other design preferred in other countries". Lead markets derive their strengths from factors such as their demand advantage, cost advantage, export advantage, market structure advantage, and technological advantage

[4, 5]. Large markets with young population that is faced with certain material and infrastructural deficiencies are seen to be providing an ideal experiment ground for many firms. With around 1.2 billion inhabitants, India is the world's second most populous country after China. It has seen sustained and uninterrupted growth rates of 5% and above for over a decade now. India has a large middle class which has kept growing ever since economic reforms were initiated in 1991. Estimates about its size vary from 50 million to 470 million. On educational front too, India has seen remarkable growth. Literacy rate in India, which stood at a meager 12% at the time of Independence (including deemed universities) increased from 20 to 611, while the number of colleges went up from 500 to 33,023 in this period (GOI, 2012a). There were 17 million students enrolled in India's institutions of higher education, of which 3.1 million were students of natural sciences. Another 2.9 million were enrolled in an engineering discipline [24]. There are no official figures available about the number of graduates per year. However, it is estimated that there are about 2.5 million graduates every years, out of which 2 million are proficient in English. The number of engineering graduates is estimated at 300,000 a year [24]. , the period after independence till 1991 when India tried to isolate itself in economic matters, it has for millennia engaged with the rest of the world, resulting in a multiethnic society with historical links to the Roman empire, Arabic countries, Eastern Africa, and the Far East [26,29]. "India's connections with the rest of the world go at least as far back as the Harappan civilization of 2500-1500 BC […]. It could be indeed argued that the India of today is the direct product of millennia of contact, trade, immigration and interaction with the rest of the world" [26]. India's vast diasporas, its socio-cultural proximity to several countries especially in the developing Asia, and the largely positive associations it has in the rest of the world point towards other advantages rooted in non-economic factors. As a consequence, India has emerged as a vibrant and versatile source for game-changing, disruptive innovations of various varieties [30, 31, 22]. Some prominent examples of innovations emanating from India

include the world's cheapest car the "Tata Nano"; "Mac 400", the handheld electrocardiogram (ECG) device of General Electric; and "Chhotu Kool", a battery-run small-size refrigerator of Godrej & Boyce [32, 33, 22], see Table .

Table 1: Some examples of recent disruptive innovations from India

Product	Firm (year of market introduction)	Market introduction Price in USD	Entry level price of existing, competing products
Tata Nano (car)	Tata Motors (2009)	$ 2,200	$ 6,500
Mac 400 (ECG machine)	General Electric (2009)	$ 1,000	$ 10,000
Chhotu Kool (fridge)	Godrej & Boyce (2009)	$ 70	$ 180
Pureit (water purifier)	Hindustan Unilever Ltd. (2005)	$ 43	$ 150
Swach (water purifier)	Tata Chemicals (2009)	$ 21	$ 150
Sakshat (tablet PC)	Indian Govt. & public institutions	$ 35	$ 500

The Twelfth Five Year Plan (2012–17) directs government support for innovation towards meeting national challenges. In his 2012 speech to the National Science Congress, Prime Minister Manmohan Singh clarified the drivers of science and innovation policy:

"The overriding objective of a comprehensive and well–considered policy for science, technology and innovation should be to support the national objective of faster, sustainable and inclusive development…Research should be directed to providing 'frugal' solutions to our chronic problems of providing food, energy and water security to our people…Science should help us shift our mindsets from the allocation of resources to their more efficient use."

III. IMPORTANT DRIVING FACTORS TOWARDS FRUGAL INNOVATION
A. Culture of *'jugaad'*

Jugaad is a Hindi word that roughly translates as 'overcoming harsh constraints by improvising an effective solution using limited resources.'[6]From connecting a diesel engine onto a cart to create a truck, to irrigation systems powered by motorbike, there are widespread examples of this kind of creative improvisation over India. The Honey Bee Network and SRISTI, the Society for Research and Initiatives for Sustainable Technologies and Institutions, have documented over 10,000 grassroots innovations of this kind, with a view to patenting them as validation of their intellectual and commercial merit.[8] The authors of Jugaad Innovation: Think frugal, be flexible, generate breakthrough growth[9]show how this mindset and adaptability are important not only to local innovations, but to multinationals whose innovation processes have become 'too rigid, insular and bloated to remain effective.' They suggest three reasons why this matters: *'First, it is* frugal: it enables innovators to get more with less. Second, it is flexible: it enables innovators to keep experimenting and rapidly change course when needed. Third: it is

democratic: it can therefore tap into the wisdom of otherwise *marginalized customers and employees.'* For some Indians, the association of frugal innovation with a jugaad mindset is limiting. It has connotations of 'making do' and of 'getting by' which overlook the increasing flows of resources into the innovation system. Yet the principles of seeking opportunity in adversity and methods of doing more with less apply even to advanced technologies.

B.   The middle-class day dreamers

Growth that has pulled millions of Indians out of poverty in recent years is also leading to the rapid growth of the country's middle class (households with disposable incomes from 200,000 to 1,000,000 rupees a year.) In 2007 the Indian middle class comprised 50 million people, roughly 5 per cent of the population. McKinsey projections show that by 2025 a continuing rise in personal income will cause this to grow at least tenfold. The middle class will comprise 583 million people, or 41 per cent of the population.[7] Despite low individual purchasing power, the overall size of the market creates huge purchasing power at lower income levels. In We are like that only, Rama Bijapurkar examines the total purchasing power of some of the middle groups: the 'aspiring' class (ranked fifth by wealth), for example, still has 65 per cent of the purchasing power of the most prosperous by sheer weight of numbers.[10]

C.   Price consciousness and experimental mind of more than half of the population

CK Prahalad's influential work corrected misconceptions of bottom of the pyramid consumers as undemanding. This is visible in sectors from consumer products to healthcare. As Joss Van Haaren, Head of Healthcare Research and Development for Phillips Bangalore, explains *"The first thing people are faced with when they arrive at a hospital in India is a payment counter. The nature of the system means patients have an awareness at a granular level of what treatments cost – it really makes a difference whether a treatment costs even 500 rupees or 700 rupees."* In India, over 70 per cent of healthcare is provided by private enterprise,[11]forcing providers to be extremely competitive, no doubt a factor in the highly efficient model of the Devi Shetty's Narayana Hrudralalaya hospitals. Like patients, private providers are very sensitive about what they pay for equipment and other necessary supplies. This is contributing to a rich seam of innovation in affordable healthcare.

D.   Bouncing demand for low cost services

India's vast rural population of 833 million[12] is spread across a land area of three million square kilometers.[13] Most poor Indians lack access to basic public services such as primary healthcare, drinking water and sanitation facilities. For example, one report claims that the Government of Bihar, a State of 100 million people, growing by at least a million people per year,[14] had not built a single secondary school for 30 years before 2009.[35] According to the International Energy Agency, 400 million Indians do not have access to electricity.[15] Necessity is sometimes the mother of invention, and with over 1.5 million NGOs, India has a strong tradition of civil society, and a socially conscious private sector that are willing to fill the void left by the government with radical new approaches.

E.   Frugal innovation-The need of era in business

While high–tech exports are growing fast [16] India, unlike China, doesn't overwhelmingly focus on manufacturing for export. Concentrate on looking for the 'Indian iPod' and you may overlook some of the more considerable influences of Indian research and innovation around the world. While the revolution provoked by India's software outsourcing story is well known, other stories of revolutionary business model innovation are less well known. Take the story of the Aravind Eye Hospital. From its beginnings as a modest 20–bed hospital in the 80s, Aravind had already grown into a 1,400–bed hospital complex by 1992. By then it had screened 3.65 million patients and performed 335,000 cataract surgeries. It now performs 200,000 surgeries a year. At the same time as running a profitable company, it delivered nearly 70 per cent of these operations free of charge to the poor. At the heart of its business model is multi–tiered pricing or cross–subsidisation – where the core service remains the same but profits from wealthier customers cover deficits from those less available to pay. This model has been imitated around the world.

F.   The pulling social finance sources

In addition to growing investment in frugal innovation by multinationals and global philanthropic foundations such as the Gates Foundation and the Wellcome Trust, there is a buoyant market in investment for social impact. In India, seven social venture capital funds have raised approximately £120 million and invested about £80 million in 72 social enterprises over the last six years.[17] Social investors like the Omidyar Network and the Acumen Fund are optimistic about the opportunities in India. The environment could develop rapidly, with government's plans for a new $1 billion 'inclusive innovation fund' already in train. Government committed a cornerstone investment of $20 million this summer that is attracting the attention of institutional and private investors the world over.

G.   Inclusive innovation policies

While little of the frugal innovation so far has been the result of government policy – indeed, some has been stimulated by the absence of public infrastructure and services – recent policies and public statements by leading politicians promote a uniquely 'inclusive model of innovation' for India. Government's willingness to capitalize on new approaches to innovation in technology platforms, connectivity and collaboration (particularly through the National Innovation Council) is turning India, according to one USAID director, into a *"laboratory for innovation in development."*[19] One initiative with vast potential to create a platform for future frugal innovation is not framed around innovation at all, but rather around social protection. The Unique Identity Scheme, headed up by the former CEO of Information Technology giant Infosys, is already the world's largest biometric database even though it is only a sixth of the way to collecting the retinal scans and fingerprints of all 1.2 billion Indians. That said, the Government is well aware of the potential of 'Aadhar' – the Hindi name for the scheme translates as 'foundation' or 'platform –to support innovation. Combined with mobile phone technology, this scheme could herald the transformation of everything from banking to the welfare state.

IV. CONCLUSION

India is fast emerging as an attractive global hub for low cost, frugal innovations. Its products are increasingly purchased in other developing nations of Asia, Africa and Latin America and in some instances in developed Western countries as well. The remarkable economic growth of recent years coupled with positive future outlook, a vast domestic

market, strong domestic technological base, a relatively open FDI policy enabling participation of foreign-owned firms and an institutional and policy framework offering relatively good protection for intellectual property rights are the factors at the core of this development. Another feature having a positive impact is probably the increasing overseas engagement of Indian firms which is making them known in other markets and thus creates positive country-of-origin effects. India is an emerging hub for conceiving and delivering innovative products and services in a profitable or value-generating manner to the underserved and the poor. As Mahatma Gandhi had said, 'True innovation happens when what you think, what you say, and what you do are in harmony.' India seems well on its path to some kind of innovative harmony. Innovations require not just inputs and capacity but also a political economy of reform. This involves creating a constituency for innovation where Government, academia, industry and the citizenry are all participants in the innovation movement. It is about creating an innovation eco-system not only concerned about creating high-tech products, but about enhancing the quality

of life for everybody by creating sustainable solutions and changing processes and mindsets. The time is right for India to blaze its own trail by creating a model of Inclusive Innovation specific to the country's needs and development goals.

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Technology Enhancement in Hotel Guestroom

Rohit Sarin
CTIHM, Shahpur,
Jalandhar
principal.ctihm@ctgroup.in

Rohit Sharma
CTIHMCT, Maqsudan,
Jalandhar
rohitrith@yahoo.co.in

Aashish Atal
CTIHMCT, Maqsudan,
Jalandhar

Rahul Hans
CTIHM, Shahpur,
Jalandhar

ABSTRACT-The present attempt is an exploratory research paper reviewing the various technologies that are being presently adopted or are in use in hotel industry. These technologies in the form of various facilities reflect the ever growing and changing expectations of the hotel guests. This paper also explores into a wide number of technologies and gadgets that enhances their business prospects and ensure long term sustainability of business processes. There is another dimension to it, hoteliers as a responsible corporate citizens are exploring the avenues in modern technology and devices to impact upon the environment like using energy efficient devices in their properties which not only help to lower the green house emissions but also prove cost saving for the business. . The challenge is to use, adopt and market such technologies without compromising on the customer satisfaction level. There is no specific research methodology adopted for the purpose and data used is mostly secondary data. The idea is to gain as much information and knowledge as possible about the new technologies that are adopted by the hoteliers these days to add value to their services and to position themselves as the environmentally responsible properties.

Kewords-Wi-fi,Gadgets,Sustainablity,Dimension,Customer Satisfaction

I. INTRODUCTION

The room sales forms the main source of hotels revenue. Now a days the customers are no more satisfied with the regular standard services like big beds, nice linen and clean rooms. Their expectations have grown, with the advent of new technologies and change of lifestyle. The technologies like Wi-Fi, internet, blue tooth and social media has become integral part of our life style, thus it is natural for the guests to expect them in their rooms also.According to Ken Kapikian, G.M of Sheraton University City Hotel," most of the customers are using latest the technology at home and look for similar kind of technologies when they are staying away from their home."(Microsoft 2008). According to another research carried by Brewer, Kim, et. al,[2008], 48% of hotel operators considered in-room entertainment as most important.

While the customers are increasingly getting technology savvy, at the same time the awareness about the environment is also increasing specially in the top-end market. Therefore it is getting increasingly important for the hoteliers to introduce new technologies that meet the growing expectations of customers and ensure environmental sustainability.

II. IMPORTANCE OF THE ENVIRONMENT AND TECHNOLOGY

With the unexpectedly growing rate of global warming and problems like ozone layer depletion, water contamination etc. There is growing global concern over the sustainable industrial growth which was rightly reflected in the Copenhagen Climate Conference 2009. Every country has committed to cut down its carbon emission like , the EU, Japan and United States have promised to cut carbon emissions by at twenty percent, twenty five percent and seventeen percent by 2020 respectively (Ames, 2009). With so much international pressure on national Governments. It is not surprising that new laws and regulation with stringent norms for pollution control by the industry is likely to be implemented in future, naturally hotel industry cannot escape from its responsibility. For sustainable business development hoteliers are now searching for panacea in the new technologies. This paper will also explore into business sustainability using guestroom technologies adopted by both hoteliers and owners.

With the right technologies and equipment in place, owners and management want to ensure that they create truly memorable experiences for their guests; eventually turn into improved yield. As travelers are increasingly aware and making daily choices to reduce their environmental impact for both at home, and in hotels where they stay. This paper also looks into how hoteliers positions their green credentials to the market by using both green technologies.

TABLE I TECHNOLOGIES IN-VOGUE IN HOTEL INDUSTRY

Area	Technology/ facility	Description
Guestroom security	Guest-room digital door viewer	Camera which provides review of visitors outside
	Guestroom door keysless entery	Remote control of the room by front office. Front office on request can lock and unlock the rooms from front office.
	Electronic door lock	Electronic card with magnetic strip when inserted door automatically opens up.
	RFID door lock	Radio Frequency Identification tag based room locking system
	Near Field Communication door security	Near Field Communication is a short-range wireless connectivity technology standard designed for intuitive, simple, and safe communication between

		electronic 11 devices. It combines the interface of a smartcard and a reader into one device			attractions or special events in town.
	Biometrics security door lock	Use of thumb print facility		In-room entertainment	Guests traveling with their personal digital devices, such as iPods, smart phones and laptops to connect their electronics devices and fully benefit from the room's entertainment system such as the LCD television to access their portable contents.
	"Sound" activated security door lock	Sound based sensors that recognize the unique sound and open the doors of room			
Information and Entertainment Facility	High Definition Television	High Definition Television (HDTV) is a video having substantially higher resolution than traditional television systems. High definition has one or two million pixels per frame; roughly five times that of standard definition television		Internet protocol television	Fully interactive guestroom entertainment, both wired and wireless internet access together with business center services made possible in one single network
	Internet Protocol Television	Internet Protocol Television (IPTV) delivers television programming via a broadband internet connection using Internet protocols suite. It requires a set-top box to deliver the programs		Virtual games	Gaming facilities include PlayStation 3, Wii as well as Xbox game stations all inside the comfort of the hotel guestrooms
	Liquid Crystal Display	A liquid crystal display (lcd) is a thin, flat electronic visual display that uses theLight modulating properties of liquid crystals	Guest Room Aminities	E-mini bar	Computerized stock management system that uses electronics sensors and Radio Frequency Identification (RFID) technology. Once the items being removed from the mini-bar, the sensor will be activated and recorded in the system
	Voice over Internet Protocol Phone	With the advance software, this technology gives guests to access a wide range of services available. . With a large color touchscreen liquid crystal display on the phone, guests can use it to make phone calls, set alarms, stocks and weather information, make restaurant reservations, wine lists selection and explore local		External multi snack displays in guestroom	Guests also have the options to select snacks placed on the automated tabletop trays or baskets outside the mini-bar. Once the guest lifts up the snacks from the tray, it will track the inventory levels and automatically add consumed items to the

		guest's room bill.
	Personal valet	Hoteliers are focusing automation systems in hotel guestrooms to provide their guests the convenience of controlling multiple functions in the guestroom via a single controller console, also known as personal valet. It enables seamless integration with airconditioning, lights, door security, and electronic safe, automated curtains operation as well as video and audio systems.
	ICE Touch – In-room concierge	Interactive Customer experience or ICE. It allows hotel guests to arrange all services within the hotel such as in-room dining, room make-up, dinning reservation and valet or bell-desk services all through a single system.
	Microsoft surface technology	Guests can reserve tickets to events, review the dinning menu from nearby restaurants and book a luxurious spa treatment; putting all the

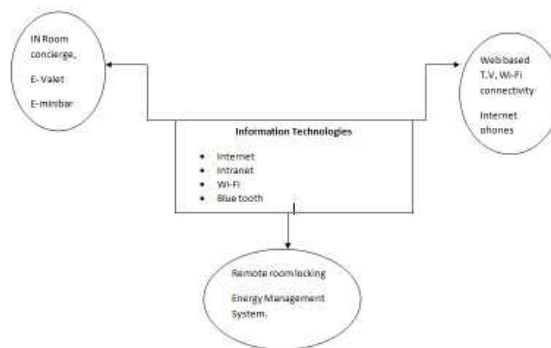|		offerings and experiences through the guests' fingertips with the interactive virtual concierge.
	Central Environmental Control – Energy Management Systems	Optimizing the use of energy consuming devices with the help of Microprocessors.

Figure 1 IT APPLICATION IN HOTELS

III. REVIEW OF LITERATURE

Supporting core business strategies coping with constant change, meeting high Customer expectations and improving the cost efficiency are constant challenges faced by hoteliers and property management. They have to continuously outperform and be able to position themselves above their competitors through constant innovations and creative ideas. Which requires adaptation of innovative.

According to Zeliha Aka, Sheraton Hotel and Convention Center Ankara, to be a market leader and win thecustomers, having efficient service is not enough. It has to be combined with smart room technology (Cisco, n.d). Business and leisure travelers are confronted with technologies adopted by hotels, which hoteliers hope to give travelers the feelings that they have the same or better technology in the guestroom as they do at home.

IV. LEVERAGING TECHNOLOGY FOR BUSINESS SUSTAINABILITY

Hotel industry is facing challenge due rising energy costs, environmental regulations,Rising consumer expectations and the competition. Meanwhile, consumers/guests are increasing becoming concerned about environmental agenda and is well informed about the issues on sustainable business and carbon footprint.

They are trying to do their part in being more environmentally responsible when they are on the road.Hotel companies are increasingly encouraging environmentally friendly practices and embracing sustainability through both developmental and operational strategies.Besides adopting the environment friendly architectural design, technologies adopted by hoteliers are focusing on energy management, waste management and water recycling etc.

V. DECIDING HOTEL IN-ROOM TECHNOLOGY

Part of the problem with guestroom technology has always been is providing enough of it to meet the guest's expectations without letting it become obtrusive. The question is whether these are enough for them or are they "over loading" with thedifferent types of electronics devices or technologies in the guestrooms for the guests.Finding the right selection of guestroom technologies has always been a balancing act between functionality, budget and the different types of target market segments which hoteliers will have to consider before investing into technologies to upgrade their hotel guestrooms or enhance their guests' experience.The desire to create the guestroom a home away from home has become more difficult with increasingly sophisticated modern technologies and devices use by consumers. It is not realistic to duplicate the home environment into a guestroom as most home installations are customized ndividually while the hotel guestrooms need to be carried out in large scale. Meanwhile, hoteliers expect the return on investment for these technologies invested will have a positive impact on their bottom line. Those technologies they selected to enhance the guests' experiences must also be able to generate revenue (Brewer et al., 2008). another issue is balancing the hotel in-room technology given the constrain of hotel infrastructures.Some hotels have less flexibility as their infrastructures cannot enable strategy, connectivity, and new technology. Today's hoteliers know that one of the ways to enhance guest experiences, create new revenue opportunities, and

VI. DIFFERENT GENERATIONS OF GUESTS

A. Baby boomers

The baby boomers belong to a group that requires something reliable and consistent.They are less experimental or adventurous. They would prefer devices and technologies that allow them to "plug and play" without going through the process of reading the operating manuals. However, they will have more income at their disposal and will be willing to spend it on luxury travel experiences as they enter retirement age.

B. Generation X

Generation X is now adults between the ages of 29 and 41. Key characteristics of Generation X include: quest for emotional security, independent, informality, and entrepreneurial ("Generation X," 2005). Generation X is entering their peak-earning years and they are the future business travelers. According to D.K. Shifflet & Associates, Generation X is already the most free spending of leisure travelers. They outspend baby boomers on trips involving a hotel stay. In 2004, Generation X spent roughly $1,297 per trip per person, compared with baby boomers' $1,155 (McMahon, 2005; De Lollis, 2005). As they are not brand loyal, they are willing to search persistently to find a place to stay that has style, rather than book the same chain hotel they used on family vacations in the 1980s (De Lollis, 2005). Gen X is the current business traveler and the traveler of tomorrow. Hoteliers are already working on how best to design their guest rooms to accommodate them.

C. Generation Y

The up and coming of Generation Y is also a large population and will be more dependent on the portability and connectivity of their technology devices in the near future (CeME, 2005). Gen-Y guests are an emerging market that is unique from Gen-X and the baby boomers. They execute their tasks, purchase event tickets, movie tickets and book hotel rooms through their mobile devices and not so much through the websites. Hotels must offer mobile-friendly online contents such as online room reservations and amenity booking which must be mobile-enabled. Therefore it is necessary for hotels toensure reliable internet connectivity throughout the hotel premises.

D. The Green generation

The next generation of guests has an inherent awareness of environmental responsibility and expects hotels they stay will somehow engaged in activities that will reflect social responsibilities and have positive impact to the environment. In view of this, hotels going green are no longer a trend, but rather a necessity so as to be part of the integrated decision made by guests to stay in the hotel. In order to have a sustainable business model for hotels, not only the hoteliers must have the right devices and the technology such as energy saving equipment or devices in the guestroom, but also able to meet the daily operational strategy for the property (Chandnani, 2010).

E. Multigenerational travel

The trend of playing-while-working will parlay into multigenerational travel. As the trend for parents having to work even during vacation being more common, there will be an increased in situations where extended families will be traveling together. For this group of travelers, besides having larger rooms,

hoteliers will need to have different amenities and different in-room technologies to meet their needs.

VII. CONCLUSION

With technology evolving in such a rapid pace, the key requirement for hotel's general managers and information technology directors in enhancing the guest experience is staying ahead of changes. The challenge here is in keeping up with the customer.

Increasingly, technology is being taken out of the hands of the hotelier and put into the hands of the guest allowing them greater control over their individual experience.Technology is changing rapidly and it is far easier for an individual to adapt than a corporation however forward thinking it may be.

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