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MAY 23 & 24, 2015

International Multi Track Conference on Sciences, Engineering & Technical Innovations

VOL - 2

Edited By
Dr Manoj Kumar

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Preface

This Conference Proceedings volume contains the written versions of most of the contributions presented during the **International Multi Track Conference on Sciences, Engineering & Technical Innovations (IMTC-15)** which was organized by CT Institute of Engineering, Management & Technology (CTIEMT), Jalandhar on May 22 & 23, 2015. This conference aims to disseminate the latest research in Wireless Network & Mobile Computing, Optical Communication, Software Engineering/Cloud Computing/Biomedical Signal Processing, Image /Speech Recognition, 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 Indian Space Research Organization (ISRO) and Punjab Technical University, Jalandhar.

The friendliness and candidness of IMTC-15 shall enhance the ability of all the delegates to grow by interacting with the experienced resource persons and young researchers. We would like to thank all participants for their contributions to the Conference program and for their contributions to these Proceedings. Sincere gratitude to the International Advisory Committee and the National Scientific Program Committee, whose members gave precious inputs and were always side by side with the Organizers.

My Gratitude is due to S. Charanjit Singh Channi, Chairman, CT Group of Institutions, Jalandhar, who has been really very encouraging and supportive. It is our pleasant duty to acknowledge the financial support from the Indian Space Research Organization (ISRO) and Punjab Technical University, Jalandhar.

This conference and the proceedings have been possible due to the unstinted support of the Management of CT group. A fundamental role in the conference preparation has been played by the local organizing committee and the members of the staff, each of which gave an outstanding contribution.

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

Dr. Manoj Kumar
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Keynote Address

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Head/ Senior Lecturer
Department of Entrepreneurship
University of Sri Jayewardenepura
Sri Lanka

Topic: Systematic View of Innovation: *Role of Universities in NIS of Developing Countries*

The systematic view of national innovation agenda has attracted much attention from the latter part of the 1980s and it is a popular research theme all around the world at present. Freeman (1988), Lundvall (1992) and Nelson (1993) are the renowned early contributors to this perspective, which is focused on interrelationships and interdependencies among the major actors of national innovation system that work to create, develop and diffuse new knowledge mainly for the commercialization of new products, services and processes. Similar discussions on the role of different actors such as government, universities and firms in terms of their contribution to the NIS have appeared even in the early studies of national innovations systems. Out of the three principal actors, universities and science and technology research centers are considered knowledge creators. They need to step forward to infringe innovation via government agencies and the industry, which is the back bone of the commercialization process. The prominent role of the university has been highlighted in the Triple Helix (Etzkowitz and Leydesdroff, 2000) focusing on the importance of knowledge creation for innovation. Interdependencies and the requirement for overlapping the roles of the three actors are highly emphasized in Triple Helix III through strong tight linkages among the actors.

Galli and Tuebal (1997) have discussed the transition of the national innovation system from system 1 (S1) to system 2 (S2), which emphasizes the operations of two sectors, business and university. Accordingly, S1 characterizes the national innovation systems in some developing countries such as Latin American countries, India and Russia as seen during 1980s and 1990s, with unilateral weak relationships. Further, it had been a closed system maintaining minimum interactions with outside world for foreign trade, limited knowledge and technology sharing with the protectionist economic policies. Similar kinds of unilateral flows and weak linkages continue to persist in most developing countries despite their being more open to the world than in the past. As increasingly complex changes are being introduced to the economic and business environment, Galli and Tueball (1997) recommend a transition from the traditional S1 to new S2, which is characterized by more openness to the outside world, more interactions with subsystems through interface units, centrality of the functioning of the system coupled with techno-economic capabilities, presence of interfacing units, and a restructured business sector. This view promotes universities' and business sector's having more linkages with the outside world. There are two other major focuses of this model; the first is establishing interface units in the university sector to promote industry-university R&D contacts directly or indirectly and, the second is the creation of technologies to connect industry with the outside world as well as among different businesses and sectors. As a result, new interrelations, linkages and transactions have appeared in the model in addition to the traditional unilateral linkages in the S1. Industry- university linkages are promoted aggressively through collaborative researches, training programs, knowledge and technology transfers stemming from a restructuring of the university sector with the UIU for mutual benefit. The role of large firms and capital goods suppliers is also emphasized, especially in providing the required facilitation for SMEs through funds and knowledge transferring within the business sector. As proposed here, technology centers act as a mechanism linking the outside world to the industries by providing hard and soft functions and producing technological capabilities relevant to firms as explained by Galli and Tuebal (1997).

Traditionally, universities were responsible for providing facilities mainly for higher education and performing basic research, resulting in their being known as teaching universities. Even at present, this remains unchanged in many developing countries. However, there is a growing need to link application with the interdisciplinary approaches in problem solving in the industries through a new institutional approach, as one of the major cornerstones of modern innovation systems (Galli and Teubal, 1997; Lee and Win, 2003; Arvanitis et al., 2008). Facilitating students to acquire practical experience (Klevorick et al., 1995) and sharing university infrastructure with industry for developing innovations (Galli and Teubal, 1997) are also suggested for mutual benefit.

There is a vital requirement for knowledge generated by universities and public research organizations, as it plays an important role in interactive innovation models and exemplifies how collaboration can reduce the uncertainty embedded in innovation processes (Guta, 2011). Hence, characterized with an interactive nature with the feedback in each and every point, the chain-linked model provides empirical evidence that new firms can emerge with new product ideas that individuals and firms identify from the market even though they do not

engage in investment based basic research (Drejer and Jorgensen, 2004). Organizations can use the market as a source of empirical knowledge and transform market ideas into commercial products, motivating entrepreneurs to seek existing latent knowledge (Hargadon and Fanelli, 2003; Metcalfe and Ramlogan, 2005). Further, the importance of collaborations and networks through Venture Capital (VC) Firms, Technology Transfer Offices (TTOs) and regional or government agencies for successful academic spin-offs have also been emphasized (Munari and Toschi, 2009).

This is an attempt to review the role of universities in the knowledge production process, not in a fragmented and isolated manner, but from the integrative and collaborative aspects. In addition, this paper intends to critically review the role of universities in the present context. It emphasizes the importance of stronger interactions with the business sector through the establishment of interface units such as incubators, business support services and consulting units, and joint research/technology programs. Further, the role of universities in terms of collaborating with the government and related institutions towards making policies, rules and regulations is also focused upon. The transition of knowledge infrastructure emanating from Mode I to Mode II (Gibbons et al., 1994) is discussed herein on the basis of the idea presented in *third mission* of universities. With this aim, the role of national universities in Sri Lanka has been studied empirically, with special emphasis on their contribution towards innovation and relationships maintained with the other main actors identified. Data on Sri Lankan universities have been collected through secondary sources such as published statistical reports and conducting in-depth interviews with high officials of the national (government) universities in Sri Lanka. It is expected to share the findings of the present study with other developing countries in order to strengthen the universities and other research and development institutions to build up the national knowledge infrastructure required towards promoting innovation.

Plenary Session

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Topic: Change Management

Management of Change – or Managing in Change…?

"The world is not a thing. It is a complex, never-ending, always changing tapestry".

Human beings are creatures with an internal urge to understand, rule and manage the world they live in. This has helped us advance from the level of "one of the primates" to an extraordinarily clever problem solver, developer, creator and facilitator that has, indeed, been able to multiply and fill and rule the world – as some of the holy scriptures of mankind demand us to do.

Some say man's success has been built on shortsighted exploitation of our environment and at the expense of other living things and the supporting structures keeping this whole planet alive. Even disasters fatal to all life on earth have been forecasted throughout centuries due to the often drastic changes and turbulence man's efforts have created.

Man is but one small actor in the vast network of variables forming this tapestry we have labelled with words such as our world, universe, cosmos and other names of this sort. Yet, our achievements have made us believe that we are omnipotent and in control of the development at all levels. In our effort to control and to lead the development in the direction we wish to, we create a lot of turbulence. Sometimes it is desirable, sometimes unexpected and unwanted movement of variables affecting us.

This presentation tackles rather briefly three topics:

1. The essence of change: One way to describe change will be given.
2. Change management: Is it possible and if so, to what extent?
3. Higher education and change: The role of universities in the management of change?

In our world we constantly are under the influence of three types of variables. Type one consists of variables we know and can affect and manage pretty well. Type two variables we know but can manage only to a limited extent and sometimes not at all. Type three variables are such that we do not even have clear knowledge of them. Yet, they do affect us in many, sometimes very dramatic ways. Some examples of all these will be given and their influence on us and our daily efforts will be described. Man's success has been able to diminish or even eliminate the influence of some earlier, fatal variables (famine, illnesses, even the effect of some natural disasters). Yet, some variables are still totally beyond our management powers. Paradoxically, our success has also created new variables that may be difficult or even impossible to manage. Turbulence in the tapestry has increased and the movement of variables has become quicker and more difficult to see in advance as a side effect of our development.

Due to the complex environment we are living in, change management has become more important than ever. At the same time it has become more difficult. Various types of analysis, strategic planning and other such traditional tools and methods are exploitable in understanding changes and preparing ourselves to face them. Yet, they may be ineffective and sometimes "blind" tools even in industry and commerce, not to mention in living a good life that after all should, perhaps, be the reason why we exist.

Higher education has a role in preparing those who will lead mankind to manage the ever more demanding challenges. Therefore, also some reasons will be given why teaching of critical thinking, decision making capacity and other meta-skills will become ever more important in change management – or managing in change, as actually, that is the best man as a small variable can do.

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Technical Session 1

ELECTRICAL ENGINEERING

A Practical Approach for Distribution Loss Reduction of 11KV Rural Radial Feeder Mullanpur Substation using Network Re-conductoring Method

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***Abstrac*t-The main aim of this study is to minimize the distribution losses by using Network Reconductoring. As average transmission and distribution losses in India have been indicated as 25 % of the total electricity generated. The main reason for high losses is consider being the use of low voltage for the distribution of power leading to high current which results in high losses. Therefore there is a large gap between demand and supply of Electricity. There are many reasons but one amongst them is different types of energy losses, all the Electricity Boards are interested in the loss reduction by applying different techniques, in this thesis a different approach of loss reduction has been discussed. Different algebraic equations have been derived, which are simple and straight, the field engineers can use these equations for installing optimum constant losses, for new installations and without any change in the basic structure for existing installations. But it is possible with help of effective, sensitive and automatic on/off switching system**

Keywords— network re-conductoring, power loss, substation

I. INTRODUCTION

The per capita energy consumption is a vital parameter for economic development of a country. The energy demand has been approximately increasing at a rate of 8.46% per annum and this energy demand can be expected to be met by increased generation giving priority to the quality of supply. The quality of supply will depend upon the transmission and distribution losses and its reduction will lead to efficient fulfillment of energy demand without wastage Energy conservation is the fastest, cost-effective and practical method of overcoming energy shortage. It is found that there is major scope of energy conservation in electrical distribution system and in consumer's installation . While using energy, a considerable amount of energy is wasted. It is estimated that there exists a potential of saving of about 30% energy used by us in daily life. In punjab, daily requirement of energy in peak hours is about 1200 MW. A 30% saving would yield a saving of more than 200MW, which is a considerable amount. This much saving would result in lowering power shortage significantly. The Conservation and efficient utilization of energy resources play a vital role in narrowing the gap between demand and supply of energy.

Normally, the Generation, transmission and distribution of electrical energy involve many operational losses. The technical losses occur naturally and are caused because of power dissipation in transmission lines, transformers, and other power system components . Considering all the points, this paper aims to analyze the ways to reduce losses in the practical field of Assam considering data of two substations.

In this paper two rural radial are considered as a field of analysis. The foremost objective of the distribution reform is to achieve efficient and quality power supply to the consumers at reasonable cost. The distribution system has about 30 to 40 % of total investments in the electrical sector, but nevertheless, they have not received the technological impact in the same manner as the generation and transmission systems. Ideally, losses in an electric system should be around 3% to 6% . In the advanced countries, it is less than 12%. However, in developing countries, around 20% of active power losses occur and so utilities in the power sector are now interested in reducing this distribution loss in order to be more competitive with the dependence of electricity prices on the system losses in deregulated markets. The transmission and distribution losses of India are among the highest in the world. Although, the transmission and distribution (T&D) losses in India is reported to be around (30-33) % but in real field it is much higher than this value. With the inclusion of the non-technical losses, the total losses go as high as 60-65% in many states with an average of about 35-40% accounting for an estimate of financial loss of around 1.5% of the national Gross Domestic Product .The major amount of losses in a power system occurs in primary and secondary distribution lines. There are certain factors contributing to the increase in the lines losses in the primary and secondary systems. Today over 21% (excluding power theft) of the total electrical energy generated in India is lost in transmission (4-6%) and distribution (15-18%). The electrical power deficit in the country is currently about 18%. Obviously, the

reduction in distribution losses can reduce this deficit considerably. So, the primary and secondary distribution systems must be properly planned so as to ensure it to be within acceptable limits.

There is possibility that the T&D losses can be brought down from existing approximately 50% to nearly 15% through various technical and commercial measures. One of the main reasons for having high losses in developing countries such as India is due to stretching of the distribution lines beyond the limits of the load centers, so also the increase of load abnormally without considering the current carrying capacity of the conductors and mismatch of generation and load causing imbalance in reactive power generation .Therefore, it is of utmost importance to select appropriate conductors in the distribution system because it determines the current density and the resistance of the line. The most preferred solution for problems like high losses and voltage drops is network reconductoring.

In this paper, Network reconductoring has been used as a measure to reduce the distribution losses for two particular area of Assam viz. Jalukbari and Zoo Road area. Network Re-conductoring is the replacement of the existing conductor on the feeder along with an optimal conductor size for optimal length of the feeder. There are certain factors contributing to the increase in the lines losses in the primary and secondary systems . Some of them are

A. Lengthy Distribution lines

In practice, 11 KV and 415 volts lines, remote rural areas are hurriedly extended over long distances to feed loads scattered over large areas. Thus the primary and secondary distribution lines in remote areas lay radially more frequently and usually extend over long distances. This results in high line resistance and therefore high I2R losses in the line which will affect the performance of the power system.

TABLE 1

Typical Loading Limits of 11 kV ACSR Conductors.

s.no	Conductor Size	area	Thermal Loading (A)	Resistance Ω/km	El l (A)	Bel l (A)
1	Squirrel	20	107	1.394	17	25
2	weasel	30	139	0.9289	23	34
3	rabbit	50	193	0.5524	35	69

B. Inadequate Size of Conductors ;

Rural loads are usually scattered and generally fed by radial feeders. The conductor size of these feeders should be adequate. The size of the conductors should be selected on the basis of (KVA x KM) capacity of standard conductor for a required voltage regulation.

II. CAUSES OF DISTRIBUTION LOSSES AND REDUCTION MEASURES

The cause for technical losses in power systems is due to energy dissipated in the conductors and equipments used for transmission, transformation, sub-transmission and distribution of power. The technical losses in our power systems are high especially in the distribution systems. The main issue in Distribution systems or rather more appropriately the issue confronting the power sector as a whole, is the reduction of Transmission & Distribution (T & D) losses to acceptable minimum levels. During the last few years some of utilities variously estimated the losses in the range over 30% to 50% much higher than the preceding years. Taking into consideration the Indian conditions such as far-flung rural areas, nature of loads, system configuration etc. the reasonable permissible (technical) . energy losses should be 10%-15% in different states. While the losses in Extra High Voltage (EHV) network are about 4%-5%, bulk of the losses occurs in distribution system. It is well known that these losses in Distribution systems include non-technical or commercial losses and that of power by various users with or without connivance of utility staff. These constitute a large component of overall losses. More than half of the T&D losses are commercial losses due to rampant theft & pilferage of electricity, meter tampering, unauthorized connections and un-metered supply.

It is, therefore, necessary to bring about improvements in planning implementation and operation of distribution systems in a scientific and efficient manner. Technical losses can be reduced and brought down to acceptable levels but cannot be made zero. The causes of high technical losses are varied and require different remedial measures to be implemented to bring them down to acceptable levels. Reduction of I2R loss in distribution systems is very essential to improve the overall efficiency of power system. Addition to that improving energy efficiency is probably the most profitable thing that can be done in the short term. This paper includes network reconductoring method as a short term measure for distribution loss reduction.

A. Network Re-conductoring

Network reconductoring is the technique where a scheme of replacement of existing conductor on the feeder by conductor of optimal size for optimal length of the feeder is done. This technique is used when the prevailing conductor is found to be no more optimal because of quick load growth. It is done when percentage loading of the conductor exceeds economic loading or to replace the deteriorated/off size conductor. The conductor's size is a very important parameter in curtailing the loss occurring in a distribution system as it determines the current density and the resistance of then line .From the studies of different conductor sizes it has

been found out that it is more economical to use conductors of higher cross sectional area. The replacement of existing line conductors by bigger sized conductors will result in reduction of technical losses in direct proportion to the ratio between the resistance of the new and existing conductor as a reduced conductor size can enhance I2R losses and an increase in the voltage drop which causes a loss of revenue as consumer's consumption is decreased and thus the revenue is also lowered.

The advantages of this method like increase in the feeder's capacity to handle expansion of load demand along with improvement of voltage profile undoubtedly leads to the reduction of the losses.The increase in the size of the conductors will require additional investment, which may not compensate for the reduction in losses.

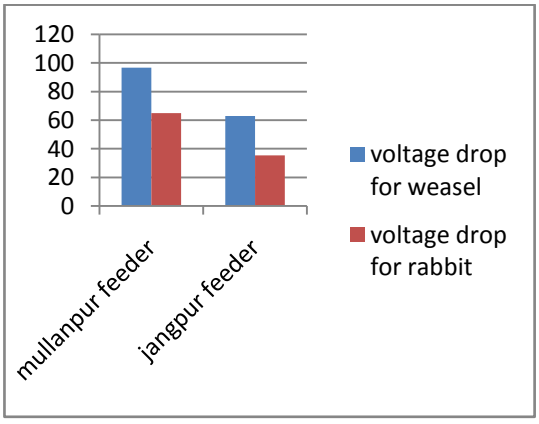
The most used practice is to find out whether the conductor is able to deliver the peak demand of the consumers at the prescribed voltages i.e. voltage drop must remain within the prescribed allowable limits as specified in the Indian Electricity Act, 2003. This scheme is much useful for the developing countries [6], where the annual growth rates are high and the conductor sizes are chosen to minimize the initial capital investment. Alternate conductors/cables may also be considered wherever suitable. The only defect with this scheme is that it leads to additional investment which increases the initial investment of the feeders

III. RESULTS AND DISCUSSION

Two substations under Guwahati circle is selected for analysis consideration. Here effort has been made to figure out the distribution losses of different areas and its causes were also discussed. Different methods are available for reducing the transmission and distribution losses [6] but we select network Re-conductoring method for our analysis. This paper includes investigation of two 11kv radial feeders i.e mullanpurand jangpur feeder,

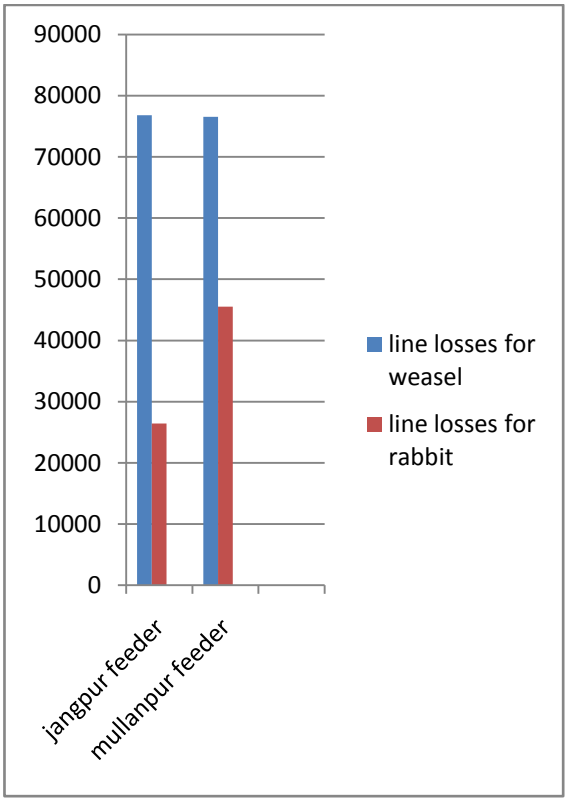
- Calculate voltage drop of both jangpur and mullanpur feeder with weasel conductor and rabbit conductor. then from above calculations graph is drawn as shown below

TABLE 2 Comparison of voltage drop



- Calculate Line losses of both jangpur and mullanpur feeder with weasel conductor and rabbit conductor. then from above calculations graph is drawn as shown below

Table 3 Comparsion of line losses



- Total saving of line losses by replacing 30mm conductor 50 mm or Total Saving in Units=62150
- Annual savings in rs/yr = Annual loss reduction in units × Unit price=372900
- Payback period = Total capital outlay / Annual savings

Payback period = 6.41yrs

IV. CONCLUSION

The work has been carried out with the objective to reduce the losses in the existing distribution system. Study of various techniques to reduce these losses is done and finally implementation of three techniques namely reconductoring or reconfiguration of existing under sized conductor or reduce to a great extent i.e. LT less system or less LT system to reduce losses and check power theft and finally replacing existing LT conductors by ABC cable to reduce losses in the power distribution network and increasing consumer satisfaction. Case study has been carried out to determine the annual loss savings, capital outlay of proposed schemes and then its payback period to check the financial viability of the proposed schemes. Implementation of the proposed

techniques to reduce losses and improve power quality is based on R-APDRP guidelines issued by Power Finance Corporation of India

From the study the following conclusions are drawn.

1) It is said that **'ENERGY SAVED IS ENERGY PRODUCED'** and reconductoring results in reduction in power losses and thus saves energy.

2) Reconductoring also improves voltage regulation at the consumer end and hence increases consumer's satisfaction.

REFERENCES

[1.] Chakravorty Sandeep, Ghosh Smarajit "Power Distribution Planning Using Multi-Criteria Decision Making Method" International Journal of Computer and Electrical Engineering, Vol. 1, No. 5 December, 2009, 1793-8163

[2.] Chakravorty Sandeep, Ghosh Smarajit (2009), "Distribution Planning Based on Reliability and Contingency Criteria", International Journal of Computer and Electrical Engineering. Vol.1 No. 2.

[3.] Dale M.Crawford and Stewart B. Holt(1975), "A Mathematical Optimization Technique For Locating Sizing Distribution Substations,and Driving Their Optimal Service Areas," IEEE. Trans. on Power Apparatus and Systems, Vol. PAS 94, No. 2, pp. 230-235.

[4.] H.A. Aalami1, M. Parsa Moghaddam, G.R. Yousefi "Modeling and prioritizing demand response programs in power markets" Electric Power Systems Research 80 (2010) 426–435.

[5.] Lin W.M(1997), "A new Approach for Distribution Feeder Reconfiguration for Loss Reduction and Service Restoration," IEEE PES.

[6.] Artac Taylan and Turkay Belgin (2005),"Optimal Distribution Network Design Using Genetic Algorithm," Electric Power Components and Systems, 33; 513-524.Cavallaro Fausto(2010)," Fuzzy TOPSIS approach for assessing thermal-energy storage in concentrated solar power (CSP) systems" Applied Energy 87 (201).

Electrical Analogy for Pulmonary Circulation in LABVIEW

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Abstract **In order to predict electronic circuit preview of pulmonary circulation. This mathematical modeling has been done. To do so electrical analogy of pulmonary circulation predicted. An idealized pressure-time and volume-time relation is introduced describing the varying degree of pulmonary circulation. The model gives satisfactory result with experimental data ,a dramatic pressure and volume result are occurred . MATLAB and LABVIEW software are used for analysis purposes. LABVIEW are used for data structure formation.**

I. INTRODUCTION

Electrical models are composed of network , each network representing a separate segment of the circulation. In electrical model pressure, charge and volume at the input and output of the corresponding segments of the circulation . The limitation of electrical models is that electrical capacitor have a number of characteristics that are not exactly to those of hydraulic compliance chamber. These characteristics include (a)the non linear pressure-time relation of compliance chamber (b) the non zero volume with respect to time in compliance chamber. The model cannot be show any collapse of vessels at the thoracic outlet. Pulmonary circulation is an indistinguishable part of circulatory system that converts deoxygenated blood to oxygenated blood by the action of lungs. The Right ventricle pumps blood to pulmonary arteries those take blood to lungs points where alveoli's helps the exchange of gases in blood and then this oxygenated blood with the help of pulmonary veins reaches at left atrium which is end point of pulmonary circulation. But in work extended pulmonary circulation, that starts from right Atrium and ends at left ventricle has been taken so as to design the effective proposed mathematical model of pulmonary circulation may be designed that contain systemic effect also.

a) Mathematical model:

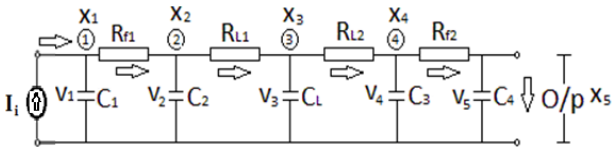


Figure:1

The model presented in this paper consist of a pumping heart coupled to lumped description of the systemic and the pulmonary circulation. The heart consist of four chamber :two ventricle and two atria. Two atria left atria and right atria are passive chamber separated from the ventricle via the mitral valve and tricuspid valve In above fig. shows that

I_i :input current (blood per unit time),
O/p: output current (blood per unit time),
C1: capacitance for Right Atria,
C2: capacitance for Right Ventricle v,
C3: capacitance for Left Atria ,
C4: capacitance for Left Ventricle,
CL: capacitance for Lungs ,
Rf1:forward resistance for right Atrioventricular valve,
Rf2:forward resistance for left Atrioventricular valve,
RL1:resistance of pulmonary arteries (from right ventricle to lungs),
RL2: resistance of pulmonary veins (from lungs to left Atria).
Mainly two method are used for calculation :

- Transfer function Technique and
- State Variable Analysis.

1) Transfer function Technique

$$T.F. = \frac{(s^4+7s^3+15s^2+10s+1)}{(s^4+8s^3+21s^2+20s+5)(s^4+6s^3+15s^2+10s+1)}$$

Where T.F is transfer function.

2) State Variable Analysis

$$x_1 = \frac{0.5\cosh(1.12t)}{e^{1.5t}} - \frac{0.3\cosh(1.12t)}{e^{2.5t}} - (0.01e^{-3.62t} + 0.05e^{-2.62t} + 0.18e^{-1.38t} + 0.95e^{-0.38t} - 0.2t - 1.2) + \frac{0.45\cosh(0.5)\sinh(1.12t)}{e^{2t}} + 0.8$$

$$x_2 = 0.6\cosh(1.12t)e^{-2.5t} + 0.027e^{-3.62t} - 0.072e^{-1.38t} - 0.89\sinh(1.12t)e^{-2.5t} - 0.448\sinh(1.12t)e^{-1.5t} - 0.2\cosh(1.12t) + 0.085e^{-2.62t} - 0.6e^{-0.38t} - 0.04t\cosh(1.12t)e^{-2.5t} + 12.02$$

$$x_3 = 0.2\cosh(1.12t)e^{-2.5t} + 0.234e^{-1.38t} - 0.034e^{-3.62t} + 0.02t + 0.7$$

$$x_4 = 0.2\cosh(1.12t)e^{-2.5t} + 0.027e^{-3.62t} - 0.072e^{-1.38t} - 0.89\sinh(1.12t)e^{-2.5t} - 0.448\sinh(1.12t)e^{-1.5t} + 0.7$$

$$x_5 = -0.3\cosh(1.12t)e^{-2.5t} - 0.011e^{-3.62t} - 0.189e^{-1.38t} + 0.052e^{-2.62t} + 0.948e^{-0.38t} + \frac{0.448\cosh(0.5t)\sinh(1.12t)}{e^t}$$

$$x_6 = 1 + (t + t^2 + 0.167t^3)e^{-t}$$

$$x_7 = \frac{t^2 + 2t + 1}{e^t}$$

$$x_8 = \frac{t + 1}{e^t}$$

$$x_9 = \frac{1}{e^t}$$

Here nine result is obtained from MATLAB software x_1 to x_9.

Software formulation for analysis of system

For analysis ,MATLAB software used for formulation of system. Before software used handwritten calculation are done by using transfer function technique. This technique will make a calculation easy and simple .

Transfer function approach.

```
num = [1 7 15 10 1];
den = conv([1 8 21 20 5],[1 6 15 10 1]);
T = tf(num,den)
step(T)
syms s;
syms t;
syms tau;
U=sym ('U(t)');
I=eye(8);
A =[-14 -84 -276 -521 -548 -296 -70 -5;1 0 0 0 0 0 0 0;0 1 0
0 0 0 0;0 0 1 0 0 0 0 0;0 0 0 1 0 0 0 0;0 0 0 0 1 0 0 0;0 0 0 0
0 1 0 0;0 0 0 0 0 0 1 0];
B =[1; 0; 0; 0; 0; 0; 0; 0];
X0 =[1; 0; 0; 0; 0; 0; 0; 0];
Phi = simple(ilaplace(inv(s*I-A), t));
X = simple(Phi*X0 + int(subs(Phi, t, t-tau)*B*U,tau,0,t))
pretty(X)
```

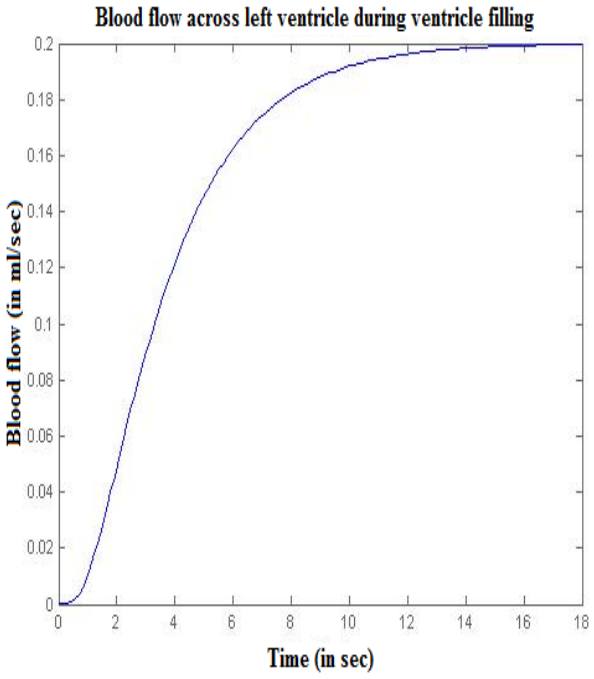
Where num is for numerator and den is for denumerator. Using MATLAB software nine result is obtained .

II. RESULT AND DISCUSSION

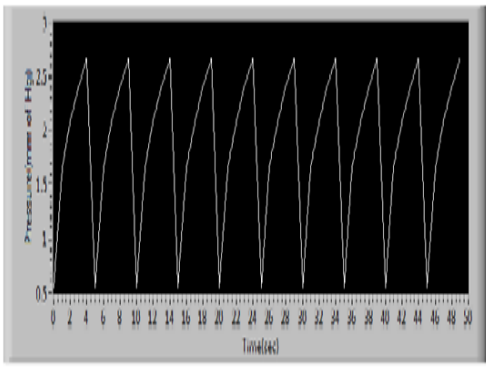
According to rahulgladwin.com the blood pressure in different heart chamber is absorb. In Right atrium minimum B.P is 0 and max. B.P is 8(mmHg). In right ventricle is min. 4(mmHg) and max. B.P is 25(mmHg). In pulmonary artery min B.P is 9(mmHg) and max. is 25(mmHg). In left atrium min. B.P is 2 and max. is 12(mmHg). In left ventricle min. B.P is 9(mmHg) and max. is 130(mmHg). In aorta min. B.P is 70(mmHg) and max. B.P is 130(mmHg). Right ventricular infarcts diminish pulmonary capillary wedge pressure and increase right atrial pressure.

Nine Results obtained from transfer-function approach.

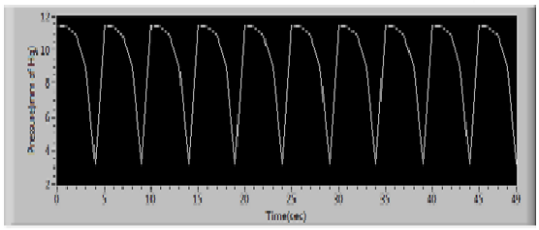
In fig. different variation of result obtained from calculation. These calculated result enters into the LABVIEW software. The pressure across right atrium can be increased when blood enter into the right atrium. After entering into right atrium the blood enter into the right ventricle through tricuspid valve. The pressure across right ventricle is abruptly rise and empty the right ventricle during contraction period. Blood flow from right ventricle to lungs through pulmonary artery by pulmonary valve. Pressure rise continuously. Pressure and volume in different zone have been calculated by this model. In these figure different pressure and volume level are seen.



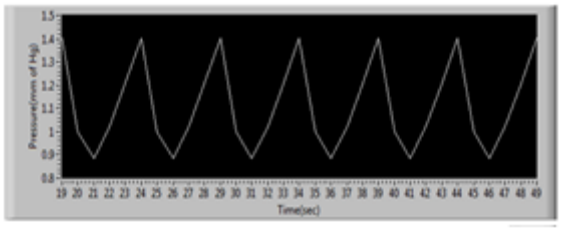
Variation of Pressure across Right Atrium



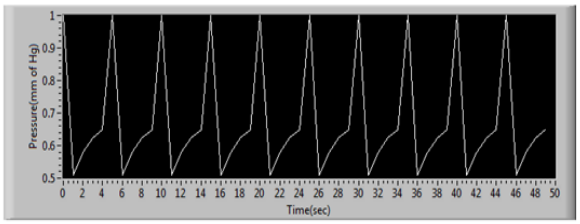
Variation of Pressure across Right Ventricle



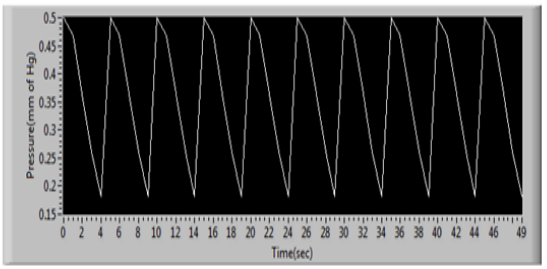
Variation of Pressure across Lungs



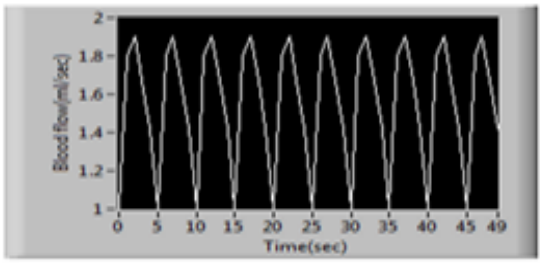
Variation of Pressure across Left Atrium



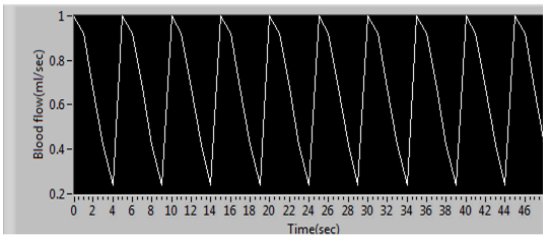
Variation of Pressure across Left Ventricle



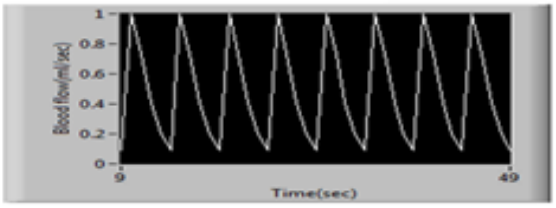
Variation of blood volume across Right Atrium



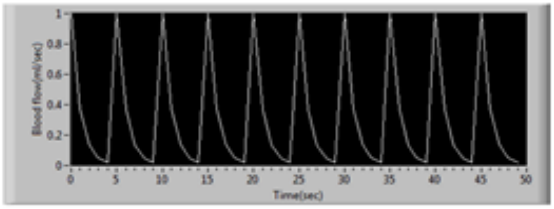
Variation of blood volume across Right Ventricle



Variation of blood volume across Left Atrium



Variation of blood volume across Left Ventricle



REFERENCES

[1]. Chaman Lal, "MATHEMATICAL MODELING FOR ANALYSIS AND SIMULATION OF PULMONARY CIRCULATION" *M. Tech Thesis, Dr. B. R. Ambedkar NIT Jalandhar, March-2012*

[2]. Marianne Catanho Mridu Sinha Varsha Vijayan "Model of Aortic Blood Flow Using the Windkessel E↵ ect", M. Tech thesis, October 25, 2012

[3]. Rosario Morello, Claudio De Capua, Francesco Lamonaca, and Maria Grazia Belvedere, "Experimental Validation of Revised Criteria for Pulmonary Hypertension Diagnosis by Uncertainty Evaluation", IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT, VOL. 63, NO. 3, MARCH 2014

[4]. Choon-Hwai Yap, Karl Thiele, Qifeng Wei, Arvind Santhanakrishnan, Reza Khiabani, Michael Cardinale,, "Novel Method of Measuring Valvular egurgitation Using Three-Dimensional Nonlinear Curve Fitting of Doppler Signals Within the Flow Convergence Zone, VOL. 60, NO. 7, 2013

[5]. C. W. Li, H. D. Cheng, "A mathematical model of Pulmonary Blood Circulation", Third Annual IEEE Symposium on Computer-Based Medical Systems, Clinical Assessment and Risk Evaluation Session 11, pp398-404, 1990

[6]. Einly Lim, Socrates Dokos, Shaun L. Cloherty, Member, IEEE, Robert F. Salamonsen,David G. Mason, John A. Reizes, and Nigel H. Lovell∗ , Senior Member, EEE", Parameter-Optimized Model of Cardiovascular–Rotary Blood Pump Interactions, VOL. 57, NO. 2, FEBRUARY 2010

[7]. K. Lu, J. W. Clark, F.H. Ghorbe1, D.L. Ware, and A. Bidan, “An integrated model of human Cardiopulmonary system”, 23rd Annual EMBS International Conference, October 25-28, Istanbul, Turkey, 2001

[8]. Y. Ma, Y. Wang, X. Cai, W. Wang, Y. Zang, S. Chan, “A non invasive auto estimation system for hemodynamic parameters of pulmonary circulation”, 19th IEEE Symposium on Computer-Based Medical Systems (CBMS'06), 0-7695-2517-1/06,2006

[9]. E. Lim, S. Dokos, S. L. Cloherty, R. F. Salamonsen, D. G. Mason, J. A. Reizes, and N. H. Lovell, “Parameter-Optimized model of cardiovascular rotary blood pump interaction”, IEEE Transaction on Biomedical Engineering, VOL. 57, NO. 2, 2010

[10]. N. C. Chesler, P. Argiento, R. Vanderpool, M. D. Alto and R. Naeije, “How to measure peripheral pulmonary vascular mechanics, 31st Annual International Conference of the IEEE EMBS Minneapolis, Minnesota, USA, 2009

[11]. N. C. Chesler, Alejandro, Roldan , Rebecca, R. Vanderpol, R. Naeije, “How to measure pulmonary Vessocular and right ventricular function”, 31st Annual International Conference of the IEEE EMBS Minneapolis, Minnesota, USA, September 2-6, 2009

[12]. J. Ye, T.T.C. Choy, “Modeling of pulmonary circulation via Electrical Bio-impedance technique”, IEEE 07803-0785-2, 1992

[13]. S. B. Hooper, “Role of luminary volume changes in the increase in pulmonary blood flow at birth in sheep”, Experimental Physiology (1998), Page 833-842, printed in Great Britain, 1998

[14]. M. Kozarski, K. Zieliński, K.J. Pałko, D. BoŜewicz, M. Darowski, “The Hybrid Pneumatic-Numerical Model of Lungs Metrological aspects of the design”, XIX IMEKO World Congress Fundamental and Applied Metrology, September 6-11, Lisbon, Portugal, 2009

[15]. O. L. Colón, J. A. S. Miguel and L. A. Zayas, “Bio-fluid mechanics of an Artificial Lungs”, Congress on Biofluid Dynamics of Human Body Systems at University of Puerto Rico, Mayagüez, July 10, 2004

[16]. A. D. L. Reyes, V F. Kappel, “A Mathematical Cardio-vascular Model with Pulsatile and Non-Pulsatile Components” Medical University Graz, SFB-Report No. 2010-11, March 2010

[17]. M. Rozanek, K. Roubik, “Mathematical Model of the Respiratory System– Comparison of the Total Lung Impedance in the Adult and Neonatal Lung”, World Academy of Science, Research program No. MSM6840770012, Engineering and Technology 30, 2007

[18]. J. Bohorquez, W. Sanchez, L. Turicchia, and R. Sarpeshkar, “An Integrated-Circuit Switched-Capacitor Model and Implementation of the Heart”, First International Symposium on Applied Sciences on Biomedical and Communication Technologies, pp. 1-5, 25-28. Digital Object Identifier, 0.1109/ISABEL.2008.4712624, October 2008

[19]. [A. C. Guyton, Hall JE, “A Textbook of medical physiology”. New York, Editions 11, 1996

Hybrid Solar - Biomass Plant for power Generation-A Review

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***Abstract*—Grid interactive renewable distributed generation (DG) has become one of the input drivers of varying energy situation in the world at a rapid pace. The need of hybrid power structure is increasing worth by the course of time. Hybrid energy system has been seen as a outstanding key for electrification of remote area where the grid addition is complex and financially not possible, that arrangement may be grouping of Solar photo voltaic(PV),Solar thermal, Wind , Biomass , micro-hydro , geothermal and additional generator for back up where the scarcity of one system can be fulfilled by others. Inconsistency and high primary investment are the issues related with solar power. Biomass power plant requires a large quantity of fuel which may not be existing in all the places and ocassions. Supply control in biomass fuel with changing solar radiations avoids the requirement of solar energy storage and eliminate the storage price. Here in paper, an attempt has been made to operate solar and biomass in parallel to produce steam from hybrid system for power generation. The hybrid system will utilize the local available energy sources.**

Keywords: Renewable energy resources(RES), Hybrid system, Solar PV , Biomass power, Rural electrification.

I. INTRODUCTION

Punjab is not rich in fossil fuel resources but it has plenty of renewable energy resources particular in solar and biomass. Punjab is leading in agriculture and contributes dominantly to the grain market of India. It produces 25% of the country's cotton, 22% of wheat and 55% of the country's area is under cultivation. Hydro and thermal power are the resources by which Punjab is meeting its electrical load. Hydro power requires constant availabilty of water. Thermal power generation is totally dependent on coal which arrives in India after covering large distances. Price of generating power from coal continues to escalate and therefore, it is harmful for the environment.

Energy saving is crucial subject today and Punjab has vast potential of solar energy about 300 sunny days annually and this renewable power cause is exploited by PEDA (Punjab Energy Development Agency).

II. PRESENT SCENARIO OF SOLAR AND BIOMASS PROJECTS PUNJAB

Source : PEDA

Table 1

SR. NO	Project	Commulative Achievements Up to Feb2014(MW)
1.	Biomass/Bagasse Cogeneration Power Project	389.59
2.	Biomass Power Projects(IPP) Independent Power Producer	62.5
3.	Solar Power Projects	10.825

III. LITERATURE REVIEW

Minna Ranjeva & Anil K. Kulkarni explains about the tool which is nick named HYPORA (for Hybrid power optimization for rural/remote areas) which capture not only technical base of renewable power but also account monetary factors including government payment facilities. It is programmed on Microsoft excel and can be used by engineers, scientists as well as common public, shareholders along with learners because of its customer easiness. The model takes into account the basic principles governing electrical power output from wind, solar and biomass system. It gives the basic idea of the trends and is reasonable estimate how to optimize the power output for a specified area.

Some authors proposed a paper in which a large amount of electrical power will be able to generated by focussed solar thermal hybrid power plant through storage scheme. Solar thermal power plant can not function steady state owing to variation of solar insolation. This paper suggests a optimal operating mode of hybrid STPP(Solar Thermal Power Plant) with biomass for continuous electricity generation as of renewable basis with optimized process. The storage coordination of STTP contributes to save biomass fuel thus increasing overall efficiency of the plant.

Some other group of authors explained the hybridization of biomass power plant by use of molten saline tower structure working on solar energy. The advantage of this amalgamation is elevated cycle efficiency with proven technologies which financiers can see operating successfully in the world. By combining these two sources a power plant could provide lower cost, dispatchable renewable electricity, base load with additional capacity during the day and evening as well as additional benefits by avoiding the burning agricultural residues in the field.

Other authors presents a paper in which the hybrid solar, biomass and battery system together with the air gap membrane distillation system(AGMD) generates electricity and water at a cost which is below the community ability to pay. This additional benefit of purifying water with the waste heat not only serves the energy and water needs of the community but also reduces the LCOE (levelized cost of electricity) of the entire system as an affordable technology for a sustainable rural development.

Rahul Mishra & Shakti Singh(2013) : proposed a work in which the potential of solar and biomass energy was estimated in a village of Punjab. This research provides a complete solution to meet energy demand of a village by RES .The optimization was done by HOMER(Hybrid Optimization Modeling Software). Hybrid energy system is widely accepted in area where grid extention is considered uneconomical. This document offer a improved sympathetic of exploiting renewable reserve in isolated/offgrid locations.

Some other authors design a model based results of the run parameters of a merged biomass solar thermal system with an included pellet burner and a temperature switch over to nourish solar energy as of a small collector field into the storage. The system was simulated with active thermal simulation situation TRNSYS by means of certified models. The manage approach of the off-the-shelf was execute via MATLAB. During this revise, it was depicted that the act of the specified system can be enhanced by optimizing the control parameters on a model based approach.

While others suggest different system works and their best possible amalgamation for the capable generation of electrical power by take advantage of nearby accessible resources. The representation within paper consists of solar PV , biomass and micro-hydro meant for the rural community using the HOMER software. The hybrid system by battery support generates 24 hour electricity supply to every household of the village at a unit cost which is less than the community ability to pay.

A company of authors recommended a hybrid power generation with technology using biomass gasifier and concentrated solar thermal processes(CSTP). The work shows that the results of gasifying agents and heat participation from CSTP on system effectiveness between observe parameters. As a result of rising heat input from CSTP, effectiveness of biomass to electricity was improved to 6.2-6.5% (from 39.9-41.2% to 46.1-47.5%).

T. Srinivas & B. V. Reddy(2014) : In this paper, hybridization of solar and biomass is proposed for energy generation to deal with the matters related with personage proficiency. The fuel effectiveness was augmented from 15 to 32% by contribution of solar energy. The alternation in fluid flow, power communication and acts were estimate with local time in unreliable solar emission situation.

Another group of authors presents a design optimization of biomass and solar power sectors. The optimization was done using HOMER software to get the best and optimal system. The optimum sizing was determined on the base of optimization and sensitivity analysis in order to get the best combination. The optimization considers components selected, its sizing and equipped approach to impart reliable and efficient system. Overall performance of the Hybrid Renewable Energy System (HRES) will be evaluated and finally analysis will be performed to get the optimal design of the HRES for the pilot area selected and thus further decisions can be taken according to the best results.

IV. CONCLUSION

Hybridization of solar and biomass energy was proposed for power generation to address the various issues related with the system. The efficiency of the system gets improved with the hybrid concept. The fuel efficiency of the system was also improved with the participation of solar energy to the biomass power plant.

This study suggests that cogeneration using HRES and AGMD provides an reliable energy and water services that meets the need of a rural population, so a feasible alternative for uphold rural progress. The proposed system will ensure 100% renewable resources to generate electricity. Last but not least solar and biomass are plentiful, secure, environment friendly and renewable resources of energy. It is green source of power generation. The result verified using HOMER software was much cheaper for electricity production but the selection of resources must be economical and sustainable.

Homer software plays an important role in renewable hybrid systems. It permits to appraise the fiscal and technological viability of a large figure of skill choices and report for distinction in technology cost and energy resource availability. It was designed for the village power program. It includes both scientific and fiscal issues engaged in the plan.

V. FUTURE SCOPE

As the Punjab has possible solar insolation which is approximately 4-7kwh/sq. m. There is bright future of hybrid solar and biomass system in Punjab as it is rich in agriculture and also vast potential of Solar insolation levels.

The combined system has the benefits of stability and providing power on environment affable origin. The intention to meet electricity requirement will be accomplish by good use of solar and biomass and thus meeting energy requirements.

In Punjab there is no such power plant till now. The combination of biomass and solar power energy system is beneficial to maximize the cycle efficiency with proven technologies. By combining these energy sources a power plant could provide lower cost, dispatchable renewable electricity as well as additional benefits by avoiding the burning agricultural residues in the field.

It has been proven that CSP(concentrated solar power)-biomass hybrid plant investment cost reduces by 43%. Such a hybrid power plant will be much beneficial to people of the remote areas so these should be developed in rural areas and thus sustainable development can be made. Being an agriculture rich state and wide solar insolation level, these

plants may overcome the shortage of supply exploiting local available resources.

REFERENCES

[1]. Shaheen Hasan Chowdhury, Amanullah Maung Than Oo, and Palash kumar Banerjee, "Biomass supported solar thermal power plant for continous electricity generation from renewable sources," Developments in renewable energy technology (ICDRET) 2012 , pp. 1-4,2012.

[2]. Minna Ranjeva and Anil K. Kulkarni, "Design optimization of a hybrid, small, decentralized power plant for remote areas," Energy procedia 20,pp. 258-270, 2012.

[3]. T. Srinivas and B. V. Reddy, "Hybrid solar-biomass power plant without energy storage,"case studies in thermal engineering 2, pp. 75-81,2014.

[4]. Florian Stift and Michael Hartl, "Model based optimization of a combined biomass-solar thermal system," Energy procedia 48,pp. 681-688,2013.

[5]. Yasuto Tanaka, Kentaro Umeki, Yutaka Tamaura. and Kunio Yoshikawa, "Performance of a hybrid power generation system using biomass gasification and concentrated solar thermal processes,"The 6th international conference on applied energy-ICAE2014, pp. 2149-2153.

[6]. Mohd Izhwan Muhamad, Mohd Amran Mohd Radzi, Noor Izzri Abd Wahab, and Hashim Hizam, "Optimal design of hybrid renewable energy system based on solar and biomass for Halal projects research institute, UPM," 2014 IEEE innovative smart grid technologies-Asia, pp. 692-696.

[7]. Mahmud Abdul Matin Bhuiyan, Anand Mandal, and Ujwal Kumar Thakur, "Optimum use of renewable energy resources to generate electricity via hybrid system," Kathmandu University journal of science, Engineering and technology, vol 9, no. 1, july 2013, pp. 212-221.

[8]. Ifegwu Eziyi and Anjaneyulu Krothpalli, "sustainable rural development: solar/biomass hybrid renewable energy system," 2013 ISES Solar World Congress, pp. 1492-1501.

[9]. Rahul Mishra and Shakti Singh, "Sustainable energy plan for a village in Punjab for self energy generation," pp. 640-647, 2013.

[10]. J. H. Peterseim, A. Tadros, S. White, U. Helwig, J. Landler and Kinneth Galang, "Solar tower-biomass hybrid plants- maximizing plant performance," SolarPACES2013 pp. 1197-1206.

[11]. Punjab Energy Development Agency.

[12]. Ministry of non renewable and energy sources.

[13]. Solar corporation of India

Power Electronic Control for Improved Wind Power Variability- An Overview

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Abstract: **One of the promising alternative energy source are renewable energy sources which bring new challenges when integrated to the power grid. Generated power from wind energy system is always fluctuating due to the fluctuations in the wind. According to the guidelines specified in IEC-61400 standard (International Electro-technical Commission) provides some norms and measurements. The performance of the wind turbine, power quality is determined. Active power, voltage sag, voltage swell, flicker, reactive power harmonics, are the major power quality measurements and electrical behavior of switching operation and these are measured according to national/international guidelines. The paper shows the various power electronic devices for electric power flow control and electric power quality improvements**

Keywords: Power Quality, Wind Generating System (WGS), Static VAR Compensators (SVC), STATCOM, Back to Back Converters.

I. INTRODUCTION

Since wind energy is a skill of variable output, it is important to consider as just one characteristic of a unpredictable, active electricity system. At maximum penetration levels, the variability of wind is measured by the normal variations of the load. The inherent flexibility and size of the power system are critical aspects in determining the system's capacity to house a maximum amount of wind power.

The inconsistency of wind energy wants to be examined in the wider perspective of the power system, rather than at the individual wind turbine level or wind farm. This shortage of coordination means that at the system level, wind energy can be extracted to offer steady output in spite of of the fact that wind is not accessible all the time at any particular site. So in terms of overall power supply, it is mainly inappropriate to consider the curve when a wind power plant produces nil power for a time, due to local wind conditions. Moreover, until wind becomes a important producer (supplying around 10 per cent of electricity demand), there is a small impact on net load changeability. Wind energy changes over time, mainly under the control of meteorological fluctuations. As the changes occur on all timescales, understanding these variations and their certainty is of key importance for the incorporation and optimal utilization of wind in the power system.

II. STATE OF THE ART OF GENERATORS FOR WIND TURBINE

Turbines can be divided into fixed speed (Type A), limited variable speed (Type B), or variable speed with either partial (Type C) or full (Type D) power electronic conversion. The various speed control types are implemented via the use of power electronics control. The a squirrel-cage induction generator (SCIG) is employed with the type 1 WTG which is directly integrated with the step-up transformer directly. In the figure 1. The turbine speed is fixed (or nearly fixed) to the electrical supply frequency, and when the turbine shaft rotates faster than the electrical grid frequency making a negative slip (positive slip and power is motoring convention) it provides real power (P).

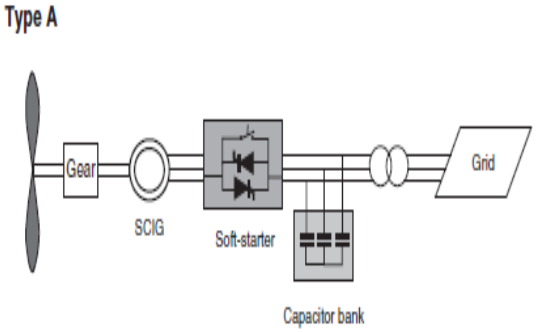


Figure 1: Typical Configuration of a Type A WTG

A main disadvantage is the reactive power drawn by induction machine for its excitation field and the huge currents the machine can draw when started. The turbine typically incorporates a soft starter and discrete steps of capacitor banks within the turbine to minimize these effects in a fashion similar to Type A, the type B turbines, wound rotor induction generators are connected directly to the WTG step-up transformer with regards to the machines stator circuit, but also comprise a variable resistor in the rotor circuit. See Figure 3.

To control the rotor currents quite rapidly so as to keep constant power even during gusting conditions, the variable resistors are connected into the rotor circuit softly and can and can influence the machine's dynamic response during grid disturbances.

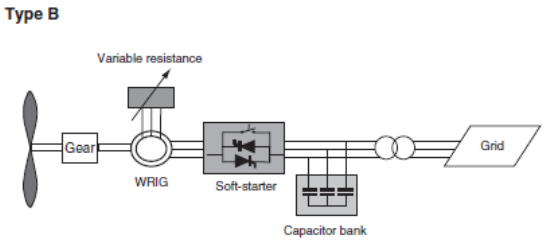


Figure 2: Typical Configuration of a Type B WTG

By adding resistance to the rotor circuit, it provides some ability to control the speed, with the blades' pitching mechanisms and move the turbines operation to a tip speed ratio to achieve the best energy capture.

By adding variable frequency ac excitation (instead of simply resistance) to the rotor circuit in the type 3 turbine, also known known as the Doubly Fed Induction Generator (DFIG), it takes the Type B design to the next level. The additional rotor excitation is supplied via slip rings by a current regulated, voltage-source converter, which can adjust the rotor currents' magnitude and phase nearly instantaneously. This rotor-side converter is connected back-to-back with a grid side converter, which exchanges power directly with the grid. See Figure 3.

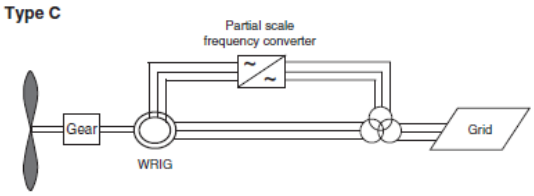


Figure 3: Typical Configuration of a Type C WTG

A major advantage of the DFIG — a great deal of control of the output is available with the presence of a set of converters that typically are only 30% of the rating of the machine. Thus, a small amount power injected into the rotor circuit can affect a large control of power in the stator circuit. The utmost advantage of the DFIG, is that it offers the advantages of separate real and reactive power control like a traditional synchronous generator, while being able to run asynchronously.

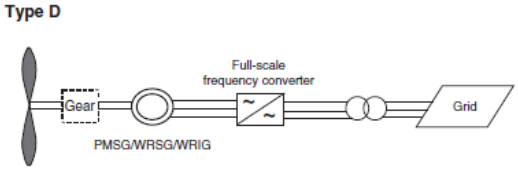


Figure 4: Typical Configuration of a Type D WTG

The Type D turbine (Figure 4) provides a great flexibility in operation and design as the output of the rotating machine reaches to the grid through a full-scale back to- back frequency converter and the turbine is allowed to rotate at its optimal aerodynamic speed, resulting in a "wild" AC output from the machine The construction of rotating machines of this type is similar to wound rotor synchronous machines, like conventional generators found in hydroelectric plants. The converters become both responsive and efficient due to advances in power electronic devices and controls in the last decade

A. *WIND ENERGY GENERATING SYSTEM:*

In this configuration, wind generations are based on constant speed topologies with pitch control turbine. because of its simplicity, it does not require a separate field circuit, it can accept constant and variable loads, and has natural protection against short circuit. The available power of wind energy system is presented as under in Eq.6

$$P_{wind} = \frac{1}{2}\rho A V_{wind}^3 \qquad (6)$$

Where ρ (kg/m) is the air density and A (m) is the area swept out by turbine blade, V wind is the wind speed in mtr/s. It is not possible to extract all kinetic energy of wind, thus it extract a fraction of power in wind, called power coefficient *Cp* of the wind turbine, and is given in Eq.7

$$P_{mech} = C_p P_{wind} \qquad (7)$$

Where *Cp* is the power coefficient, depends on type and operating condition of wind turbine. This coefficient can be express as a function of tip speed ratio γ and θ pitch angle. The mechanical power produce by wind turbine is given in Eq. 8.

$$P_{mech} = \frac{1}{2}\rho \Pi R^2 V_{wind}^3 C_p \qquad (8)$$

Where R is the radius of the blade (m).

III. POWER ELECTRONIC CONCEPTS FOR ENHANCED PERFORMANCE OF WIND TURBINE.

A. *Soft-starter*

The soft-starter's function is to reduce the in-rush current, thereby limiting the disturbances to the grid. Without a soft-starter, the in-rush current can be up to 7–8 times the rated current, which can cause severe voltage disturbances on the grid. (see Figure 1 & 3, Types A and B).

B. *Capacitor bank;*

The capacitor bank is used in fixed-speed or limited variable-speed wind turbines (see Figure 1& 3, Types A and B). It is an electrical component that supplies reactive power to Generators and Power Electronics the induction generator. Thus the reactive power absorbed by the generator from the grid is minimized.

C. *STATCOM – STATIC SYNCHRONOUS COMPENSATOR*

The STATCOM (or SSC) generates and/ or absorbs reactive power in which the output can be changed to control the specific parameters of an electric power system.

It is connected in parallel. It is solid state switching converter which independently controls real and reactive power at its output terminals when it is fed from an energy source at its input terminals. The STATCOM is a voltage-source converter from a given input of dc voltage produces a set of 3-phase ac-output voltages, each in phase with and coupled to the corresponding ac system voltage through leakage reactance.

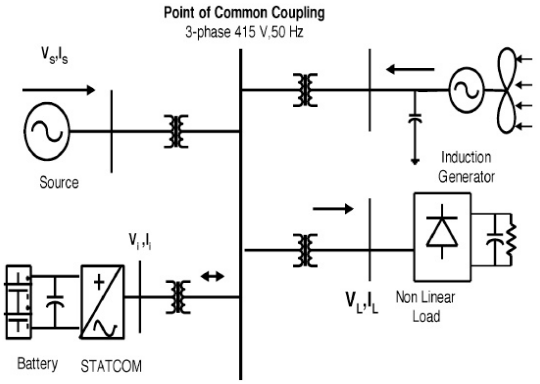


Fig.5. Grid connected system for power quality Improvement

The dc voltage is provided by an energy-storage capacitor. A STATCOM can improve power-system performance in such areas as the following:

1. The dynamic voltage control in Transmission and distribution systems and power-oscillation damping in power transmission systems;

2. The transient stability;

3. The control of voltage flicker control and it also controls real power in line when it is needed.

D. Static VAR Compensator (SVC)

The SVCs use the thyristor controlled reactors(TCR) which consists of a inductance in series with a bidirectional thyristor pair and thyristor switches reactors(TSR).

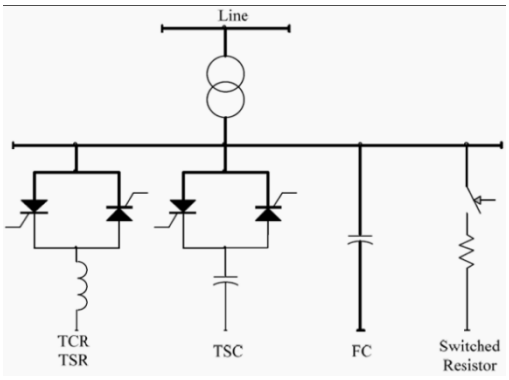


Fig.6 Static VAR Compensator

The current flow is controlled by adjusting the firing angle (from 90degree to 180 degree) of the thyristors.SVC outputs are continuous and do not cause sudden voltage changes on the system and are highly affective in regulating voltages.

But the TCR produces higher harmonic components currents in phase control mode. By connecting the TCR components in delta , the third harmonic components can be cancelled in the three phase system. More harmonic can be taken off by connecting additional filters elements.

E. Dynamic Voltage Restorer (DVR);

The DVR is a power electronic device that is similar in function to that of STATCOM and is used to control the WPP reactive power ,but is connected in series.

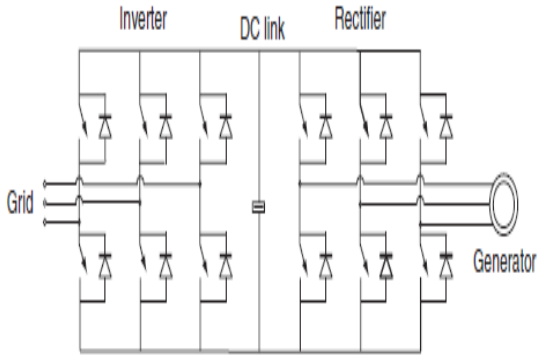
IV. APPLICATION OF POWER ELETRONIC CONVERTERS IN WPPS

A. Back to Back Converter

Working principle of Back to Back PEC

There are several types of PECs that are possible – the back to back converters, matrix converters, multilevel converters ,AC-link converters and others but the tried and proven PWM.

The back-to-back converter is a bidirectional power converter consisting of two conventional pulse-width modulated (PWM) VSC converters



Structure of the back-to-back frequency converter

Figure 7 *Back to Back PEC*

The capacitor between the inverter and rectifier makes it possible to decouple the control of the two inverters, allowing the compensation of asymmetry on both the generator side and the grid side, without affecting the other side of the converter. The power flow at the grid-side converter is controlled to keep the DC link voltage constant. The back to back PEC also allows independent control of both active and reactive power ,very much required by the grid operator.

B. Multilevel Power Converter

Presently, the multilevel power converters are known for medium to high-power, high-voltage wind turbine applications. the basic idea behind the multilevel converter technology is to form a sinusoidal voltage from several levels of voltages, typically obtained from capacitor voltage

sources. the several proposed multilevel converter topologies can be classified in the following five categories:

a)multilevel configurations with diode clamps,

b) multilevel configurations with bi-directional switch interconnection,

c) multilevel confiurations with flying capacitors,

d) multilevel configurations with multiple three-phase inverters,

e) multilevel configurations with cascaded single phase H-bridge inverters. These topologies are shown in Figure

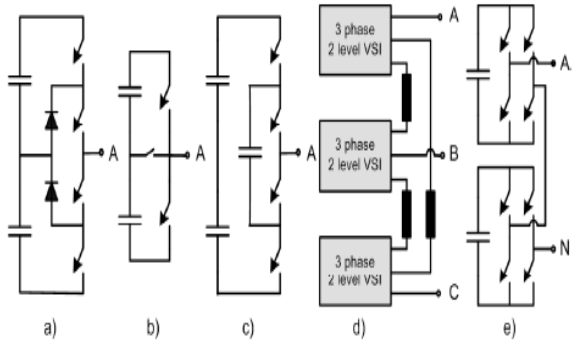


Figure 8.Multilevel topologies: a) one leg of a three-level diode clamped converter; b) one leg of a three-level converter with bidirectional switch interconnection; c) one leg of a three-level flying capacitor converter; d) three-level converter using three two-level converters and e) one leg of a three-level H-bridge cascaded converter

The main object of the multilevel converter was to have a higher voltage capability of the converters but, as the ratings of the components increases and the switching- and conducting properties improve, the secondary effects of applying multilevel converters become more and more advantageous. The decrease content of harmonics in the input and output voltage as well as a reduced EMI is reported .

C. Modular Power Converters

At reduced wind speeds and hence low level of the produced power, the full scale power converter concept provides low utilization of the power switches and thus increased power losses. Therefore, a scheme in which several power converters are running in parallel is used as shown in Figure

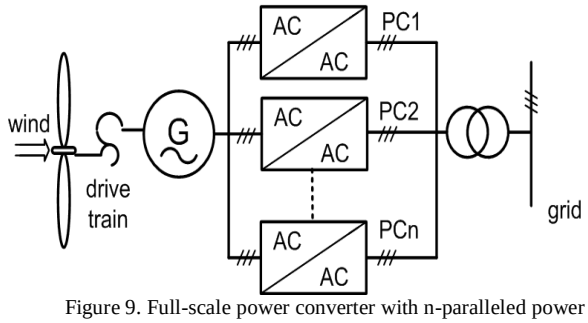


Figure 9. Full-scale power converter with n-paralleled power converters.

By employing power electronics many of the wind turbine systems get similar performances with the conventional power plants. The produced real power depends on the available wind speed and the reactive power can in some solutions like full scale power converter based wind turbines, be delivered without having any wind producing active power.

V. CONCLUSION

It is thus seen that PECs are an integral part of the WPPs that help them to be fully automatic and unmanned. Depending on the type and complexity of the PEC used, the cost of power electronic circuits continues to reduce, making them a cheaper alternative and rendering them as most widely used devices in WPPs. Therefore, more and more expertise is required to be developed to maintain such equipment at the local and national levels in order to reduce the downtime of the WPPs.

REFERENCES

[1.] K. S. Hook, Y. Liu, and S. Atcitty, "Mitigation of the wind generation integration related power quality issues by energy storage," *EPQU J.*, vol. XII, no. 2, 2006.

[2.] R. Billinton and Y. Gao, "Multistate wind Energy conversion system models for adequacy assessment of generating systems incorporating wind energy," *IEEE Trans. on E. Conv.*, vol. 23,no. 1, pp. 163–169, 2008.

[3.] J. Manel Carrasco, "Power electronic system for grid integration of renewable energy source: A survey," *IEEE Trans. Ind. Electron.*, vol. 53, no. 4, pp. 1002–1014, 2006.

[4.] M. Tsili and S. Papathanassiou, "A review of grid code technology requirements for wind turbine," *Proc. IET Renew.power gen.*, vol. 3, pp. 308–332, 2009.

[5.] J. J. Gutierrez, J. Ruiz, L. Leturiondo, and A. Lazkano, "Flicker measurement system for wind turbine certification," *IEEE Trans. Instrum. Meas.*, vol. 58, no. 2, pp. 375–382, Feb. 2009.

[6.] Indian Wind Grid Code Draft report on, Jul. 2009, pp. 15–18, C-NET.

[7.] C. Han, A. Q. Huang, M. Baran, S. Bhattacharya, and W. Litzenberger, "STATCOM impact study on the integration of a large wind farm into a weak loop power system," *IEEE Trans. Energy Conv.*, vol. 23, no. 1, pp. 226–232, Mar. 2008.

[8.] F. Zhou, G. Joos, and C. Abhey, "Voltage stability in weak connection wind farm," in *IEEE PES Gen. Meeting*, 2005, vol. 2, pp. 1483–1488.

[9.] R. S. Bhatia, S. P. Jain, D. K. Jain, and B. Singh,"Battery energy storage system for power conditioning of renewable energy sources," in *Proc. Int. Conf. Power Electron Drives System*,Jan. 2006, vol. 1, pp. 501–506.

[10.] S. W. Mohod and M. V. Aware, "Grid power quality with variable speed wind energy conversion," in *Proc. IEEE Int. Conf. Power Electronic Drives and Energy System (PEDES)*,Delhi, Dec. 2006.

[11.] Fu. S. Pai and S.-I. Hung, "Design and operation of power converter for microturbine powered distributed generator with capacity expansion capability," *IEEE Trans. Energy Conv.*, vol. 3,no. 1, pp. 110–116, Mar. 2008.

[12.] J. Zeng, C. Yu, Q. Qi, and Z. Yan, "A novel hysteresis current control for active power filter with constant frequency," *Elect. Power Syst. Res.*,vol. 68, pp. 75–82, 2004.

[13.] M. I. Milands, E. R. Cadavai, and F. B. Gonzalez, "Comparison of control strategies for shunt active power filters in three phase four

wire system," *IEEE Trans. Power Electron.*, vol. 22,no. 1, pp. 229–236, Jan. 2007.

[14.] S. W. Mohod and M. V. Aware, "Power quality issues & it's mitigation technique in wind energy conversion," in *Proc. of IEEE Int. Conf. Quality Power & Harmonic*, Wollongong, Australia,2008.

[15.] Saeid Eshtehardiha, Mohammad Bayati poodeh and Arash Kiyoumarsi, "Optimized Performance of STATCOM with PID Controller Based onGenetic Algorithm." In International Conference on Control, Automation and Systems 2007, Oct.17-20, 2007 in COEX, Seoul, Korea

Comparison of Backstepping and DSC Tehniques for The Control of Non-Linear System

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***Abstract*—The aim of control system design is to satisfy performance objectives i.e. disturbance rejection, stability, accurate input tracking and insensitivity to parameter uncertainty. Control methods are generally classified into linear control method and non-linear control method. Back stepping is a recursive Lyapunov-based scheme and can directly use for the control of non-linear systems. But conventional back stepping although systematic, suffers from severe problem of 'explosion of terms' which arises due to repeated differentiations of virtual controllers. In order to tackle this problem, a new approach called dynamical surface control (DSC) was first introduced by Swaroop et al. In DSC, a first order filtering of the synthetic input is carried out at each level of the traditional back stepping design and was implemented for automated control of passenger vehicles including the throttle & brake dynamics.**

Key word: Back stepping, dynamic surface control (DSC)

I. INTRODUCTION

Control is used to modify the behaviour of a system so it behaves in a specific desirable way over time. The aim of control system design is to satisfy performance objectives i.e. disturbance rejection, stability, accurate input tracking and insensitivity to parameter uncertainty. Control methods are generally classified into linear control method and non-linear control method. In linear control design, we first lay down the quantitative specification of the closed loop control system and then synthesize a controller which meets this specification. However, systematic specification for non-linear systems is much less accurate because the response of the non-linear system to one command does not reflect its response to another command. Non-linear control deals with the modelling, analysis and the design of the control system contain at least one non-linear component. In the design, we are given a nonlinear plant to be controlled and some specifications of closed-loop system behaviour, and our task is to design a controller so that the closed loop system meets the desired characteristics. Considered a typical system block as shown below:

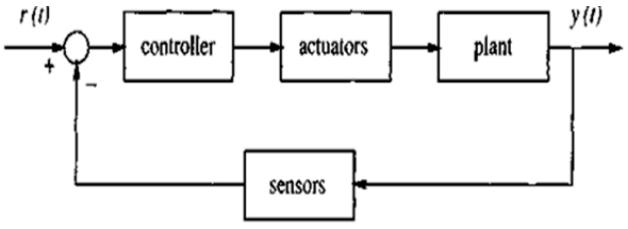

Fig.1 Block diagram of control systems

It is composed of four parts: a plant to be controlled, sensor for measurement, actuator for control action and a control law usually implemented on computer. Non-linearity may occur in any part of the system and thus make it a non-linear control system.
One method is to linearize the system by approximate transformation. The well linear technique is as follows:

PID Control

Local linearization and Gain Scheduling

Feedback Linearization

Some design technique directly use non-linear tools and are the example of robust non-linear control. Our main consideration is here to design a control law which is based on the lypunov direct method and determine the stability properties of non-linear system by constructing a scalar "energy-like" function for the system and examining the function time variation. The basic philosophy of the lypunov direct method is the mathematical extension of the physical observation: if the total energy of the mechanical (or electrical) system is continuously dissipated, then the system whether linear or non-linear must eventually settle down to the equilibrium point. Many feedback control techniques are based on the idea of designing the feedback control in such a way that a Lyapunov function, or more specifically the derivative of a Lyapunov function, has certain properties that guarantee boundedness of trajectories and convergence to an equilibrium point or an equilibrium set. There are various such methods:

Lyapunov Redesign

Nonlinear Damping

Back stepping

Sliding Mode Control

II. BACKSTEPPING

The back stepping approach, a recursive Lyapunov-based scheme, was proposed in the beginning of 1990s.This technique was given by Krstic, Kanellakopoulos and Kokotovic [1]. The idea behind this technique is to design a controller by considering some state variables as virtual control and then design an intermediate control law for them.

A. Illustrative Example

Considering the following system,

$\dot{x}_1 = x_2 + x_1^2$
(1)

$\dot{x}_2 = x_3 + x_2^2$
(2)

$\dot{x}_3 = u$
(3)

Control Objective: To design a state feedback control to asymptotically stabilize the origin.

*Step **1**:* Defining$z_1 = x_1$, the dynamics of the new coordinate

$\dot{z}_1 = x_2 + x_1^2$

Defining a virtual control law for (2), sayα_1, and let z_2 be an error variable representing the deference between the actual and virtual controls, i.e.

$z_2 = x_2 - \alpha_1$

Rewriting (2) in terms of the new state variable,

$\dot{z}_1 = z_2 + \alpha_1 + x_1^2$

Objective is to design a virtual control law α_1 which makes $z_1 \to 0$

Consider a control Lyapunov function

$V_1 = \frac{1}{2} z_1^2$

The time derivative of which becomes

$\dot{V}_1 = z_1(\alpha_1 + x_1^2) + z_1 z_2$

We can now select an appropriate virtual control α_1, which would make the first order system stabilizable.

$$\alpha_1 = -c_1 z_1 - x_1^2$$

Time derivative of V_1 becomes

$\dot{V}_1 = -c_1 z_1^2 + z_1 z_2$

Step 2: Deriving the error dynamics for

$$z_2 = x_2 - \alpha_1$$

$$\dot{z}_2 = x_3 + x_2^2 + (x_2 + x_1^2)(c_1 + 2x_1)$$

Define a virtual control law α_2 and let $z_3$be an error variable representing the difference between the actual and virtual controls

$z_3 = x_3 - \alpha_2$

The control objective is to make $z_2 \to 0$. Choosing a control Lyapunov function $V_2 = V_1 + \frac{1}{2} z_2^2$
Taking time derivative gives
$\dot{V}_2 = -c_1 z_1^2 + z_2(z_1 + \alpha_2 + x_2^2 + (x_2 + x_1^2)(c_1 + 2x_1))$
$+ z_2 z_3$

Selecting an appropriate virtual control α_2 to cancel some terms related to z_1, x_1 and x_2 .

$$\alpha_2 = -z_1 - c_2 z_2 - x_2^2 - (x_2 + x_1^2)(c_1 + 2x_1)$$

So the time derivative of V_2 becomes

$$\dot{V}_2 = -c_1 z_1^2 - c_2 z_2^2 - c_3 z_3^2 + z_2 z_3 = -\sum_{i=1}^{2} c_i z_i^2 + z_2 z_3$$

Step 3: Deriving the error dynamics for

$$z_3 = x_3 - \alpha_2$$

$$\dot{z}_3 = u - \frac{\partial \alpha_2}{\partial x_1}(x_2 + x_1^2) - \frac{\partial \alpha_2}{\partial x_2}(x_3 + x_2^2)$$

Objective is to design the actual control input *u* such that z_1, z_2 and z_3 converge to zero. Choosing a Lyapunov function V_3

$$V_3 = V_2 + \frac{1}{2} z_3^2$$

Its time derivative is given by,

$\dot{V}_3 = -\sum_{i=1}^{2} c_i z_i^2 + z_2 z_3 + z_3 (u - \frac{\partial \alpha_2}{\partial x_1}(x_2 + x_1^2) -$
$\frac{\partial \alpha_2}{\partial x_2}(x_3 + x_2^2))$

Choosing *u* such that $\dot{V}_3 \leq 0$

$$u = \frac{\partial \alpha_2}{\partial x_1}(x_2 + x_1^2) + \frac{\partial \alpha_2}{\partial x_2}(x_3 + x_2^2) - c_3 z_3 - z_2$$

Derivative of Lyapunov function is

$\dot{V}_3 = -\sum_{i=1}^{3} c_i z_i^2$

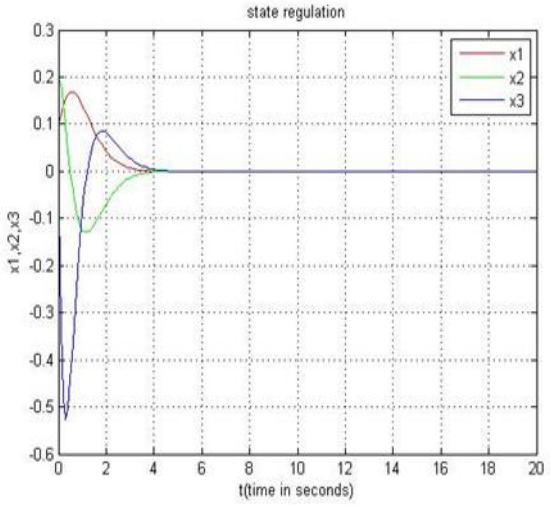

Fig.2 Stable by backstepping

Hence according to La Salle Theorem z_1, z_2 and z_3 converge to zero as $t \to \infty$ and so doesx_1, x_2 and x_3 and thus u(t) is bounded as in Figure 2.

III. DSC TECHNIQUE

Conventional back stepping although systematic, suffers from severe problem of 'explosion of terms' which arises due to repeated differentiations of virtual controllers. Thus, the complexity of controller increases drastically limiting the use of back stepping technique to higher order systems. An alternative control design method called multi-surface sliding control was developed independently of back

stepping but is mathematically very similar. MSS however, has same problem as integrator back stepping. In order to tackle this problem, a new approach called dynamical surface control (DSC) was first introduced by Swaroop et al. [2]. In DSC, a first order filtering of the synthetic input is carried out at each level of the traditional back stepping design and was implemented for automated control of passenger vehicles including the throttle & brake dynamics.

A. DSC Design Method

Consider a nonlinear system of the following form[3]:

$$\dot{x}_1 = x_2 + f_1(x_1) + \Delta f_1(x_1)\dot{x}_2 = x_3 + f_2(x_1, x_2) + \Delta f_2(x_1, x_2) \vdots$$
$$\dot{x}_{n-1} = x_n + f_{n-1}(x_1, \dots, x_{n-1}) + \Delta f_{n-1}(x_1, \dots, x_{n-1})\dot{x}_n = u$$

Going in a direction similar to back stepping approach, let

$$S_1 = x_1 - x_{1d} \quad (4)$$

which implies

$$\dot{S}_1 = \dot{x}_1 - \dot{x}_{1d} = x_2 + f_1(x_1) + \Delta f_1(x_1) - \dot{x}_{1d}$$

where, S_1 is a dynamic sliding surface and would converge to a neighborhood about zero, if x_2 tracks $\bar{x}_2$, asymptotically. The synthetic value of virtual control x_2 is

$$\bar{x}_2 = -f_1(x_1) - \frac{S_1\rho_1^2}{2\epsilon} - K_1S_1 + \dot{x}_{1d} \quad (5)$$

Here, ϵ is an arbitrarily small positive constant which will be chosen later. It is a measure of the regulation (or tracking) accuracy that one desires. Departing from the approach of back stepping, we pass $\bar{x}_2$ through a first order filter, with time constantτ_2, to obtainx_{2d},

$$\tau_2\dot{x}_{2d} + x_{2d} = \bar{x}_2, \qquad x_{2d}(0) = \bar{x}_2(0) \quad (6)$$

From (5) and (6), we have,

$$\tau_2\dot{x}_{2d} + x_{2d} = -f_1(x_1) - \frac{S_1\rho_1^2}{2\epsilon} - K_1S_1 + \dot{x}_{1d} \quad (7)$$

The choice of a first order filter stems from simplicity of implementation. First order filter for x_{2d} allows us to eliminate the partial derivatives associated with the model uncertainties. Following the above procedure, for$2 \le i \le n-1$, the i[th] surface is given by,

$$S_i = x_i - x_{id} \quad (8)$$

And$\bar{x}_i$ is chosen to drive$S_i \to 0$,

$$\bar{x}_{i+1} = -f_i(x_1, \dots, x_i) - \frac{S_i\rho_i^2}{2\epsilon} - K_iS_i + \dot{x}_{id} \quad (9)$$

Filtering$\bar{x}_{i+1}$, $\dot{x}_{i+1,d}$ is obtained,

$$\tau_{i+1}\dot{x}_{i+1,d} + x_{i+1,d} = -f_i(x_1, \dots, x_i) - \frac{S_i\rho_i^2}{2\epsilon} - K_iS_i + \dot{x}_{id} \quad (10)$$

Finally, define

$$S_n = x_n - x_{nd} \quad (11)$$

Where, $\tau_i(i = 2, \dots, n)$ are the time constants of the filters used and $K_i(i = 1, \dots n)$ are the surface gains which can be chosen so as to ensure stability. The above controller leads to regulation of state errors to zero.

The control action *u* is chosen to be

$$u = \dot{x}_{nd} - K_nS_n \quad (12)$$

B. Illustrative Example

The following example is considered here

$$\dot{x}_1 = x_2 + x_1^2 \quad (13)$$
$$\dot{x}_2 = x_3 + x_2^2 \quad (14)$$
$$\dot{x}_3 = u \quad (15)$$

Following the above approach first a dynamic sliding surface S_1 is defined:

$$S_1 = x_1 - x_{1d} \quad (16)$$

which implies

$$\dot{S}_1 = \dot{x}_1 - \dot{x}_{1d} = x_2 + x_1^2 - \dot{x}_{1d} \quad (17)$$

The synthetic value of virtual control x_2 which will make S_1 converge to zero, is given as,

$$\bar{x}_2 = -\frac{S_1(x_1^2)^2}{2\epsilon} - K_1S_1 + \dot{x}_{1d}$$

On passing $\bar{x}_2$ through a first order filter with time constant τ_2, one can obtain x_{2d}.

$$\tau_2\dot{x}_{2d} + x_{2d} = \bar{x}_2, \qquad x_{2d}(0) = \bar{x}_2(0) \quad (19)$$

Similarly, S_2 and S_3 can be defined and the corresponding first order filters can be defined. The controller designed after further formulation is given as:

$$u = \dot{x}_{3d} - K_3S_3 \quad (20)$$

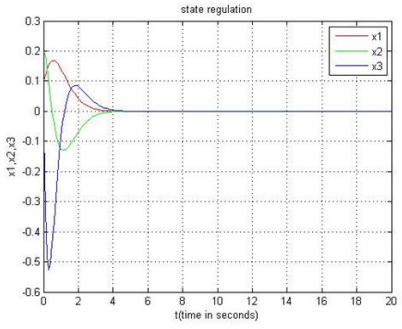

Fig.3 Stable by Dynamic Surface Control(DSC)

IV. CONCLUSION

In this paper comparison of backstepping and dynamic surface control (DSC) is studied. As conventional back stepping although systematic, suffers from severe problem of 'explosion of terms' which arises due to repeated differentiations of virtual controllers. In order to tackle this problem, a new approach called dynamical surface control (DSC) was first introduced by Swaroop et al.

REFERENCES

[1] M. Krstic, I. Kanellakopoulos, P. V. Kokotovic, "Nonlinear and Adaptive Control Design," Wiley, New York,1995.

[2] D. Swaroop, J. C. Gerdes, P. P. Yip, and J. K. Hedrick, "Dynamic surface control of nonlinear systems," Proc. Amer. Control Conf. Albuquerque, NM, pp. 3028-3034, 1997.

[3] Song, Bongsob, Hedrick, J. Karl, "Dynamic Surface Control of Uncertain Nonlinear Systems LMI Approach," 2011, 254p

[4] Cao Ling-zhi, Li Chun-wen, Chen Hua-ying, Cui Guang-zhao, "Backstepping Control of Position Synchronization System in Crane Lifter," Proceedings of the IEEE International Conference on Automation and Logistics Qingdao, China September 2008, 2282-2285.

[5] B.A. Idowu, U.E. Vincent, A.N. Njah, "Generalized Adaptive Back stepping Synchronization for Non-identical Parametrically Excited Systems," Nonlinear Analysis: Modelling and Control, 2009, Vol. 14, No. 2, 165–176.

[6] Chao-Chung Peng • AlbertWen-JengHsueChieh-Li Chen, " Variable structure based robust backstepping controller design for nonlinear systems" Nonlinear Dyn (2011) 63: 253–262.

[7] A. Witkowska and R. Smierzchalski, "Nonlinear backstepping ship course controller," International Journal of Automation and Computing volume 6, No. 3, pp. 277–284, 2009.

[8] E. Babaei, S.A.KH. Mozaffari Niapour, M. Tabarraie, "Design of a non-linear power system stabilizer using the concept of the feedback linearization based on the back-stepping technique," Faculty of Electrical and Computer Engineering, University of Tabriz, 51664, Tabriz, Iran, 2013.

Effect of Power System Parameters on Transient Stability Studies

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Abstract: **Transient stability studies play a vital role in providing secured operating configurations in power system networks. This paper shows an investigation of the effects of some key power system parameters on transient stability. The parameters for which this analysis is carried out include fault location, load increment,, fault clearing time and generator speed. The analysis has been carried out on a ieee9-bus system. From this analysis, the impact of these parameters on power system transient stability has been highlighted.**

Keywords-fault location; load increment; fault clearing time; generator s speed.

I. INTRODUCTION

The definition of stability includes a number of factors that may be involved: the load carried before a fault occurs, the type of fault and its location in the system, the time required to clear the fault, the change in steady state operating angles when the faulted portion of the system is removed from service, and the moment of inertia of the rotating machines at each end of the system. Stability, then, is the ability of a system to continue to operate without loss of load when any reasonable system change or disturbance occurs. The transient stability is one of the important constraints in the planning and maintenance of a secured power system operation. Transient stability is concerned with the ability of the power system to maintain synchronism when subjected to severe perturbations. These perturbations can be faults such as: a short circuit on a transmission line, loss of a generator, loss of load, gain of load or loss of a portion of transmission network [1][2].

II. BACKGROUND OF STUDY

Modern Electric Power system is a complex network of synchronous generators, transmission lines and loads. With changes in generation schedules and load, the system characteristics will vary [1-3]. 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 main aim of this thesis project is to investigate the various power system stability problems, after which one important problem will be singled out for discussion and research[6-7].

III. METHODOLOGY

The initiation of fault and its removal by circuit breakers in a power system shows that the system is going through a fault with change in the system configuration in three stages: pre-fault, fault and post-fault stages. The dynamics of the power system during fault and post-fault periods are nonlinear and the exact solution is too complex. In transient stability studies, particularly, those involving short periods of analysis in the order of a second or less, a synchronous machine can be represented by a voltage source behind transient reactance that is constant in magnitude but changes its angular position

- *SWING EQUATION*

Let us consider a three-phase synchronous alternator that is driven by a prime mover. The equation of motion of the machine rotor is given by

$$J\frac{d^2\theta}{dt^2} = T_m - T_e = T_a \qquad (1)$$

Where

J *is*the total moment of inertia of the rotor mass in kgm^2

T_m is the mechanical torque supplied by the prime mover in N-m

T_e is the electrical torque output of the alternator in N-m

θ Is the angular position of the rotor in rad

Neglecting the losses, the difference between the mechanical and electrical torque gives the net accelerating torque T_a. In the steady state, the electrical torque is equal to the mechanical torque, and hence the accelerating power will be zero. During this period the rotor will move at *synchronous speed* ω_s in rad/s.

The angular position θ is measured with a stationary reference frame. To represent it with respect to the synchronously rotating frame, we define

$$\theta = \omega_s t + \delta \qquad (2)$$

Where δ is the angular position in rad with respect to the synchronously rotating reference frame. Taking the time derivative of the above equation we get

$$\frac{d\theta}{dt} = \omega_s + \frac{d\delta}{dt} \qquad (3)$$

Defining the angular speed of the rotor as

$$\omega_r = \frac{d\theta}{dt}$$

we can write (3) as

$$\omega_r - \omega_s = \frac{d\delta}{dt} \qquad (4)$$

We can therefore conclude that the rotor angular speed is equal to the synchronous speed only when $d\delta/dt$ is equal to zero. We can therefore term $d\delta/dt$ as the error in speed. Taking derivative of (3), we can then rewrite (1) as

$$J\frac{d^2\delta}{dt^2} = T_m - T_e = T_a \qquad (5)$$

Multiplying both side of (5) by ω_m we get

$$J\omega_r\frac{d^2\delta}{dt^2} = P_m - P_e = P_a \qquad (6)$$

Where P_m, P_e and P_a respectively are the mechanical, electrical and accelerating power in MW.

We now define a normalized inertia constant as

$$H = \frac{\text{Stored kinetic energy at synchronous speed in mega - joules}}{\text{Generator MVA rating}} = \frac{J\omega_s^2}{2S_{rated}} \qquad (7)$$

Substituting (7) in (5) we get

$$2H\frac{S_{rated}}{\omega_s^2}\omega_r\frac{d^2\delta}{dt^2} = P_m - P_e = P_a \qquad (8)$$

In steady state, the machine angular speed is equal to the synchronous speed and hence we can replace ω_r in the above equation by ω_s. Note that in P_m, P_e and P_a are given in MW. Therefore dividing them by the generator MVA rating S_{rated} we can get these quantities in per unit. Hence dividing both sides of (8) by S_{rated} we get

$$\frac{2H}{\omega_s}\frac{d^2\delta}{dt^2} = P_m - P_e = P_a \qquad (9)$$

Equation (9) describes the behaviour of the rotor dynamics and hence is known as the swing equation. The angle δ is the angle of the internal emf of the generator and it dictates the amount of power that can be transferred. This angle is therefore called the *load angle*.

IV. SIMULATION OF RESULTS

This section presents computer simulations with the program developed in the power word simulator. The analysis has been carried out on a IEEE 9-bus test system for shown in Figure 1. It consists of Nine (9) buses, three (3) synchronous generators, three (3) loads and two (2) transformer

Bus Records

Number	Name	Nom kV	PU Volt	Volt (kV)	Angle (Deg)	Load MW	Load Mvar	Gen MW	Gen Mvar
1	Bus1	16.5	1.04	17.16	0			71.63	27.91
2	Bus 2	18	1.025	18.45	9.35			163	4.9
3	Bus 3	13.8	1.025	14.145	5.14			85	-11.45
4	Bus 4	230	1.02531	235.821	-2.22				
5	Bus 5	230	0.99972	229.936	-3.68	125	50		
6	Bus 6	230	1.01225	232.819	-3.57	90	30		
7	Bus 7	230	1.02683	236.171	3.8				
8	Bus 8	230	1.01727	233.971	1.34	100	35		
9	Bus 9	230	1.03269	237.519	2.44				

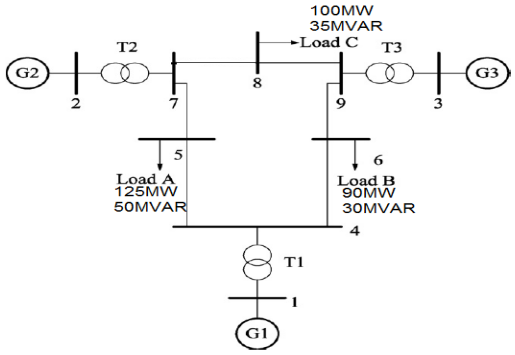

Fig. 1: Single-line diagram of three machine IEEE 9 bus power system

A. *EFFECT OF FAULT LOCATION*

This sub-section analyzes the effect of fault location in transient stability. A three-phase fault is simulated at two different locations, one close to the generating station and the other one far from the generating station. Figure 2 shows the angular positions of the generators with the

generator at bus 8 as reference, when a three phase fault occurred at bus 8 and the fault was cleared at the critical clearing time by removal of line 7-8. The critical clearing time for this case is 125 ms. The generators swing together to show stable equilibrium. Figure 3 shows the angular positions of the machines when a three phase fault occurred at bus 7 and the fault was cleared at the critical clearing time by removal of line 7-8. The CCT for this case is 124ms. The generators swing together to show stable equilibrium. It is observed that the critical clearing time of the fault on bus 7 is lower than that of bus 8. This shows that when faults close to the generating station are cleared, the system returns to stability more rapidly than those on lines further away from the station.

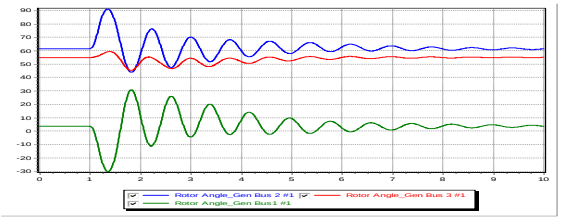

Fig 2 Rotor angle response with fault on bus 7

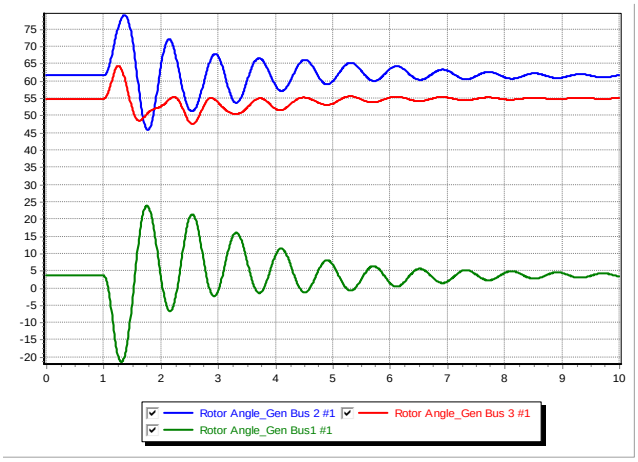

Fig 3 Rotor angle response with fault on bus 8

B. *Effect Of Critical Clearing Time*

In order to know the effect of fault clearing time on transient stability, a disturbance in the form of a three phase fault was simulated at some buses and different lines removed to determine the stability or otherwise of the power system. The critical clearing time, which is a measure of the stability, was determined by varying the fault clearing times. The stability and instability of the power system at a given fault is determined by the behavior of the generators in the system. If the rotor angles of the generators diverge, the system is unstable and if otherwise, the system is stable. Figure 4 show the angular positions of the generators with the generator at bus 8 as reference when a three phase fault occurred at bus 8 and the fault was cleared at the critical clearing time 0.15 second. The generators swing together to show stable equilibrium. Figure 5 shows the angular positions of the machines for a clearing time greater than the critical clearing time. In this case, the clearing time increased beyond the critical clearing time and the machines lost synchronism as seen in the figure

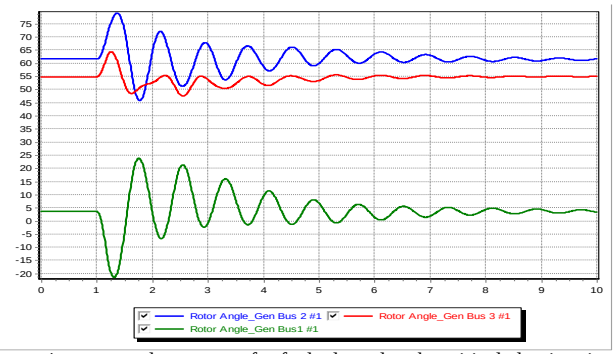

Figure 4 rotor angle response for fault cleared at the critical clearing time

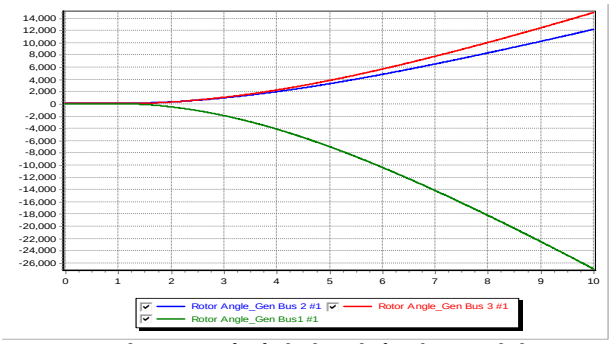

Fig. 5 Rotor angle response for fault cleared after the critical clearing time

C. *Effect of load change*

The objective of this sub-section is to investigate the impact of load change .For this reason, load at bus no 6 is increased from the base value by 50%.In order to evaluate the effects of load variation on the transient stability of the system. figure 6&7 shows the generator rotor angle response & generators frequency response when 50% Load increased in bus no 6. Increment of the load beyond certain limit caused the machines' rotor angle to diverge continuously leading to loss of synchronism and hence, instability. In order to maintain the stability of the system within certain range of the load increment, power generation has to increase while the voltage at all buses has to drop. In order to evaluate the effects of load open on the transient stability of the system. Figure 7&8 shows the generator rotor angle response & generators frequency response when all load open in bus no 6

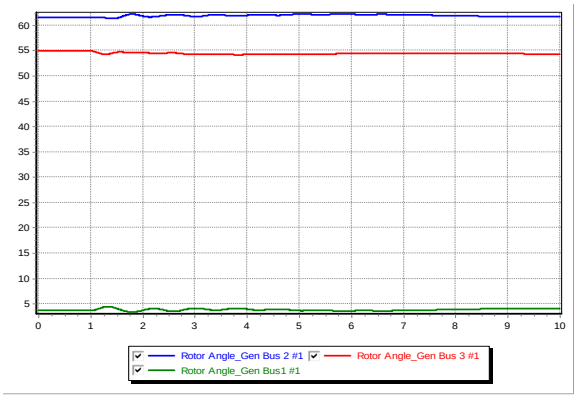

Fig. 6 Generator rotor angle response when 50% load increase in bus no 6

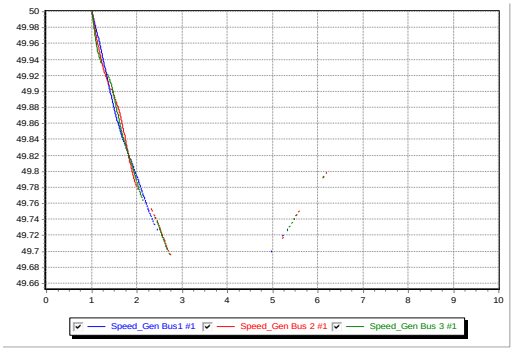

Fig. 7 generators frquency response when 50% load increase in bus no 6

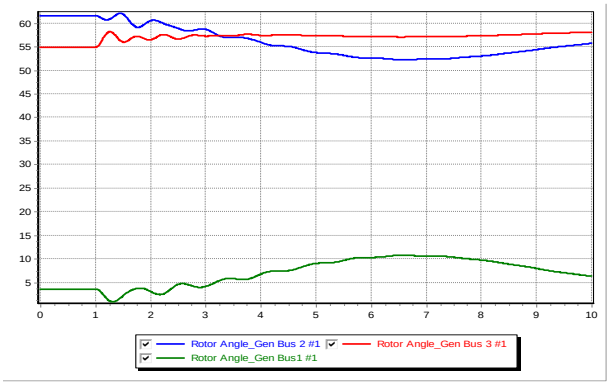

Figure7 Generator rotor angle response when all load open in bus no 6

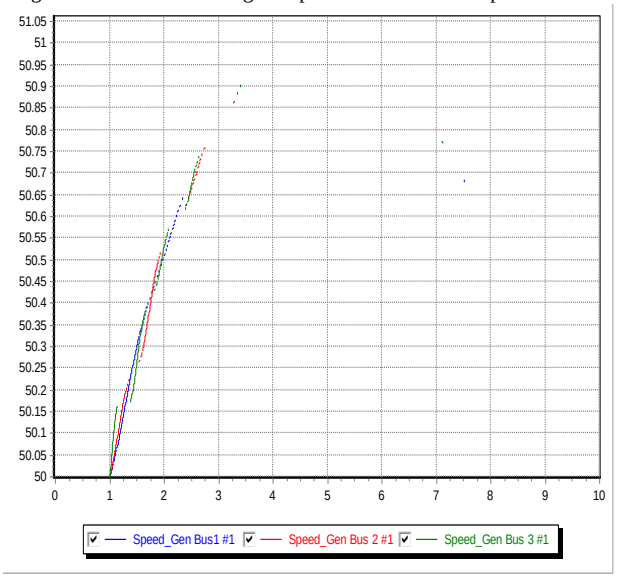

Figure 8 Generators frequency (speed) response when all load opens in bus no 6

D. Effect of fault on the speed (frequency)

This sub-section is aimed at investigating the response of the generator speed in relation to the mechanical power input, electrical power output, power angle and the damping of the generator when a fault occurs in the system. Consider a three phase fault on bus 8.

In the steady-state, the generators in a power system network operate at equilibrium corresponding to the mechanical power input being equal to the electrical power output. When a fault occurs in the system, the initial configuration of the system will be lost and since is constant, then will become greater than . An excess of the mechanical input over the electrical output accelerates the rotor, thereby storing excess kinetic energy, and the power angle increases. With increase in the power angle, the electrical power will begin to increase until it matches the mechanical power input . At this point, with the fault cleared, the accelerating power becomes zero but the rotor is still running above synchronous speed; hence the power angle and the electrical power will continue to increase. Now , causing the rotor to decelerate toward synchronous speed until the power angle reaches its critical value. The rotor angle will continue to oscillate back and forth at its natural frequency and the damping present in the generators will cause the oscillations to eventually subside. Figure 9 depicts the deviation from the speed when the system is perturbed and the eventual return to synchronous speed when the fault was cleared.

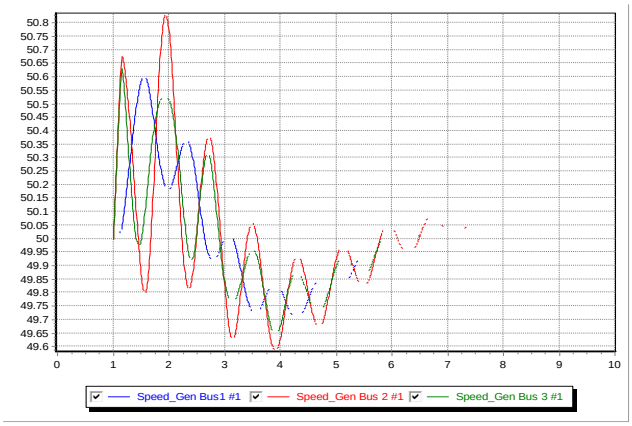

Fig 9. The generators' speed (frequency) response when a three phase fault occur bus no 8

IV. CONCLUSION

Transient Stability Analysis is a major investigation into the operation of power systems due to the increasing stress on power system networks. The main goal of this analysis is to gather critical information, such as CCT of the circuit breakers for faults in the system, effect of location of fault within a power system network, effect of load increment and effect of fault on the synchronous speed of machines in the system. This information can aid protection engineer make an informed decision when designing protection scheme for a power system. This paper presents a transient stability analysis of IEEE 9-bus test system Power word simulators software. To analyze the effects of these parameters on the system stability, a three-phase fault was applied at different locations in the system. The stability of the system has been observed based on the simulation graphs of the generators' swing curves and generators' speed. The simulation results showed that the critical clearing time decreases as the fault location becomes closer to the power generating station.

The results obtained from this study, confirmed and established the findings in previous stability studies regarding these parameters.

REFERENCES

[1.] Ayman S. Abdel-Khalik, Mahmoud I. Masoud, Barry W. Williams, Adel L. Mohamadein and M. M. Ahmed, "Steady-State Performance and Stability Analysis of Mixed Pole Machines With Electromechanical Torque and Rotor Electric Power to a Shaft-Mounted Electrical Load", IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, VOL. 57, NO. 1, JANUARY 2010.

[2.] Tomislav Idzotic, Gorislav Erceg, Damir Sumina, "Synchronous Generator Load Angle Measurement and Estimation", ISSN 0005–1144 ATKAAF 45(3–4), pp179–186 (2004).

[3.] Athula D. Rajapakse, Francisco Gomez, Kasun Nanayakkara, Peter A. Crossley, and Vladimir V. Terzija," Rotor Angle Instability Prediction Using Post-Disturbance Voltage Trajectories", IEEE TRANSACTIONS ON POWER SYSTEMS, VOL. 25, NO. 2, MAY 2010.

[4.] Yuri V. Makarov Zhao Yang Dong David J. Hill, "A Generlal Method for Small Signal Stability Analysis" IEEE Transactions on Power Systems, Vol. 13, No. 3, August 1998..

[5.] Atif Zaman Khan, Farrukh Shahzad, "A PC BASED SOFI'WARE PACKAGE FOR THE EQUAL AREA CRITERION OF POWER SYSTEM TRANSIENT STABILITY", IEEE Transactions on Power Systems, Vol. 13, No. 1, February 1998.

[6.] Yin Chin Choo, Mohammad A. Kashem, Michael Negnevitsky, "Transient Stability Assessment of a Small Power System Subjected to Large Disturbances".

[7.] Huynh Chau Duy, Huynh Quang Minh and Ho Dac Loc, "Transient Stability Analysis of A Multi Machine Power System".

Power System Stability with Rotor Angle Control: A Review

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Abstract: **In the recent decade, power demand has increased significantly. On the other hand, expansion of power generation and transmission is affected due limited resources and environmental restrictions. As an effect some generators and transmission lines are heavily load thus power system stability becomes a key factor. Electric power distribution system consists of dispersed generators and load connected through complex transmission network. Transient stability is regarded as major problem for power system stability. Power system stability comprise of frequency, voltage and rotor angle stability. The main objective of this paper is to understand the stability of power system with the main focus on rotor angle stability.**

Keywords: Power System Stability; Swing Equation

I. INTRODUCTION

A power system consist of several generating stations, several consumers who utilize the electrical energy is generated by generating stations. The objective of power system is to generate electrical energy in sufficient amount and distribute to various consumers at best suited locations and maintaining the quality and reliability at an economic price.The quality of implies that

- frequencyte be maintained constant at the specified value (50 Hz).
- Voltage to be maintained at the specified value.

Further, the interruptions to the supply of energy should be minimum as possible.

The load on the system varies from instant to instant because of diversified nature of activities of the consumers (e.g. domestic, industrial, agricultural etc.)

The generating station must be in a 'state of readiness' to supply the load without any intimation from the consumer. This 'variable load problem' is to be tackled effectively because this causes instability in system. Stability of interconnected system may be defined as ability to deliver power in a stable manner even after subjected to some form of disturbances. Power system is subjected to wide range of disturbances i.e., small disturbances like load changes, generation changes etc. and large disturbances like faults and outages of equipments etc.

II. CLASSIFICTION

Power system stability Classification is depicted in fig. 1.below.

A. Rotor Angle Stability:

It is the ability of the system to remain in synchronism when subjected to a disturbance. The rotor angle of a generator depends on the balance between the electromagnetic torque and mechanical torque of the generator where electromagnetic torque is due to the generator electrical power output (P_e) and mechanical torque is due to the input mechanical power (P_m) through a prime mover. To remain in synchronism means that electromagnetic torque (T_e) is exactly balanced by the mechanical torque (T_m) of all the generators. If in any one or more generators the balance between electromagnetic torque (T_e) and mechanical torque (T_m) is disturbed, due to disturbances in the system, then this will lead to oscillations in the rotor angle. Rotor angle stability is further classified into small disturbance angle stability and large disturbance angle stability.

- Small-disturbance or small-signal angle stability

If a disturbance is small enough so that the nonlinear power system can be approximated as a linear system, then the study of rotor angle stability of that particular system is called as small-disturbance angle stability analysis. Small disturbances can be small load changes like switching on or off of small loads, line tripping, small generators tripping etc. Due to small disturbances there can be two types of instability: non-oscillatory instability and oscillatory instability. In non-oscillatory instability the rotor angle of a generator keeps on increasing due to a small disturbance and in case of oscillatory instability the rotor angle oscillates with increasing magnitude. Steady state stability: The study of steady state of the stability is concerned with the determination of the upper limit of machine loadings before losing synchronism, provided the loading is increased gradually.

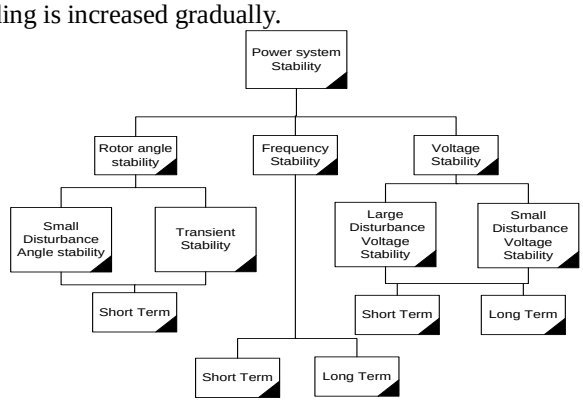

Fig. 1. Classification of Power system stability

- Large-disturbance or Transient Stability:

Transient stability involves the study of large disturbances of machine due to sudden acceleration of rotor fault, type of fault, location of fault, severity of fault and clearing time of fault and the highest power that is permissible to flow through the network without the loss of stability following a sustained period of annoyance is referred to as the transient stability of the system. Going beyond that maximum permissible value for power flow, the system would temporarily be rendered as unstable.

B. Voltage stability:

It is the ability of the system to go on with steady state voltages at all the system buses when subjected to a disturbance. If the disturbance is large then it is called as large-disturbance voltage stability and if the disturbance is small it is called as small-disturbance voltage stability. Contrary angle stability, voltage stability can also be a long term phenomenon. In case voltage fluctuations appear due to fast acting devices like induction motors, power electronic drive, HVDC etc then the time frame for understanding the stability is in the range of 10-20 s and therefore can be treated as a short term phenomenon. And on the other hand if voltage variations are due to slow change in load, over loading of lines, generators hitting reactive power limits, tap changing transformers etc then time frame for voltage stability can stretch from 1 minute to several minutes.

The main difference between voltage stability and angle stability is that voltage stability depends on the balance of reactive power demand and generation in the system where as the angle stability mainly depends on the balance between real power generation and demand.

C. Frequency stability:

It refers to the ability of a power system to maintain steady frequency following a severe disturbance between generation and load. It depends on the ability to restore equilibrium between system generation and load, with minimum loss of load. Frequency instability may lead to sustained frequency swings leading to tripping of generating units or loads. During frequency excursions, the characteristic times of the processes and devices that are activated will range from fraction of seconds like under frequency control to several minutes, corresponding to the response of devices such as prime mover and hence frequency stability may be a short-term phenomenon or a long-term phenomenon.

Though, stability is classified into rotor angle, voltage and frequency stability they need not be independent isolated events. A voltage collapse at a bus can lead to large excursions in rotor angle and frequency. Similarly, large frequency deviations can lead to large changes in voltage magnitude.

Dynamic Stability: The ability of a power system to maintain stability under small disturbances is known as small signal stability or is investigated under dynamic stability.it is generally concerned to small disturbances lasting for about 10 to 30 seconds.

III. SWING EQUATION

The behavior of a synchronous machine under transient condition is described by swing equation. The angular position of rotor at any instant t can be represented as:

$\theta = \omega_s t + \delta$ electrical radian

θ is continuously changing with time and δ is the angular displacement of the rotor from synchronous rotating speed reference.

$$\frac{d\theta}{dt} = \omega_s + \frac{d\delta}{dt}$$

&

$$\frac{d^2\theta}{dt^2} = \frac{d^2\delta}{dt^2}$$

Therefore angular acceleration of rotor becomes

$$\alpha = \frac{d^2\theta}{dt^2} = \frac{d^2\delta}{dt^2}$$

The accelerating torque T_a is equal to the difference of input shaft torque T_m and output electromagnetic torque T_e

$T_a = T_m - T_e$

$\omega T_a = \omega T_s - \omega T_e$

$P_a = P_m - P_e$

$j\frac{d^2\theta}{dt^2} = T_a$

$j\frac{d^2\delta}{dt^2} = T_a$

$\omega j\frac{d^2\theta}{dt^2} = P_a = P_m - P_e$

$M\frac{d^2\delta}{dt^2} = P_a = P_m - P_e$

A graph of δ versus time t is represented in swing curve. Any tendency of δ to increase beyond the point of stability is informed. Thus the relay protection on power system and controller are installed for proper control and critical fault clearance.

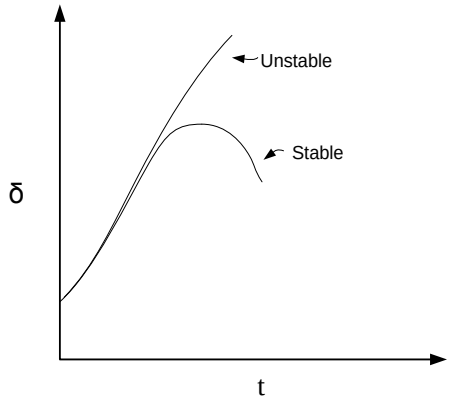

FIG.2

IV. CONCLUSION

Power system stability has become a vital problem in the modern era. The constant changing load affects the transient stability of the system. The various technique like swing equation and facts devices such as stat-com can be used for power system stability and control.

REFERENCES

[1.] L. Gyugyi, "Power Electronics in Electric Utilities: Static Var Compensators" in Proc. IEEE' 76, paper 4, p. 483–494, 1988.

[2.] A. E. Hammad, "Analysis of power system stability enhancement by static var compensators", IEEE Trans. On Power Systems, vol. 1, No. 4, pp. 222-227,1986.

[3.] P. Kundur, *Power System Stability and Control*, EPRI Power System Engineering Series, New York, McGraw-Hill Inc, 1994.

[4.] K. R. Padiyar, *FACTS Controllers in Power Transmission and Distribution*, New Age International Publishers, 2007.

[5.] A. Gherbi, B. Francois and M. Belkacemi, Methods for power system transient stability analysis:State of the art, *Canadian Journal of Electrical and Computer Engineering*, vol.41, no.3, pp.826-850,2002.

[6.] H.D. Chiang, F.F. Wu and P.P. Varaiya "Foundations of direct methods for power system Transient stability analysis," IEEE Trans. circuits and systems,1987,CAS-34,(2),p.160-173

[7.] P. M. ANDERSON AND A. A. FOUAD, Power System Control and Stability, IEEE Press, 1994.

[8.] P. KUNDUR, "Power System Control and Stability", New York: McGraw-Hill, Inc., pp. 3-168, 699-825 and 1103-1166, 1994.

Symbolic Math Compution for the Analysis of Self Excited Induction Generator

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***Abstract*- In this paper the use of Matlab symbolic computation technique is used for simulate self excited induction generator. In this technique, the computer itself carries out both the tiresome work of deriving the complex coefficients of the polynomial equations and solving them. The programming becomes very simple yet versatile. Good relation between the results obtained from the conventional method and that obtained using symbolic computation validates the effectiveness of this technique.**

Keywords—Self excited induction generator; Symbolic Math ;Matlab.

I. INTRODUCTION

We can use electricity to run just about everything. Without electricity, we wouldn't be doing about half the things we do now. Our communication networks wouldn't exist without electricity. People live longer now because electricity improved technology and medical science. Electricity is an important parameter for measuring economic progress also. It is the unique form of energy that enables technical innovation and productivity growth. However, the important achievements of electrification remain still unused by many people of the world as population is growing faster than the current rate of electrification. Today, most of the electricity generated comes from coal, oil, and natural gas. These fuels have very low reserves and will finish in the future. Also there is negative effect of these fuels. They produce pollutant gases when they are burned in the process to generate electricity. To overcome the problems of conventional energy sources we are shifting towards non-conventional energy sources such as wind energy, bio-gas, solar and hydro potential, etc. These all produces energy without any pollution .These sources have low cost generating system, which is capable of operating in the remote areas and in conjunction with the variety of prime movers. Renewable resources are able to provide us with limitless energy. People living in rural areas who do not have access to the national grid may have to travel long distances and wait long times for their batteries to be recharged at commercial centers. Practical action has developed reliable and cost effective wind energy systems for charging batteries to help meet the electrical energy needs of these people. Small scale wind energy generators also have the potential to stimulate village-level charging enterprises for either community or private use. Therefore practical action aims to develop and promote local industries capable of manufacturing and maintaining the generators. There are lots of windy areas across the globe, and in many parts of the world people are trying to use wind energy as much as possible, though efficiency of this energy source still remains a big problem, largely because of inconsistency of wind blowing.

With the renewed interest in wind turbines and micro-hydro-generators as best energy source, the induction generators are being considered as an alternative choice to the well-developed synchronous generators because Induction generator having the following merits:

- Minimal maintenance and inexpensive.
- Inherent overload protection and runs independently.
- At high speed ~400 Hz, reduces size and weight of machine (Roughly 0.33 m long , 0.5 m diameter) and filter components.
- Ability to produce useful power at varying rotor speeds.

Induction generators runs on the principle that motors produce electrical power when their rotor is rotated faster than the synchronous speed. In normal motor operation, stator flux rotation is faster than the rotor rotation. This is initiating stator flux to induce rotor currents, which create rotor flux with magnetic polarity opposite to stator. In this way, rotor is dragged along behind stator flux, by value equal to slip. In generator operation, a prime mover (turbine, engine) drives the rotor above the synchronous speed. Stator flux still induces currents in the rotor, but since the opposing rotor flux is now cutting the stator coils, active current is produced in stator coils, and motor is now operating as a generator, and sending powerback to the electrical grid. The ability of the induction generator to generate power at varying speed facilitates its application in various modes of operations such as:

A. Grid connected induction generator

B. BIsolated induction generators

Further induction generators are classified on the basis of rotor construction as

- Wound rotor induction generator.
- Squirrel cage induction generator.

Depending upon the prime movers used and their locations, generating schemes can be broadly classified as under:

- Fixed speed Fixed frequency:
- Variable speed Fixed frequency:
- Variable speed Variable frequency

II. STEADY STATE MODELING AND ANALYSIS OF SELF EXCITED INDUCTION GENERATOR

Most of the steady state models of SEIG developed by different researchers are based on per phase equivalent circuit. These models use the following two basic methods; i) Loop impedance method and ii) Nodal admittance method. The steady state model based on Loop impedance method and used in this paper . This model makes assumptions that the load is purely resistive, core loss component is neglected and the machine parameters (except for magnetizing reactance) remain constant

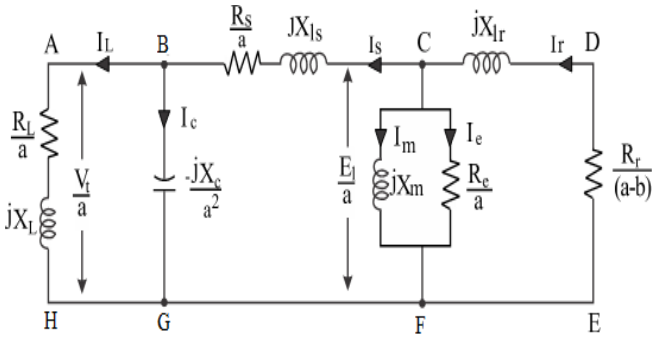

Fig. 1: Per phase equivalent circuit of self-excited induction generator

Where:
Rr, X_{lr} = Rotor resistance and reactance, Rs, X_{ls} = Stator resistance and reactance referred to stator.
R_L, X_L = Load resistance and reactance, X_m= Per phase Saturated magnetic reactance, X_c=Per phase capacitive reactance, Fg= Generated frequency, Fr= Rated frequency, a = Ratio of generated to rated frequency, b = Ratio of actual rotor speed to synchronous speed corresponding to rated frequency, Is =Stator current, I_L = Load current, I_r= Rotor current, I_c= Capacitive current, E_1 = Air gap voltage per phase at rated frequency , Z=Impedance of complete circuit.
Conventional equivalent circuit of self-excited induction generator can be solved using Loop Impedance method.

$$Z_{AB} = \left(\frac{R_S}{a} + jX_{ls}\right) \text{----------1}$$

$$Z_{BC} = \frac{(jX_m//R_e/a)\left[\frac{R_r}{a-b}+jX_{lr}\right]}{(jX_m//R_e/a)+\left[\frac{R_r}{a-b}+jX_{lr}\right]} \text{---------2}$$

$$Z_{AD} = \frac{\frac{-jX_C}{a^2}\left(\frac{R_L}{a}+jX_L\right)}{\left(\frac{R_L}{a}+jX_L\right)+\frac{-jX_C}{a^2}} \text{----------3}$$

$$Z_S = Z_{AB} + Z_{AD} + Z_{BC} \text{----------4}$$

The equivalent circuit result into single loop equation

$I_S * Z_S = 0$

For successful build up Is cannot be zero. Thus Zs must be equal to zero .By Separating the real and imaginary components of Zs , Two equations are obtained in terms of various machine parameters

Real (X_m, a) = $P_1X_ma^5 + P_2X_ma^4 + (P_3X_m+P_4)a^3 + (P_5X_m+P_6)a^2 + (P_7X_m+P_8)a + P_9X_m + P_{10}$ ---5

Imaginary (X_m, a) = $(Q_1X_m+Q_2)a^4 + (Q_3X_m+Q_4)a^3 + (Q_5X_m+Q_6)a^2 + (Q_7X_m+Q_8)a + Q_9$ ---6

Where P_1- P_{10} and Q_1-Q9 are the coefficients in terms of various machine parameters

Coefficients P_1-P_{10} and Q_1-Q_9 can be found using Symbolic Math Tool Box In MATLAB

These Coefficients are:

$P_1 = -(X_ls\ X_{lr}\ X_L)$

$P_2 = (X_{lr}\ X_lr\ X_L)*b$

$P_3 = X_{ls}*(Rr*\ R_L+Re*R_L+\ X_{lr}*\ Xc) +X_{lr}*(Re*Rs+\ Xc*\ X_{ls}+\ Rs*R_L)+X_{ls}*(Re*Rr+\ Re*Rs+\ Rs*Rr)$

$P_4 = X_{ls}*Re*(X_{lr}*R_L +Rr*X_L) +Re*Rs*X_{lr}*X_L$

$P_5 = -X_{ls}*(X_{lr}*\ Xc +Re*R_L)*b - X_{lr}*(Rs*R_L+\ Re*R_L+\ Xc*X_L)*b-(Rs*Re*X_L)*b$

$P_6 = -X_{lr}*Re*(Rs*X_L+X_{ls}*R_L)*b$

$P_7 = -Xc*Rr*(Rs+\ R_L)-Xc*Re*\ (Rs+\ R_L+\ Rr)$

$P_8 = -(Re*X_{lr}*Xc*(R_L+Rs))-(Re*Rr*X\ c*(X_L+X_{ls}))-(Re*Rs*Rr*R_L)$

$P_9 = Re*Xc*\ (Rs+\ R_L)*b$

$P_{10} = Xc*X_{lr}*Re*(R_L+Rs)*b$

$Q_1 = X_{ls}*X_L*(Re+\ Rr) +X_{ls}*Xlr*R_L+X_{lr}*X_L*(Re+\ Rs)$

$Q_2 = X_{ls}\ *X_{lr}*X_L*Re$

$Q_3 = -X_{ls}*(Re*X_L+X_{lr}*R_L)*b-X_{lr}*X_L*(Rs+\ Re)*b$

$Q_4 = -(X_{ls}*X_{lr}*X_L*Re)*b$

$Q_5 = -Xc*Re*(X_{ls}+X_{lr}+X_L)-RL*Re*(Rs+Rr)-R_L*(X_{lr}*Xc+Rr*Rs)-Xc*(Rs*X_{lr}+X_{ls}*Rr+X_L*Rr)$

$Q_6 = -Re\ X_{lr}*(X_{ls}*Xc+\ Xc*X_L+Rs*R_L)-Rr*Re*(X_{ls}*R_L+Rs*X_L)$

$Q_7 = Re*(X_{lr}*X\ c+\ X_{ls}*Xc+\ *X_L+Rs*R_L)*b+\ Xc*X_{lr}*(Rs+\ R_L)*b$

$Q_8 = Re*X_{lr}*(Xls*Xc+\ Xc*X_L)*b+\ (X_{lr}*Re*R_L*Rs)*b$

$Q_9 = Re*Xc*\ Rr*(R_L+Rs)$

These Nonlinear Polynomial Equations 1 & 2 are solved with Newton-Raphson (NR) procedure to determine ' Xm' and 'a ' in MATLAB. Air-gap voltage 'E' of machine is determined using mathematical model . After determination of E and Xm we can determine

- Stator and rotor current
- Magnetizing and core loss branch current
- Load and capacitor branch current
- Terminal voltage and generated power

III. SHORT COMINGS OF CONVENTIONAL METHOD

Although the conventional methods are effective in simulating the SEIG performance, they have common disadvantages

1. All the coefficients of the non-linear equations or a higher order polynomial need to be derived manually. The mathematical manipulations are tiresome, time-consuming and prone to human errors.
2. The expressions for the coefficients are very lengthy and complicated, which require Lot of human effort for accurate programming and debugging.
3. The model lacks flexibility as the coefficients are valid only for a given circuit configuration. For example, inclusion of the core-loss resistance or the addition of compensation capacitive reactance will change the order of the equations.

Many researchers have proposed different techniques to tackle these problems. However they still require some degree of manual manipulation of the mathematical equations before these techniques are applied. This paper proposes MATLAB symbolic computation, which eliminates all the above problems.

IV. SYMBOLIC MATH COMPUTATION IN MATLAB

Many applications in math, science, and engineering require symbolic operations, which are mathematical operations with expressions that contain symbolic variables. The starting point for symbolic operations is symbolic objects. Symbolic objects are made of variables and numbers that, when used in mathematical expressions, tell MATLAB to execute the expression symbolically. Typically, the user first defines (creates) the symbolic variables (objects) that are needed, and then uses them to create symbolic expressions that are subsequently used in symbolic operations.

MATLAB can compute on symbolic variables just as on constants. This exempts one from the tedious job of manual manipulation of the complex equations to obtain the final two equations 5 and 6. It can also solve several simultaneous equations hence the user does not need to use numerical methods to solve the complex equations 7 and 8 obtained after the manipulation. Since MATLAB performs both the jobs, steady state modeling and simulation of EIG becomes very simple and effective [6]. Few simple examples below illustrate the symbolic computation that can be done in MATLAB Command Returns syms a b creates two symbolic variables a & b.

Command	Result in MATLAB
x = (a + b)^2	$x = (a + b)^2$
x = expand (x)	$x = a^2 + 2ab + b^2$
y = (a - b)^2	$y = (a - b)^2$
y = expand(y)	$y= a^2 - 2ab + b^2$
z = x^2 + y^2	$z = (a^2 + 2ab + b^2)^2+(a^2 - 2ab + b^2)^2$
z = simple (z)	$z = 2a^4 + 12a^2b^2 + 2b^4$

Equation 4 can be written down in the similar fashion and can be solved. Similarly, the following commands can be used to solve the Z for a and b if the Z happens to be a complex quantity

Command	Result in MATLAB
zreal = real(z)	Equates real terms of Z to zero.
zimag = imag(z)	Equates imaginary terms of Z to zero.
	Assigns the equation name as ‘zimag.

[a, b] = solve(zreal, zimag) ,Solves zreal and zimag for a and b
a = double (a)
b = double (b)
Returns the numeric values of a and b
In this way equation 4 can be solved directly using MatLab Symbolic Computation technique. This exempts one from having to manually derive equations 5 and 6 and using numerical methods to solve them.

V. CONCLUSION

From the results it can be concluded that the MatLab Symbolic computation technique is very effective for the simulation of SEIG. This technique has the advantage that there is no need to manually derive the complex coefficients of the polynomial equations. It also exempts one from using complex numerical methods to solve the polynomial equations. Modeling becomes very simple yet versatile. Core loss and other component can be included easily. The programming and debugging become very easy.

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REFERENCES

[1] B.V. Gorti, G.C. Alexander, and R. Spee, “A novel, cost-effective stand-alone generator system,” IEEE Trans. Energy Conversion, vol. 2, Sept. 1996.

[2] J. Faiz, A.A. Dadgari, S Horning, and A. Kehyani, “Design of a three phase self-excited induction generator,” IEEE Trans. Energy on Conversion, vol. 10, pp. 516 –523, Sept. 1995.

[3] L. Shridhar, B. Singh, C. S. Jha , and B. P. Singh, “Analysis of self-excited induction generator feeding induction motor s,” IEEE Trans. Energy Conversion, vol. 9, pp. 390–396, June 1994.

[4] H. C. Rai and B. Singh, “Investigations on single-phase self-excited induction generator for standby power generation,” IEEE conf, vol. 3, pp. 1996 – 2000, Aug.1997.

[5] L. Wang and Sung-Chun Kuo, “Steady state performance of a self-excited induction generator under unbalanced load,” IEEE CNF, vol. 1, pp. 408 – 412, Jan. 2002.

[6] T.F. Chan, Member IEEE, “Self-Excited Induction Generators Driven by Regulated and Unregulated Turbines” IEEE Transactions on Energy Conversion, Vol. 11, No. 2, June 1996.

[7] T. F. Chan, “Steady state analysis of self-excited induction generators,” IEEE Trans. on Energy Conversion, vol. 9, pp. 288–296, June 1994.

[8] T. F. Chan, “Analysis of self-excited induction generators using an iterative Method,” IEEE Trans. Energy Conv., vol. 10, pp. 502–507, Sept. 1995.

[9] T. F. Chan, and L. L. Lai, “Steady-state analysis and performance of a single-phase self-regulated self-excited induction generator,” IEE Proceedings on Generation, Transmission and Distribution, vol. 149, pp. 233 – 241, March 2002.

[10] T. F. Chan and L. L. Lai, “A novel excitation scheme for a stand-alone three-phase induction generator supplying single-phase loads,” IEEE Trans. on Energy Conversion, vol. 19, pp. 136 – 143, Mar. 2004 .

[11] Y. N. Anagreh, “A new approach for steady-state analysis of single-phase self excited induction generator,” IEEE CNF, vol. 2, pp. 509 – 512, Sept. 2004 .

[12] Vineet P. Chandran and Shelly Vadhera “Comparison of nodal admittance and loop impedance methods for self excited induction generator”, International Journal of Advanced Engineering Technology E-ISSN 0976-3945.

[13] S. Murthy, “A generalized dynamic and steady state analysis of self excited induction generator (SEIG) based on MATLAB,” IEEE CNF, vol.3, pp.1933– 1938, Sept. 2005.

[14] S. S. Murthy and S. Acharya, “MATLAB based steady state analysis of self excited induction generator,” IEEE CNF on Power Electronics and Drive Systems, vol. 1, pp. 749 – 753, Nov. 2003.

[15] S. S. Murthy, "A novel self-excited self-regulated single phase induction generator", Part 1: Basic system and theory, IEEE Transactions on Energy Conversion, vol. 8,(3), pp. 377-382, 1993 685, Dec. 1990.

[16] B.Singh and L.B.Shilpkar “Steady-state analysis of single-phase self-excited induction generator” IEE Proc.-Gener. Transm. Distrib. Vol. 146, No. 5, September 1999.

[17] A. H. Albahrani and N. H. Malik, “Steady state analysis of parallel operated self-excited induction generators,” Proc. Inst. Elect. Eng. C, vol. 40, no. 1, pp. 49–55, 1993.

[18] A.L. Alolah and M.A. Alkanhal, “Optimization-based steady state analysis of three phase self-excited induction generator,” IEEE Transaction on Energy Conv., vol.15, pp. 61 – 65, Mar. 2000.

[19] Hassan E. A. Ibrahim, Mohamed F. Serag “Analysis of Self Excited Induction Generator using Particle Swarm Optimization” World Academy of Science, Engineering and Technology 57 2011.

[20] O. Ojo, "Performance of self-excited single-phase induction generators with short shunt and long shunt excitation connections", IEEE Trans. Energy Conversion, vol. 11 (3), pp 477–482, 1996.

[21] S.S. Murthy “General steady-state analysis of three-phase self-excited induction generator feeding three-phase unbalanced load/single-phase load for stand-alone applications”, IEE Proceeding , Vol. I50 No. 1. Janurary2003

[22] E. Bim, J. Szajner, Y. Burian, "Voltage compensation of an induction generator with long shunt connection", IEEE Trans. Energy Conversion, vol. 10 (3), pp 305–313, 1995.

[23] S. P. Singh, B. Singh, and M. P. Jain, “Performance characteristics and optimum utilization of a cage machine as capacitor excited induction generator,” IEEE Trans. Energy Conversion, vol. 5, pp. 679

[24] L. Wang, J. Su,"Dyna mic performances of an isolated self-excited induction generator under various loading conditions", IEEE Transactions on Energy Conversion, vol.14 (1), pp.93-100, 1999.

[25] S.S. Murthy, Ph.D., O.P. Malik, Ph.D., and A.K. Tandon, M.Tech," Analysis of self-excited induction generators”. IEEE Proc, Vol. 129, Pt. C, No. 6, November 1982.

[26] A.K. Tandon, S.S. Murthy steady state analysis of capacitor excited induction generator

IEEE Transactions on Power Apparatus and Systems, Vol. PAS-103, No. 3, March 1984.

[27] Ashok K. Goel, S.C. Saxena, S. Bhanot, "Fast learning algorithm for training feed-forward neural networks",International Journal of System Science, vol. 37, no. 10,pp. 709-722, 2006.

[28] S. Limanond, J. Si, "Neural network based control design: An LMI approach, "IEEE Transactions on Neural Networks, vol. 9(6), pp. 1422-1429, 1998.

[29] Narendra K. S, K. Parthasarathy, "Identification and control of dynamical systems using neural networks,"IEEE Transactions on Neural Networks, vol.1, pp. 24-27, 1990.

[30] D. Joshi, K. S. Sandhu, and M. K. Soni “Performance Analysis of Self-Excited Induction Generator Using Artificial Neural Network” Iranian journal of electrical and computer engineering, vol. 5, NO. 1, winter spring 2006.

[31] Raja Singh Khela, K. S. Sandhu" ANN Model for Estimation of Capacitance Requirements to maintain Constant Air-Gap Voltage of Self-Excited Induction Generator with Variable Load” ISSN : 0976-8491(Online) ISSN : 2229-4333(Print), IJCST Vol. 2, Issue 4,Oct- Dec. 2011

[32] R.S Khela, R. K Bansal, K. S. Sandhu and Ashok Kumar Goel “Application of Artificial Neural Network for Analysis of Self-Excited “Induction Generator” JCS&T Vol. 6 No. 2.

Causes, Consequences and Remedies for Impact Load

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***Abstract*—The impact load is that load which causes a sudden thunder strike of heavy inrush current to flow into itself which causes very high capricious in whole of the electrical system by inrush current and this phenomena is unavoidable. This is not only necessary evil but blessing in disguise also in many fields. So we have no remedy from its impact as there is always reaction with every action. Conventionally one of the remedy is starters-the same starter by further modified can reduce the current flow as minimum as system can tolerate with. In this paper the new solution is introduced that is two point AC starter which will surpass the other devices.**

Key word: inrush, thunder, capricious, capritivity

I. INTRODUCTION

Let any power, generation and distribution system be of vital superiority. Yet it is degraded if adequate stability and sustainable arrangements are not maintained i.e. smooth systematic, uninterrupted, non-fluctuating or load drifting occurred. Generally all these absorbability are tackled with conventional arrangements like AVR, governor, speed regulator etc. But as for impact load which is unavoidable and has drastic adverse affect where tripping of, black out occasionally may occurred or collapse the electrical system causing breakdown of system and fire hazards if system is not recovering back to its original status within due time.

To face such type of problem the remedial measure is quite simple and it is further simplifies by adopting workable solution so here it is my earnest request to the house to bear with simplest and realistic approach to channelize our solution and our team has conquered it by visualizing the approach and its zest. More over all these dents are vividly elaborated in technical books. But this so vital phenomenon is not highlighted. Therefore most of our engineers are unaware able from its practical aspect and concept. Moreover we are concentrating fractional kW utilities but when we move out to heavy duty industries than we really condemned our inadequate accomplishment in our aspect. But necessity is the mother of invention so time to time the remedial solution is derived by our own job engineer and there valuable advice is as followed:

- Be well conversant with machinery.
- Make proper preliminary checks
- Off load the system completely such as
    - Drilling Bit
    - Drilling Head
    - Chipping Axes
    - Shearing Ram
    - Driving Belt
    - Coupling Pinion
    - Outlet Release valve etc
- 100% serviceability of main power supply.
- Keep well vigilance at any abnormality.
- Check momentum of moving part.
- Give adequate time for boot strapping.
- Keep strict watch till plant runs to its brim.

Now gradually load up the system step by step. Take time not to show of your seniority but to save guard the system and to pay much more than aviated time.

So further also no complicated calculation neither any sophisticated arrangements nor additional logistic needs are required. But simply making use of available technology resources and machinery and introducing simply laying ideal i.e. 3 phase transformer. So to surpassing the systems supremacy So to reduce the heap of junks moreover we are well conversed with their appropriate and varying utilities that is for example motor generators, relays, transformer and various associated switch board. So it is the real use of 3R approach.

As our main consideration is to tackle the rush in current on impact load and electrical system especially because of impact load which is not a running load and neither it gradually increasing even not because of malfunctioning of components but it is a necessary evil like pain from child's birth.

This load causes sudden inrush of current which put the plant in the surge vibration. This situation is simply watched by an engineer by blinking eyes till the system reverts back to normal. Because at this junction there are 50% percent chances of success or failure and 100% chances of tripping and there will be drastic starvation, shedding of load and

collapsing of electrical system and paralyzing the plant for prolonged period like fire hazards and switch boards, damaging of armature, collapsing of rectifier circuit, sharing off coupling shaft and sharing off foundation.

II. CAUSES

Reasons of impact Load are drastically deteriorative to perpetuate it we shall take the example of an operational Firm. And selling ship will be the appropriate one, it is not merely connector but also an explorer of my prolonged maritime marine perquisite on boat ship. We shall discuss the perk of impact load in to situation

1. When ship is getting ready to set sail
2. And when it is sailing /exploring /maritime operation

The figure 1 showing the requirement of load varying as per need but the pulses of impact load are tolerable provided pulses are subsiding within tolerable time and within safe current level as quickly as possible.

Prime mover speed is well controllable And AVR of alternator has prompt response and quick control to apprehend the effect of the impact Load.

1. Workshop.
2. Cold Room
3. Air comp/HPPP.
4. AC domestic plants.
5. Capstans wind divide.
6. under water machinery.
7. Windlass.
8. Inter/levying hall bur.

Wide Band / tolerance of synchronizing components

III. CONVENTIONAL TECHNIQUE

We are well aware of these phenomena and accordingly we are using DOL 3 or 4 point starter for DC machine. But as for AC starter are concerned there is really ignored and there consequences is ruining of electrical system. Till now we are using DOL, star delta starter. Of course advancement is going on for hybrid and solid state devices. The present arrangement is vivid as shown in the figure 1.

Infect let us know what starter does- starter is a devise

- Which starts the motor?
- Stop the motor.
- And safe guard the system.

Starter steps down the current required by the motor to safe level when the motor is started and provide actual running current when motor has picked up adequate speed i.e. about 70%, time wise it is about to 4-7 seconds. And shut of the system if any abnormal eventuality occurs.

When motor is started its field takes the formation of star connection and to delta connection when its contacts are changed from start to run. When the run position operates there is still thunder jerk because of impact load. Of course this jerk is bearable by the motor but the installation is still in danger zone.

This is the simple line diagram of star delta starter. This starter helps us to reduce the jerk just by 50%. And this 50% jerk will be tackled by the modified AC starter.

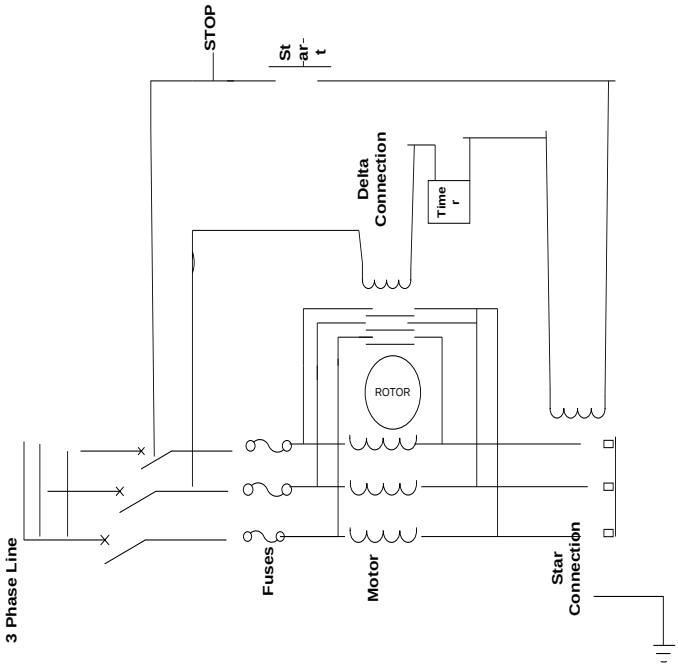

Fig.1 Prevailing version of star-delta starter

IV. MODERN TECHNIQUE

By modifying the prevailing devices by making two points Ac Starters. So, it is our recommendation to incorporate Two Point Ac Starter in all heavy duty prevailing starters. By modifying figure 1 as explained earlier brief description, if in this arrangement, by incorporating three phase delta-star transformers and three in number change over contractor with set timer will modify the existing layout into modified 2-point AC starter. We are making use of original star delta starters. The usual step down arrangement is by connecting stator winding in star connection while starting i.e. current to the motor will be cube root of the main current and while full current will be available for motor. But by incorporating one more delta star transformer at the main terminal of the motor we will be able to tackle the starting current by another step of $\sqrt{3}$.

and finally $\sqrt{\sqrt{3} - \sqrt{3} - 3}$

Tally to Impact load sketch

1. MS on-off.

2. Safety fuse.
3. Main contactor.
4. COS TO M-SW1
5. COS TO M-SW2
6. Make before contact Timer.
7. Local Engine switch.
8. Safety fuses.
9. U/V Contactor.
10. U/I Contactor.
11. Sort contactor.
12. Run contactor.
13 CO Timer.

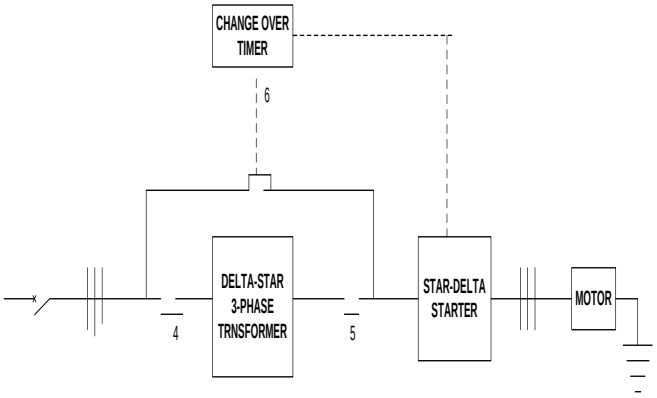

Fig. 2 Modified version of star-delta starter

As soon as start push button is pressed main contactor will come on provided all the safety and interlocks are in contact. Main starter will come on –motor current will be shed by delta star transformer as well as star delta starter. Once the motor has picked the full speed motor will come into running position i.e. delta connection soon after contactor 4 and 5 will change over to contactor 6 and motor will run as usual. Contactor 6 make before break that the changeover time for all contactor is set between 4 to 7 seconds. So we could control the motor current in two steps and also shown in figure 2.

V. CONCLUSION

The consequences of Impact load or rush in current is very high capricious pulses in whole of the electrical system. Actually this phenomena is unavoidable and there is no captivity from its impact because it is a necessary evil, you cannot have any action alone by subsiding reaction, .that is why for captivity from its capricious behavior the alternatives are the following

- To shed the load
- Minimize the load
- Make adequate use of protective devices.

REFERENCES

[1]. Ashfaq Husain, Electric Machines: 2nd Edition, Dhanpat Rai & Co.

[2]. J B Gupta, Utilization of Electric Power & Electric Traction, Vol. 4, Katsons Books.

[3]. J.B.Gupta ,Switchgear and Protection, Katsons Books.

[4]. H.Partab, Art and Science of Utilisatiopn of Electrical Energy, Dhanpat Rai & Co.

Feasibility and Economic Analysis of Solar Photovoltaic Power Plant in Punjab

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***Abstract*— The aim of this paper to examine that the solar photovoltaic system is feasible or not in Punjab state. The economic analysis of the photovoltaic system is also calculated. As the solar energy is very much beneficial for all the purposes as it is renewable resources so it's availability is free of cost and our efforts is only to utilize this energy in proper way. The solar energy is uses in two ways: solar photovoltaic system and concentrated solar power to generate electricity from it. In this paper the solar PV technology is further studied and the feasibility analysis of this is examined. For doing this firstly the levelized cost of electricity (LCOE) is calculated for peak. Medium and base load separately for certain plant in Punjab .then the cost experience curve is formed. In economic analysis the efficiency of plant, its electricity prices are calculated. In last the result justifies the proposed method. The main goal of this study is examine the solar energy in Punjab environment.**

***Keywords— Photovoltaic system; Feasibility analysis; levelized cost of electricity; economic Analysis*.**

I. INTRODUCTION

This template, modified in MS Word 2007 and saved as a "Word 97-2003 Document" for the PC, provides authors with most of the formatting specifications needed for preparing electronic versions of their papers. All standard paper components have been specified for three reasons: (1) ease of use when formatting individual papers, (2) automatic compliance to electronic requirements that facilitate concurrent or later production of electronic products, and (3) conformity of style throughout a conference proceeding. Margins, column widths, line spacing, and type styles are built-in; examples of the type styles are provided throughout this document and are identified in italic type, within parentheses, following the example. Some components, such as multi-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

Table 1.

year	Available electricity (MU)	Consumption of electricity (MU)	Power purchase (MU)
2007-08	29415	32658	3243
2008-09	32915	40165	7250
2009-10	37896	42569	4673
2010-11	40956	47958	7002
2011-12	42349	49277	6928
2012-13	39918	48881	8963
2013-14	40,819	50,850	10031

Source: 1. Central Electricity Authority, Delhi.
2. Punjab State Electricity Board, Patiala.

To avoid this situation government should take the new effective measures by introducing non- conventional and renewable energy resources like solar energy, wind energy, hydro plant etc. Solar energy in India is also a new and existing technology. Solar Energy: A new Revolution. This revolution is now joined by India to become a developed nation as development is basically starts from the base of everything and power is the basic requirement of every task. Generating power from the renewable resources is very beneficial. In this study main focus is on solar energy. Solar energy is what it means utilizes solar energy in proper way indirectly as well as directly. Using solar energy directly to produce electricity is known as photovoltaic energy. In this technology the solar energy is fall into the solar panels and this panel can convert this heat or light energy into electricity in the form of Direct current (DC). Basically the solar panel is made up of semiconductor materials which sense light and due to photovoltaic effect the electricity is produced. In indirectly form the light is first converted into thermal energy than into electricity is also known as concentrated solar power. In this study the solar photovoltaic energy is examined. The feasibility analysis of the study is checked. The Levelized cost of electricity (LCOE) of peak, base and medium load separately calculated and then the cost experience curve calculated and then compared with LCOE to check its feasibility analysis. As for doing all this study the certain plant in Punjab is chosen and by taking their parameter the result is concluded that plant is reliable or not in Punjab weather. The solar photovoltaic plant at Village Khatkar Kalan in District Nawanshahr of the state of Punjab is taken as a reference for this study. Further the price of electricity and efficiency of the plant is calculated and the main factor that influence this and also the factors which modify and that increase the efficiency also discussed. Then the sensitivity analysis of the plant is done. By studying different inputs of the financial analysis and the result is obtained. This signifies the significance of various factors which are involved in it.

II. INTRODUCTION

The main objective of this study is to develop the methodology for study the feasibility analysis and also calculating the economic factors of a solar photovoltaic power plant.

The another objective of the study is to project the failure or success of a plant. If the result shows the project's failure then certain preventive measures are to be taken to save it.

It can estimate the cost of the electricity produced varying from year to year, if cost is increasing then it is necessary to determine the factors which effect the cost.

A. Theoretical study:-

- LCOE: - It stands for levelised cost of electricity. The general theory of power plant cost analysis mainly depends upon the initial investment, but in case of Non-Convential power plant O&M cost is also has significant role. First of all in this LCOE is calculated as it is an important indicator for calculating the cost of the generating units in a power plant. It is the cost of electricity for lifetime of the project. As the cost of the electricity mainly depends upon the following factors:
- C_{DEP} = Depreciation cost of solar PV plant. It is the fixed cost that will be returned to the investors. It mainly depends upon the lifetime of the year.
- $C_{O\&M}$ = it represents the annual cost of operation & maintenance of solar PV plant. It includes basic expenses, wages, labour insurance, material cost and insurance of solar PV plant.
- C_{INCOME} = Annual return of capital.it is basically the amount that annually given to the investors.
- C_{INTER} = Annual loan interest.it is what which will be given to the bank annually.
- E= Annual capacity of generation. It varies from peak, medium and base load.

The cost of model of PV power plant are:-

$$C_{PV} = \frac{C_{DEP}+C_{O\&M}+C_{INCOME}+C_{INTER}}{E}$$

The LCOE for a power plant can be calculated on the basis of their lifetime. As in the case of the solar power plant the lifetime is 25 years. The LCOE has a significant effect while comparing the cost of the different power plants. The other credits, incentives etc. also have significant impact on the LCOE. The use of LCOE for comparison of various plants of unequal life time is also possible. It would also be help to prepare a good idea on the cost of electricity for a newly planned power plant. In this study the LCOE for solar power plant is calculated for peak, medium and base load separately. The direct normal irradiance (DNI) has totally impact on the LCOE. The capacity factor has inversely impact on the LCOE and Feed-in – tariff.

Finally, the average LCOE is also calculated:-

$$LCOE_{AVG} = \frac{LCOE_{PEAK}*E_{PEAK}+LCOE_{MED}*E_{MED}+LCOE_{BASE}*E_{BASE}}{E_{PEAK}+E_{MED}+E_{BASE}}$$

- Cost experience curve: - The solar photovoltaic experience curve shows that the SPV system is a significant component in the electricity market. Solar photovoltaic power plant has an impediment against the conventional or non-renewable energy resources. These plants will develop the overall economy of the country and also give economic advantages. For these conditions, firstly it to be studied that the system is feasible or not. To represents the experience curve there are many empirical formulas. Basically the experience curve is a relationship between the unit cost of production and cumulative production of the solar technology. The basic experience curve relationship are :

$$C_x = C_o \left(\frac{P_x}{P_o}\right)^{\frac{\log PR}{\log 2}}$$

C_o = specific investment at any reference PV plant.

C_x = specific investment of specific PV plant.

P_o = cumulated capacity at any reference PV plant.

P_x = cumulated capacity at specific PV plant.

Log (PR) = log of progress ratio.

Progress ratio (PR):-

PR= 1- LR

LR= learning ratio. It is defined as with every doubling of cumulative production the per unit cost will decreases. The rate at which it decreases is known as learning ratio.
To calculate the value of the specific investment of any reference PV power plant following relation is used:-

- $$C_o = C_r \frac{DNI_r}{DNI_s}$$

Where C_r = Feed in tariff for specific power plant.
DNI_r = Direct normal irradiance of reference plant.
DNI_s = Direct normal irradiance of specific plant.
Direct normal irradiance (DNI) = is the solar radiation received in an area in what amount. In this the PV panels are placed the perpendicular or at some angle to sun. The DNI value is recorded by the geographical radiation.

- **Cost/ KW** = Cost/ KW means the price of electricity. It is calculated for a particular year or for a particular month. It is an electricity tariff that can be different for different power plants and it also varies from one country to other country or even state to state. In case of a non-conventional power plant located in a particular city it varies from city to city also. It's basic key factor on which it depends is the type of fuel used and their cost, incentives, maintenance etc. in this study the price of electricity of solar

plant is calculated and as it is renewable energy resource so there is no cost of fuel only initial investment and the amount of units generated are considered in solar power plant the formula for calculating the price of electricity is given below:

$$P = \frac{C}{E}$$

Where C = cost of the factors that effect the price of the electricity in solar power plant.

E = system peak energy in a particular year.

The main factors that effect the cost of the electricity is:

- I_p = Panel cost
- I_L = Installation cost
- I_i = Inverter cost
- L_p = system lifetime
- L_i = inverter lifetime
- M = maintenance cost

$$\mathbf{C = I_p + I_L + \left(\frac{L_p}{L_i}\right) I_i + L_p * M}$$

As this price is calculated for a particular year. In solar PV plant the inverter has also an important role so for calculating the price of electricity the inverter's parameter must be considered.

- **Efficiency**: it is defined as the ability to do some work with very efficiently by using same amount of parameters or it means utilizing the input in a very efficient way to increase the output. Now a days, due to the energy crisis main focus is on the renewable sources and in case of solar plant it is very necessary to increase the efficiency of a solar power plant. The efficiency of a solar power plant mainly depends upon the weather conditions, the net power generated. The basic relation for calculating efficiency of SPV plant:-

$$\text{Efficiency} = \frac{Power\ Max.}{Power\ Input}$$

In this the power max. = $V_{os} * I_{sc} * form\ factor$

Where $\boldsymbol{V_{os}}$ = open circuit voltage in volts.

$\boldsymbol{I_{sc}}$ = Short circuit current in amperes.

Form factor = it is the factor that determines what amount of energy should be produced for particular time it is also known as availability factor. The form factor for a solar plant depends upon the sunlight availability. But mainly the value of the form factor is taken as 0.70.

- **Sensitivity analysis**: Sensitivity analysis is basically means the impact on output by varying the values in input. This analysis is done to determine the variations in the input effect on the financial feasibility of installing and operating of a solar PV system. By studying different inputs of the financial analysis and the result is obtained. This signifies the significance of various factors which are involved in it. Here are the various factors which are considered for its varying:-

- **LCOE**: - levelized cost of electricity is mainly used to study the economic analysis of the solar photovoltaic power plant. As the LCOE is very sensitive to the economic variations. The basic formula for the LCOE is:

$$\text{LCOE} = \frac{C_{DEP} + C_{O\&M} + C_{INCOME} + C_{INTER}}{E}$$

In this the capital cost is varies and its effect on the LCOE is obtained. For the 3 different factors are produced: 0%, 15%, and 30% of interest rate and plus or minus 15% capital cost and here the variations are calculated.

a) NPV: - It stands for net present value.NPV is the measurement that are very often used in capital budgeting to measure and compare the profitability of the investor. It is the term that take total return on investment into consideration. NPV is a way to access rather the cash flow of a project is positive while taking into account the time value of money. In its simplest form it means that a cost (rupee) today is worth more than a cost (rupee) tomorrow.

- The sensitivity analysis of NPV is done to check the reliability of the cost of the power plant.

$$\text{NPV} = \frac{R - k_t}{1 + d}$$

Where R= annual revenues of the solar photovoltaic power plant.

k_t = annual cost of the solar photovoltaic power plant.

d = nominal discount rate.

The annual revenues of the SPV plant is calculated by using relation:

$$\mathbf{R = E_{pv}\,(1 - f_{epv})^{t-1}\,P_{epv}\,(1 + E_p)^{t-1}}$$

Where E_{pv} = annual PV electricity yield

f_{epv} = degradation factor of solar plant.

P_{epv} = market electricity price of SPV power.

E_p = increases in annual rate of electricity.

The annual cost of the SPV plant is calculated by:

$$k_t = C_{DEP} + C_{O\&M} + C_{INCOME} + C_{INTER}$$

By calculating these values net present value of solar photovoltaic power plant is calculated.

Calculation**:-**

- LCOE :- Levelized Cost of Electricity firstly calculated by using these equation :-

$$\mathbf{LCOE = \frac{C_{DEP} + C_{O\&M} + C_{INCOME} + C_{INTER}}{E}}$$

- C_{DEP} = Depreciation cost of solar PV plant.
- $C_{O\&M}$ = It represents the annual cost of operation & maintenance of solar PV plant.
- C_{INCOME} = Annual return of capital.
- C_{INTER} = Annual loan interest.
- E= Annual capacity of generation. It varies from peak, medium and base load.

The all these factors will be depend upon the initial investment expect annual capacity of generation. The initial investment of the 200kw solar plant at village Khatkhar Kalan district Nawanshahr is:

Initial investment (I) = 43642000 Rs.

- C_{DEP} = 80% of I
  = 80% of 43642000
  = 34913600 Rs.
- C_{INCOME} = 70% of I
  = 70% of 43642000
  = 30549400 Rs.
- C_{INTER} = 12% of I

  = 12% of 43642000

  = 437040 Rs.

- $C_{O\&M}$ = 75000 Rs.

III. RESULT

Feasibility analysis**:** To do this analysis the following parameters are considered:-

• LCOE- Levelized cost of electricity is calculated and compared for 2003 onwards. The formula is used to calculate as it is described in present work. The result obtained is shown in table:

Table 2.

Year	2003	2004	2005	2006	2007	2008
CP_{BASE}	15560	8715	7090	6898	4848	6915
CP_{MED}	3838	5057	4736	4152	4285	3871
CP_{PEAK}	2802	3337	3247	2776	3145	2951
Year	2009	2010	2011	2012	2013	2014
CP_{BASE}	21200	21200	7717028	8817.83	46824.8	10159.3
CP_{MED}	5710	6031	5646.6	5170.05	5781.19	5543.18
CP_{PEAK}	2942	3640	4173.78	3767.84	3420.52	3597.33

Then the average LCOE for 2003 onwards is also calculated:-

Year	2003	2004	2005	2006	2007	2008
	2009	2010	2011	2012	2013	2014
CPAVG	4400	4900	4544	4021	3960	4904
	5336	6151	5491.81	5242.62	5487.7	
	5387.7					

For this values the graph is following:

• Cost experience curve: The basic cost experience curve data is calculated as :

Year	2003	2004	2005	2006	2007	2008
	2009	2010	2011	2012	2013	2014
CX	4303	4289	4612	4338	4314	4266
	4309	4211	4293	4271	4314	4330

The cost experience curve is compared with the LCOE curve to determine the feasibility analysis:

As the curve The solar PV plant in Village Khatkar Kalan in District Nawanshahr of the state of Punjab is feasible. The investment for this plant is feasible. As in this study the main focus is on the potential of the renewable energy. In this study it is clear that the land cost is not so high and the weather conditions and the technology will degrade its efficiency.

• Cost/KW : the intial cost of the solar photovoltaic plant is very high and it effect the cost of electricity as in the renewable resources after the payback period the plant is running free of cost and the only factor is the maintenance cost which is also very low. Then the cost of the electricity calculated for 2003 onwards are :

Year	2003	2004	2005	2006	2007	2008
	2009	2010	2011	2012	2013	2014
Cost	17.90	16.53	18.67	17.11	15.21	17.58
	18.16	22.63	19.29	18.75	16.12	19.60

As seen from the table of the cost/KW the cost is very high. So the long-term policies and research & development are further needed in the solar power plant to decrease this cost.

• Efficiency : The efficiency of the solar photovoltaic plant Village Khatkar Kalan in District Nawanshahr of the state of Punjab is 18.10%. As the efficiency is very low many Factors which effect it. Now a days the new and efficient solar panels are Introduced which increase the efficiency of the plant and the sunlight hours are also Effect it.

IV. SENSITIVITY ANALYSIS:

• The preferable LCOE is 5.7 and 6.6 with interest rate 30%.

• With increase/ decrease in capital cost at 15%, the solar system can be installed at the interest of 30%.

• In sensitivity analysis main highlights is that the LCOE was very sensitive to the variation of PV cost.

• The NPV values are strongly affected by the PV yield and discount rate also.

• The NPV value with interest 30% is not feasible.

• The acceptable NPV cost is 3.9 and 3.6 with interest rate 10% and 20% respectively

REFERENCES

[1] IEA(International Energy Agency), 2010. Technology Roadmap-Solar Photovoltaic energy.

[2] Jürgen Dersch, Michael Geyer, Ulf Herrmann, 2004. Trough integration into power plants—a study on the performance and

economy of integrated solar combined cycle systems. Energy, 29, 947-959.

[3] Theocharis Tsoutsos, Vasilis Gekas, Katerina Marketaki, 2003. Technical and economical evaluation of solar thermal power generation. Renewable Energy, 28, 873-886.

[4] Li Xin, Li An-ding, Li Bin, Zheng Fei, 2005. Economic analysis of dish/stirling solar power system, Proceedings of the CSEE, 25(6), 108-111.

[5] W. Palz, "Solar Electricity – An Economic Approach to Solar

[6] Energy," *Butterworths*, UNESCO, pp. 73, 1978.

Track-2

Technical Session 2

MECHANICAL ENGINEERING

Performance Techniques for Operability of Regulating Globe Valve and Its Functioning

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***Abstract*— The valve manufacturers use FEA simulation tools to effectively optimize the design. This paper briefly explains the typical problems faced in the industry with the conventional globe such as the difficult manual operation due to higher valve torque, stem bending issues in stainless steel material, packing performance deterioration by rotating stem design, galling problems at stem threads and at flange bolts and gland packing eyebolts at low temperature. It also dealt on the common control valve parameters which degrade performance like cavitation problems leading to erosion, reduced flow capacity, flow separation & recirculation, pressure drop across the valve & Noise levels.**

Main objectives are:

To know about new disc tapering angle.

To know about modifications in stem design.

To know about modern FEA analysis.

Keywords— DISC; FEA.

I. INTRODUCTION

Economic and environmental constraints dictate the need for the efficient performance of valves in stringent environments. Keeping this in mind, the globe & control valve designs were optimized using the latest software for FEA. Standard globe valves are used in throttling applications where the flow rate is moderately regulated by manually adjusting the disc positions whereas in control valves the flow is very precisely controlled by the automatically operated actuators in the closed loop system.(1,2) The control valves have inherent flow characteristics that define the relationship between the valve opening and flow rate under constant pressure conditions. Globe valves over a period of usage face several typical problems in the site like deteriorated packing performance, seat leakage, difficulty in operating the valve & stem bending problems in stainless trims and binding of yoke-sleeve and stem threads due to the galling process etc. This paper explains in detail about the various problems faced in the site along with the solutions to overcome such issues and also it talks about the new globe features that enhance product performance. The cost focus was also given to reduce the valve weight in view of the global concerns on cost reduction.

Weight reduction is done by optimizing the various parameters like cover flange thickness optimization using Finite element analysis (FEA)(5).

II. LITERATURE REVIEW

In recent years, the valve manufacturers across the world focused their attention towards developing high performance globe valve designs to outweigh the problems caused by the conventional globe.(3)

Typical problems faced in the industry with conventional Globe as follows:

- Higher valve torque due to the high thrust force acting on the disc.
- Difficult manual operation.
- Stem bending problems more prominent in stainless steel material.
- The high frictional forces at the stem threads & yoke sleeve collar faces leads to high torque and shortens valve life.
- Rotating stem design deteriorates the packing performance at fewer cycles.
- Improper selection of stem and yoke-sleeve material resulting in galling.
- Stem binding due to galling with the mating components.
- Gland packing leaks –not meeting fugitive emission requirements.
- Galling of flange bolts and gland packing eyebolts at low temperature.
- Threaded seat ring design leaks at high pressure applications

III. MODIFICATION AND OPTIMIZATION

Non-rotating globe design arrangement significantly reduces the valve torque.

- Body-bonnet cover flange thickness and disc thickness optimization using ASME calculations and FEA simulation.
- In-suite seat arrangement (Integral body seat design) and seal-welding of threaded seat ring eliminates the leakage through the seat threads.
- Guided disc arrangement and selection of high strength stem material avoids the stem bending problem as well improves the sealing performance.
- The fugitive emission service requirements are met by eliminating the packing erosion caused by the stem rotation.

- Introduction of needle roller/thrust ball bearing at the yoke-sleeve collar faces reduces the friction. Also the introduction of washers and application of proper lubricants at nut surfaces helps to reduce the galling of bolts.
- Selection of proper material of stem and yoke-sleeve avoids galling in the threads (ex. Al, Bronze with SS combination).
- The new taper seat angle reduces the seating thrust and hence the torque.
- Disc seat contact at the bottom for tight shut-off.

IV. NEW DISC SEATING TAPER ANGLE

Disc sealing force is the force which is exerted on the disc against the seating surface to have tight shut-off. The sealing force can be reduced by changing the taper seat angle from 20 to 15 degrees as the force component vector depends on the seating angle. The figure.1 depicts the disc taper angle.

F = 3.14 x Ds x W x P x SIN (A+B)

Where F = Seating force

Ds = Diameter of seat ring bore

W= Width of the disc contact area.

P= Fluid pressure

A= Seat angle

B= Friction angle.

In the above formula when "A" is changed from 20 to 15 degrees, the sine component reduces and hence the disc sealing force.

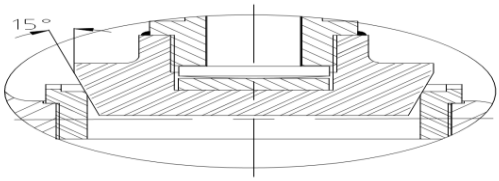

Fig.1

A. *Non-Rotating Stem Design:*

The conventional rotating type globe designs have more difficulties in manually operating the valve due to higher valve torque. This problem is addressed by converting from rotating to non-rotating type stem design. This helps in reducing the valve torque by 15% to 25% when compared with that of the rotating stem design due to the elimination of packing frictional torque. The anti-rotating device across the stem flat prevents the stem rotation and allows only the guide support to linear travel through the slot guide provided in the bonnet. The fugitive emission requirements are easily met by preventing the stem rotation and also the packing life is enhanced by minimizing the packing erosion.Figure.2 and shows the arrangement of non-rotating stem design and the anti-rotating device

Fig. 2

B. *Body Guided Disc Type:*

In this arrangement, the disc is very closely guided along the ribs provided in the body, during the valve opening and closing. This supporting rib reduces the alignment variations caused by the bending of the stem. Also it takes up the bending load that comes on the stem when the hand wheel is over-tightened and also it resists the side thrust exerted on the disc. This guiding arrangement provides effective sealing of the disc by the effective transmission of the hand wheel force to the disc. The figure.3 shows the body guided ribs.

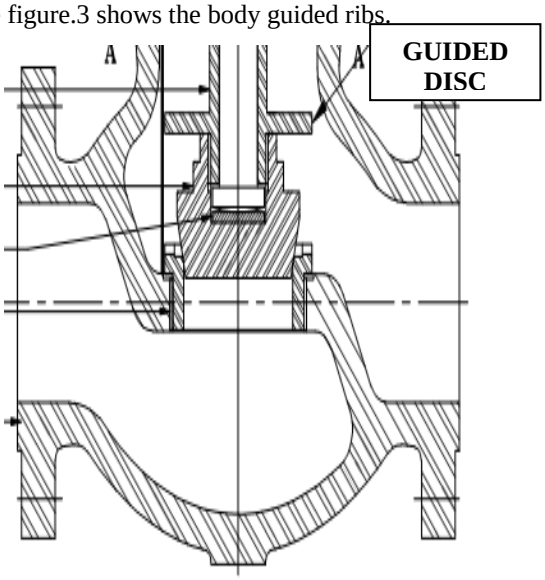

Fig. 3

V. DESIGN OPTIMIZATION – USING FEA

Finite element analysis is done on the pressure subjected components like body, bonnet & disc using FEA package. Structural analysis ensures that the stresses and deflection

induced are within the allowable limits. The pressure loads are applied on the body and disc surfaces exposed to the line fluid and also bolting load is applied on the body & bonnet bolting spot face area. These give the realistic picture of how the valve behaves under the pressure conditions. Fixed constraints are given on the end flanges of the body to stimulate that it is fixed on the pipe flanges. The Figure 4 shows the FEA analysis on body, bonnet & disc. The body stress plots shows that the maximum stress induced is 14000 psi, which is less than allowable stress of 18000 psi for stainless material. Similarly the disc stress and strain induced are within the allowable limits. The fringes of red color is the maximum value and blue is the minimum value induced.(4)

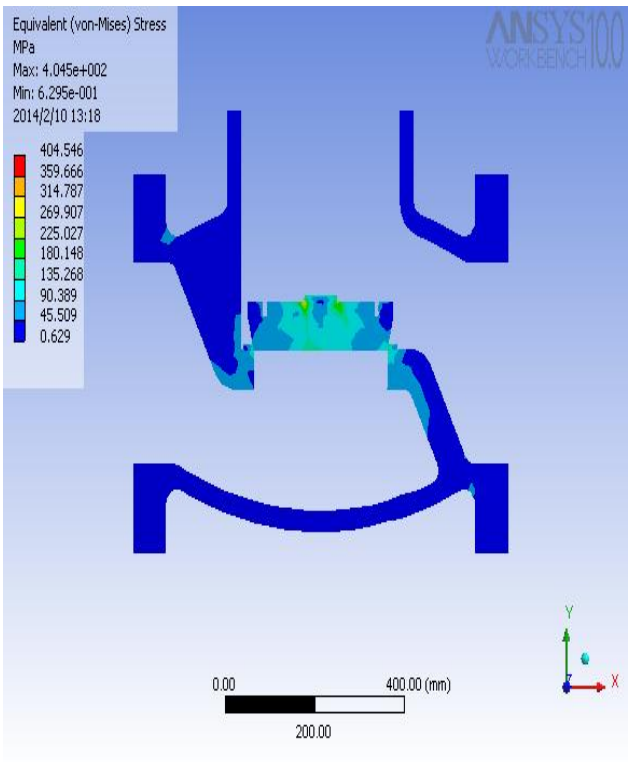

Fig. 4

A. Maximum shear stress and Total deformation Optimization – FEA

The Body-Bonnet flanged joint flange thickness is calculated by using the ASME SECTION VIII calculations. After the developments of CAD/CAE software, the valve industries started realizing that the ASME calculations were excessively conservative due to the more factor of safety on the mechanical strength which is inbuilt in the ASME approach of design by codes. The designs are validated using the ASME calculations and also by FEA. The FEA analysis gives the opportunity for optimizing the flange thickness further to meet the demands of the market on reducing the weights for cost reduction. The weight reduction along with the enhanced performance made the product always to be competitive in the market.

The ASME calculations and the FEA results are compared and analyzed for the optimized flange thickness. The FEA accurate interpretation of the results gives the designer a better opportunity for optimizations. In this analysis each single load can be detailed and the possibility to include the real and also non-linear bolts and gasket behavior get the loads. The real geometry can be taken into account including the uni-lateral contacts, material non-linearities and hub geometry.As we can see effects of maximum shear stress and total deformation in figure 5 & figure 6 respectively.

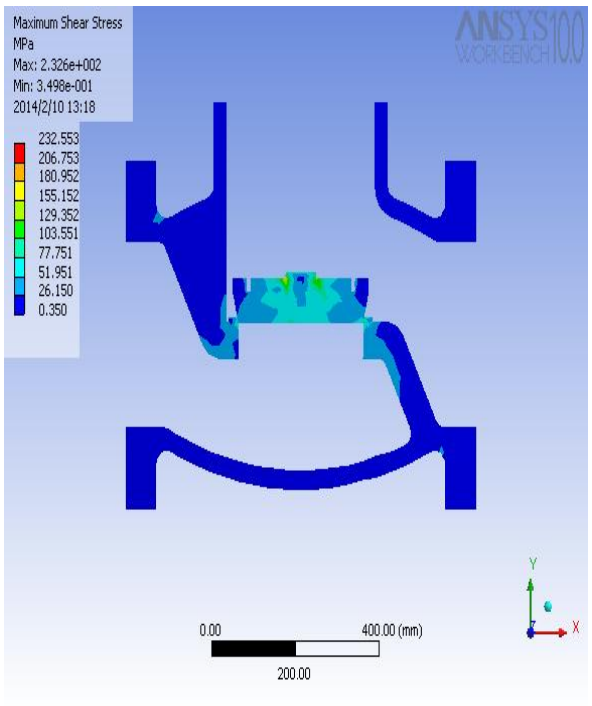

Fig. 5

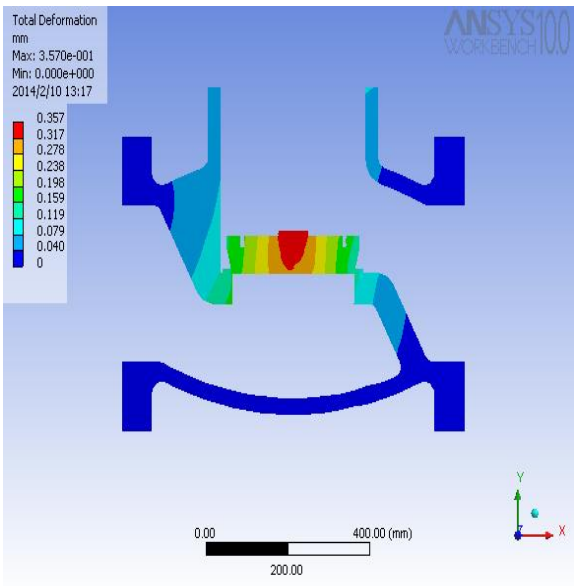

Fig. 6

VI. CONCLUSION

It has been shown that the means of improving the conventional globe performance by adopting the new features like Non-Rotating stem, Integral seat, Guided disc etc. These new features are incorporated in the design to improve the performance parameters like valve sealing leakage rate, valve torque, packing emission requirements and minimized hand wheel effort. It has also been shown how FEA tools are used to effectively optimize the valve design.

REFERENCES

[1] Valve handbook by GH pearson

[2] Fluids Handling Principles and practice, 2nd edition

[3] Schweitzer, Philip A., Handbook of Valves

[4] ANSYS 10.O & SOLID WORKS.

[5] Fluids Handling Principles and practice, 2nd edition

[6] International Journal of Engineering and Innovative Technology (IJEIT) Volume 3, Issue 10, April 2014 -Behaviour analysis of stainless steel globe valve under different temperature conditions using FEA AUTHORS DR GURUDUTT SAHNI ,BALPREET SINGH

[7] 2nd National conference on 5th april 2014 at st soldier institute of engg & tech. THE EFFECT OF THERMAL STRESSES ON GATE VALVE AND ITS OPTIMIZATION USING FEA ANALYSIS AUTHORS DR GURUDUTT SAHNI ,BALPREET SINGH.

Cold Sprayed Coating for Power Plants

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***Abstract*— The power plants, based upon coal or waste, are facing problem of failure of boiler tubes due to corrosive surrounding environment. This problem increases with rise of working temperature of plants. The working environment becomes more corrosive with the presence of chlorine and its compounds around the boiler tubes. In this study, the failure mechanism of the tubes and one of the preventive methods of coating by cold spray technique is discussed.**

Keywords—Cold Spray; Power Plant; Corrosion; Chlorine

I. INTRODUCTION

The failure of the boiler and super-heater tubes of power plants by corrosive degradation is still a serious issue and needs research worldwide. The presence of chlorine containing compounds in the flue gases, which come in contact with the metals/alloys, results in more severe degradation conditions. The chlorine containing compounds are usually found in the power plants working on different types of waste as fuel [1-5]. These waste based power plants are known as waste-to-energy or WTE plants, and the failure of the boiler tubes is more rapid in comparison to coal based thermal plants. There are several methods suggested in literature to slow down the corrosive failure of the plant components. One of the methods is the application of protective surface layer coatings. Out of the several layer coating techniques, thermal spray techniques famous amongst all. Recently a new member is included in the thermal spray family, namely cold spray technique. In the subsequent sections, study related to chlorine based failure mechanism and cold spray technique is provided [6,7].

II. FAILURE MECHANISM IN WTE PLANTS

The mechanism of failure of plants components in chlorine based surrounding atmosphere is known as 'Active-oxidation'. In this mechanism, a cycle of oxidation and chlorination reactions takes place, named as oxy-chlorination reaction cycle. During this mechanism a chain of chemcial reactions takes place and results in the formation of a surface oxide scale on the metal components. This oxide scale loose its ability of protection during its formation. The oxidation of the metal elements results in only degradation of the metal. The boiler tube material will loose its strength and capacity of carrying loads and results in their failure [4,5].

During burning of the fuels, such as waste in WTE plants, the chlorine and its various compounds with alkali and heavy metals vaporize and travel with the flue gases. These flue gases comes in-contact with the plant components such as boiler and superheater tubes. The heat of the flue gases transferred to the fluid present in the tubes. During this interaction the various compounds present in the flue gases, including chlorides, deposits on the tubes due to high temperature. The composition of deposits varies, depending upon the temperature conditions. At temperature lower than 400^{o}C, heavy metal chlorides deposits on the tubes, and in the temperature range between 500 to 700^{o}C, alkali chloride deposits. This depends upon the melting behavior of the compounds present in the flue gases [4, 5].

The chlorine which is present in these tube deposits released in the form of gas and penetrates from all the protective layer of tube surface. This gases chlorine generates a high partial pressure of chlorine in the region between tube surface and surrounding oxide layer. Due to this high chlorine pressure, the elements of tube material react with chlorine and forms metal chlorides. These chlorides further vaporize and reach to the atmosphere of high oxygen pressure. At this conditions chlorides again converted to metal oxides with the release of chlorine in the form of gas. This is the important point in this discussion that chlorine which was consumed during the start of the chain of reactions is again released in the end. This shows that same chlorine is again ready to start the reaction cycle and there is no need of new chloride deposits from the flue gases. In this way, with the passage of time tube material elements are converted into non-protective oxides, which detached from the tube surface. This results in decrease in tube thickness and results in lessen the load bearing capability of the boiler and super-heater tube material [1-5].

III. COLD SPRAY COATING METHOD

Amongst the various preventive methods against the failure of the boiler tube materials, surface coating is the favorable of the research community. The thermal spray coating techniques includes HVOF, plasma spray and CVD are famous amongst the large family. Around three decades back a new member joined this family with the designation of cold spray coating method. This method is coming out of its age in last decade and is becoming popular power plant industry [6, 7].

This method is known by many designations like cold spray, kinetic spray and cold gas dynamic spray. The coating principle of the method is different from all other members of the thermal spray community. The working temperature of this method is lower as compared to other technique that's why this method is named as cold spray. It is this property of low coating temperature that gives uniqueness to this method. The low temperature also develops coating microstructure which is different from that generated at high temperature. The cold spray technique is available in two formats depends upon the working conditions [6, 7]:

1) *Low pressure cold spray (LPCS)*
2) *High pressure cold spray (HPCS)*

In the cold spray system the coating material is used in the form of powder. This powder material flows towards the spray nozzle with the help of carrier and accelerating gas. The gases generally used are *Nitrogen* and *Helium* in this system. However, the *Helium* gas is more costly, but gives excellent coating results as compared to other gases. The powder reached in the converging-diverging nozzle usually known as *DeLaval* nozzle [6]. The nozzle accelerates the powder particles present in the gas and increases the kinetic energy of the particles. The range of this kinetic energy is kept lower than the melting range of the particles. During this whole spray process the particles remains in original solid state. Now, in-contrast to HVOF and other high temperature thermal spray methods, the coating in this method is developed by using the kinetic energy of the particles only. The high speed particles travels like a bullet fired from the gun and penetrates deep inside the surface of the base material placed in-front of them. After the development of first coating layer on the base metal, subsequent particles penetrates into the first particle layer and in this process creates a thick layer of the solid particles coating. The creation of coating by solid particles results in formation oxide-free coating. The bullet like penetration of the particles leaves less space between the particles, thus coating obtained is dense [6, 7].

The properties, of the coating microstructure obtained by the solid spraying particle material, is favorable to stop the chain reaction formed by the chlorine gas in the corrosive boiler environment. If chlorine gas unable to interact with the tube surface below the coating and also not able to form high chlorine partial pressure (as discussed above in this study), then it is a possible to increase the tube life. The increase in tube life results in higher working efficiency of the plants and low maintenance cost. This will result in compensation of the coating cost and thus net higher return from the working of the plant.

IV. CONCLUSION

A. The corrosion problem in power plants still needs remedies.
B. The boiler tube failures in WTE plants in more severe as compared to coal based power plants.
C. The chlorine presence in fuel is more damaging than other elements.
D. The cold spray coating is new and different from other techniques, and still research is required for their role in preventing corrosion in WTE and other plant conditions.

REFERENCES

[1] T. Ishitsuka, and K. Nose, “Solubility study on protective oxide films in molten chlorides created by refuse incineration environment”, Materials and Corrosion, 2000, 51(3), pp.177-181.

[2] A.A. Khan, W. De Jong, P.J. Jansens, and H. Spliethoff, “Biomass combustion in fluidized bed boilers: Potential problems and remedies”, Fuel Processing Technology, 2009, 90, pp. 21-50.

[3] Shang-Hsiu Lee, and Nickolas J. Themelis, “High-Temperature Corrosion in Waste-to-Energy Boilers”, Journal of Thermal Spray Technology, 2007, 16(1), pp. 104-110.

[4] H.H. Krause, “Boiler tube failures in municipal waste to energy plants”, Materials Performance, 1996, 35 (1), pp. 46-53.

[5] H. Singh, and T. S. Sidhu, “High temperature corrosion behavior of Ni-based superalloy Superni-75 in the real service environment of medical waste incinerator”, Oxid. Met., 2013, 80 (5–6), pp. 651–668.

[6] H. Singh, T. S. Sidhu, and S. B. S. Kalsi, “Development of cold spray from innovation to emerging future coating technology”, J. Braz. Soc. Mech. Sci. Eng., 2013, 35, pp. 231–245.

[7] H. Singh, T. S. Sidhu, and S. B. S. Kalsi, “Cold spray technology: Future of coating deposition processes”, Fract. Struct. Integr., 2012, 6, (22), pp. 69–84.

Comparative Study of Surface Roughness While Machining of EN8D Steel Under Wet and MQL Condition

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Abstract-High surface quality at low cost is always desirable in manufacturing industries. As during machining the temperature of cutting area is very high, it affects the tool life and surface quality. The high temperature generation is controlled by supplying the cutting fluids during the machining. But due to environmetal regulations there use during the machining become restricted. So it leads to the development of new techniques of supplying lubrication like minimum quantity during machining (MQL). It not only environmental friendly but also economical. Other than the heat generation, the surface quality is also affected by the various parameters like tool geometry, cutting parameters, work material quality and environmental factors. Hence, in this research work comparative analysis of surface quality was made while machining EN-8D steel by varying the cutting parameter and tools shape under wet and MQL.

KeyWord: Design of experiment; Surface roughness; Cutting fluid; ANOVA.

I. INTRODUCTION

The challenge of modern machining industries mainly focused on the achievement of high quality in terms of work part dimensional accuracy and surface finish, high production rate and cost saving. Surface finish is related to the end product and also allows the proper function of the product in the application. The resultant surface roughness in the cutting operation is determined by ideal surface roughness (geometry of the tool and machining parameter) and natural surface roughness (due to irregularities and uncontrollable factors in the cutting operation) [1]. During machining operation surface, roughness is also influenced by work material factors, geometric factors and machine tool factors [2]. The better surface quality is achieved by machining EN-8D steels at low feed rate and high spindle speed [3]. It was investigated that the feed has the variable effect on surface roughness [4]. For the surface roughness, the feed rate is the main influencing factor, followed by the tool nose radius and cutting speed. Depths of cut have no significant effect on the surface roughness [5]. Also, the surface quality is improved when the cutting speed increased [6]. Also like feed rate, the cutting speed has a main influence on the surface roughness. Higher the cutting the speed lower the value of surface roughness [7]. Hence several researchers have done the research on machining, and it was found that surface quality is the desired output during the machining. The surface roughness and cutting forces are significantly reduced by the application of MQL supply during the machining of AISI 1045 steel when compared to wet condition [8]. Surface quality obtained by the application of MQL is better than dry condition during machining of hardened medium carbon steel. Because of the reduction in auxiliary flank wear and formation of built-up, edge that is responsible for surface roughness due to a reduction in cutting zone temperature [9]. Surface topography characteristics are not only depend on the selection of cooling and lubrication technique during machining of C45 steel. However, it is mainly affected by selection of cutting parameters, namely the cutting speed and feed rate. Depending on the cutting parameter selection, better surface roughness, waviness and profile bearing ratio as well as surface topography appeared during minimum quantity lubrication supply [10]. Cutting forces are affected both by cutting speed and by cutting environmental during the machining process. In addition, forces were found lesser during MQL supply when compared with dry and wet environment conditions. Ra value for dry machining observed during experimentation was 1.2 µm and for wet turning 1.1 µm. However, it is 0.9 µm during MQL condition [11]. Cutting forces are decreases and surface finish improved with the use of MQL supply during the machining of hardened steel AISI 4340. They concluded that the cutting temperature is less for 20 ml/min as compared to 10ml/min during MQL supply [12]. Cutting performance are improved by the application of MQL supply during the machining of AISI 4140 steel when compared to dry and flooded conditions. They also analyzed that position of MQL nozzle as relevant parameters during the machining process [13]. MQL supply on the rake and flank face improve the subsurface integrity[14]. Surface roughness is lower by amount 20-35% by using vegetable-based oil Minimum quantity lubrication when compared with dry machining of EN-31 alloy steel [15]. Cutting forces are reduced 16% by MQL supply during the machining of Aluminum bronze. They concluded; this is due to a reduction in force of friction between chip and tool, which in term reduction of cutting force. Reduction of cutting forces means less power consumption which in terms of saving energy during MQL [16]. The machining performance with vegetable-based fluid (Boron, Chlorine and Nitrite free) delivered under MQL provided equivalent performance to that of dry condition during machining of

SAE 1050 steel [17]. It observed that longer tool life during the hard turning of 9CrSi steel by (MQL) of peanut oil when compared with dry and emulsion MQL[18]. Therefore it has observed from above past research work that researcher have investigated the effect of MQL on surface quality, but still there is a need to investigate the effects of MQL on other materials. Hence in this research work the effect of MQL on surface quality during machining of EN-8D steel has been investigated.

II. EXPERIMENTAL DETAILS

A. *Work Materials*

For the present study EN-8D steel was selected as work material. The materials used as wide range of applications e.g., It is used to manufacture axle's, rams and ring gears, conveyor parts, logging parts, spindles, shafts, sprockets, studs, pinions pump shafts, etc. Work pieces of length 300mm and 50mm were used in experimentation. The work piece material was hardened to 25-30 HRC before machining. The chemical composition of work piece material has been shown in table (1) given below.

Table 1: Composition of Material EN-8D.

C%	**Si%**	**Mn%**	**P%**	**Cr%**	**S%**
0.40/0.45	0.15/0.35	0.70/0.90	0.035max	0.20max	0.035 max

B. *Cutting Inserts*

As per the problem formulated, the surface roughness was investigated for the different shapes of carbide inserts. The tungsten carbide cutting inserts were selected for the experimentation. The inserts were triangular and trapezoidal in shape. The cutting inserts were purchased from the Sandvik company ltd.

C. *Machine Tool*

Machine that holds the work piece between two rigid and strong supports, called centre. The chuck is mounted on the projected end of the machine spindle. The cutting tool is rigidly held and supported in the tool post and is fed against the revolving work. There were many types of machine tools were available in the market but the required machine tool, which was used in the present study was made of HMT limited. The lathe machine of LB- 17 model was used. The experimental set up for flooded and MQL as shown in Fig (1) and Fig (2).

Fig 1 : Experimental set up (Flooded condition)

Fig 2 : Experimental setup (MQL)

III. EXPERIMENTAL DESIGN

Taguchi approach is used to design an experiment (DOE). It is well- known technique that provides process optimization used for high quality system. It provides optimum condition of process parameter that is least sensitive to the various causes of variations. Signal to noise ratio and orthogonal array are two major tools used in robust design.

Table 2: input machining parameters at different Levels

Level	Speed(mm/min)	Feed(mm/rev.)	Environment	Insert shape
1	1.6325	1.4925	1.5263	1.3450
2	1.0425	1.2950	0.8163	0.9975
3	0.8450	0.9900		
4	1.1650	0.9075		
Delta	0.7875	0.5850	0.7100	0.3475

The S/N ratio characteristics can be divided into three categories (a) Nominal the best (b) Smaller the better (c) Larger is better features. For the surface roughness, the solution is "smaller is better" and S/N ratio is determined according to the following equation:

$$S/N = -10 \log_{10} [\text{mean of sum of squares of measured data}]$$

Where, S/N = Signal to Noise Ratio, n = No. of Measurements, y = Measured Value.

Selection of parameters and their levels must be taken into consideration before finalizing the design of experiments [8]. In the present's research two different cutting parameters spindle speed and feed having four different levels of each parameter are used as shown in table (2). In addition, two different types of environment and inserts are used during experimentation. Therefore, total four parameters are considered in the experiment. Degree of freedom (DOF) for cutting parameters (speed and feed) is 2 each,1 DOF for environment and 1 DOF for cutting inserts. Total DOF in the present investigation are:

$(1 \times 1) + (1 \times 1) + (4 \times 2) = 10.$

Hence, L16 orthogonal array was used for planning the experimentation. Where cutting speed selected as 50, 75, 100 and 125 m/min and feed rate are 0.1, 0.2, 0.3 and 0.4

mm/rev have been taken in the experiment. Also, two tool shapes and environments, triangular and trapezoidal insert and Wet and MQL have been taken.

IV. RESULTS AND DISCUSSION

The experiments are performed, and the surface roughness is measured. At least one run with the same setting of parameters was taken into consideration and the mean SN ratio as shown in the table (3). All these calculation are performed using software Minitab-14

Table 3: Output data for surface roughness and Mean

Input machining parameter	Levels and corresponding values of machining parameters			
	Level 1	Level 2	Level 3	Level 4
Speed (mm/min)	50	75	100	125
Feed (mm/rev.)	0.1	0.2	0.3	0.4
Environment	Wet	MQL	…… ….	…… …
Insert form	Triangular	Trapezoidal	…… …..	……..

The main effect plot of different process parameters (cutting speed, feed, Environment and tool geometry) on surface roughness are calculated and plotted as shown in fig (3).The average value of Mean has been calculated to find out the effects of different parameters and as well as their levels. Both ANOVA technique and Mean are used to analyze the results and to reach on the best solution. The table (4) indicates the response for Mean in which rank show the relative importance of each factor to the response.The ranks and the delta values for various parameters show that Speed has the greatest effect on surface roughness and is followed by depth of cut feed and inserts form. As surface roughness is

Table 4: ANOVA for Mean

Speed (mm/min)	Feed (mm/rev.)	Environment	Insert shape	**Ra (µm)**	**Mean**
50	0.1	Wet	Triangular	2.5	-7.9588
50	0.2	Wet	Triangular	2.45	-7.78332
50	0.3	MQL	Trapezoidal	0.61	4.2934
50	0.4	MQL	Trapezoidal	0.97	0.26457
75	0.1	Wet	Trapezoidal	1.68	-4.50619
75	0.2	Wet	Trapezoidal	1.03	-0.25674
75	0.3	MQL	Triangular	0.89	1.0122
75	0.4	MQL	Triangular	0.57	4.8825
100	0.1	MQL	Triangular	0.88	1.11035
100	0.2	MQL	Triangular	0.71	2.97483
100	0.3	Wet	Trapezoidal	1.01	-0.08643
100	0.4	Wet	Trapezoidal	0.78	2.15811
125	0.1	MQL	Trapezoidal	0.91	0.81917
125	0.2	MQL	Trapezoidal	0.99	0.0873
125	0.3	Wet	Triangular	1.45	-3.22736
125	0.4	Wet	Triangular	1.31	-2.34543

S = 0.2461 R-Sq = 91.8% R-Sq(adj) = 82.4%

lower the better type quality characteristic. It is clear that the third level of cutting speed (A3), fourth level of feed (B4), second level environment (C2) and second level of inserts form (D2) result in the minimum value of surface roughness.

Table 5: Response table of Mean Ratios for surface roughness

	DF	Seq SS	Adj SS	Adj MS	F	P	%contribut
Speed	3	1.3432	1.3430	0.4477	7.89	0.014	26.06%
Feed	3	0.8837	0.8830	0.2945	4.86	0.039	17.16%
Environ	1	2.0164	2.0162	2.0164	33.29	0.001	39.15%
Insert sh	1	0.4830	0.4830	0.4830	7.97	0.026	9.37%
Residua	7	0.4240	0.4240	0.0605			8.23%
Total	15						

Analysis of variance (ANOVA) was performed at 91% confident level to identify the significant of each cutting parameters from table (4). It is clear that the Environmental has a significant effect on surface roughness. The contribution of another parameter cutting speed, feed and inserts form having less effect. Also, it is clear from ANOVA table (6) the contribution by the error associated are 12.86. The terms R-Sq = 91.8% indicates that the model is best and it cover all the variation provided by different process parameters.

Table 6:

Surface roughness at optimum level	Experimental value mean	Predicated value	% error
$A_3B_4C_2D_2$	0.0585	0.0525	10.25

The main effect plot was constructed by using Taguchi orthogonal array technique with the help of Minitab software 14. The signal to noise ratio was found by considering smaller the better qualities features for surface roughness. The plot between data means and mean of the signal to noise ratio as shown in fig (3).

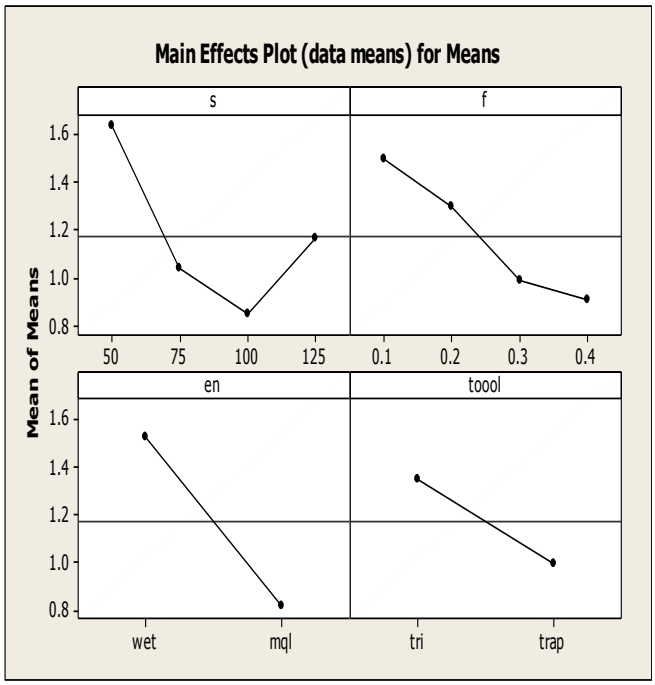

Figure 3: Main effect plot for surface roughness

From the figure (3) the optimum parameters found are cutting speed 75 m/min, feed 0.2 mm/rev, depth of cut 1.0 mm and triangular insert shape. The minimum surface roughness for optimum parameter is recorded on these levels.

V. CONFORMATION TEST

In order to validate the results, confirmation experiments were conducted for response characteristic (surface roughness) at optimal levels of the process variables. The average values of the features were obtained and compared with the predicted values It is to be pointed out that these optimal values are within the specified range of process variables

VI. CONCLUSION

1. The ANOVA for the mean SN ratio shows that cutting speed as significantly affects the surface roughness and its contribution is 26.06 %.
2. The minimum surface roughness is obtained at cutting speed 100 m/min, feed 0.4 mm/rev, MQL environment and trapezoidal insert shape.
3. The results obtained from conformation test shows that the error in experimental and predicted values is 10.25 % which is less than 25 %. It shows that our experimental results are fit to the best.

The effect of inserts shape on surface roughness is minimum with MQL.

REFERENCE

[1.] Maharadika, M. (2005). "Neural network prediction of cutting the tool wears while turning operations." The University of Malaya, Malaysia.

[2.] Groover, M. P., (2007),"Fundamental of modern manufacturing material process and systems". John Wiley & Sons, Singapore,

[3.] Satheesh Kumar, N. Shetty Ajay, Ananth K, Harsha Shetty.(2012), " Effect of spindle speed and feed rate on surface roughness of Carbon Steels in CNC turning" International Conference on Modeling, Optimization and Computing.

[4.] Singh Hardeep, Khanna Rajesh, Garg M.P., (Dec. 2011). " ffect of Cutting Parameters on MRR and Surface Roughness in Turning EN-8" Journal of urrent Trends in Engineering Research Vol.1, No.1

[5.] Ashvin J. Makadia , J.I. Nanavati, (2013),"Optimisation of machining parameters for turning operations based on response surface methodology" Journal of Measurement vol. 46, pp.1521–1529.

[6.] Salvi S.B, Deshmukh R.R., Deshmukh S.D., (2013), "Analysis Of Surface Roughness In Hard Turning By Using Taguchi Method" International Journal of Engineering Science and Technology (IJEST), Vol. 5.

[7.] Bhattacharya,A.,Das, S., Majumder, P., Batish, A., (2009), "Estimating the effect of cutting parameters on surface finish and power consumption during high speed machining of AISI 1045 Steel using Taguchi Design and Anova". Journal of production Engineering 3, pp31-40.

[8.] Ross, PJ., (1989). "Taguchi Techniques for Quality Engineering",Tata McGraw Hill, Industrial Engineering Series.

[9.] Young Kug Hwang and Choon Man Lee, "Surface roughness and cutting force prediction in MQL and wet turning process of AISI 1045 using design of experiments" Journal of Mechanical Science and Technology 24 (8) (2010) 1669-1677.

[10.] T. Nusrat Chowdhury and N. R. Dhar "Experimental analysis and modelling of tool wear and surface roughness in hard turning under minimum quantity lubricant environment" international conference on industrial engineering and operations management, Kuala Lumpur, Malaysia, January 22 – 24, 2011.

[11.] Tadeusz Leppert "Effect of cooling and lubrication conditions on surface topography and turning process of C45 steel" International Journal of Machine Tools & Manufacture 51 (2011) 120–126.

[12.] Patil Deepak kumarh, Dr. M.Sadaiah, "Investigations on finish turning of AISI 4340 steel in different cutting environments by CBN insert," International Journal of Engineering Science and Technology (IJEST), Vol. 3 No.10 October 2011.

[13.] D.V.Lohar, Shri.C.R.Nanavaty "Performance Evaluation of MQL for turning of AISI 4340 steel" International Journal of Emerging Trends in Engineering and Development July, 2012.

[14.] Mohammadjafar Hada, Banafsheh Sadeghi, "Minimum quantity lubrication-MQL turning of AISI 4140 steel alloy, Journal of Cleaner Production 54 (2013) 332-343.

[15.] C.S. Rakurty, P.I. Varela, A.K. Balaji, "Effects of targeted Minimum Quantity Fluid (MQF) application on surface integrity" Procedia CIRP 8 (2013) 462 – 468.

[16.] Gurpreet Singh, Dr. Sehijpal Singh, Ajay Kumar "Experimental Evaluation of Machining Performance into Turning of EN-31 Steel With Dry and Vegetable Based Oil Minimum Quantity Lubrication," International Journal of Research in Mechanical Engineering & Technology, Vol. 3, Issue 2, May - Oct 2013.

[17.] Sabahudin Ekinović, Edin Begović, Elma Ekinović, Belma Fakić "Cutting Forces And Chip Shape in MQL Machining Of Aluminium Bronze" Journal of Trends in the Development of Machinery and Associated Technology Vol. 17, No. 1, 2013, p.p. 17-20.

[18.] Rosemar Batista Da Silva, Álisson Rocha Machado, Déborah Oliveira Almeida, Éder Silva Costa "Turning of Medium Carbon Steel with Vegetable-Based Oil delivered by MQL,"22nd International Congress of Mechanical Engineering (COBEM 2013) November 3-7, 2013, Ribeirão Preto, SP, Brazil.

[19.] Van-Cuong Nguyen, Thai-Son Le, Minh-Duc Tran, Dang-Binh Nguyen, "An Investigation on Effect of Characteristics of the Peanut oil MQL on Tool life in Hard turning 9CrSi steel," International Journal of Machining and Machinability of Materials 05/2013; 13(4):428-438.

Welding Process Selection for 20 mm Thick Mild Steel Plate of 0.2%c using Graph Theory and Matrix (GTMA)

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***Abstract*— In the present global changes in manufacturing sector, selection of welding process is a difficult task. This paper presents a procedure using a graph theory and matrix approach (GTMA) as a decision making approach for the selection of welding process for 20mm thick plate of mild steel (0.2%C), based on the qualitative analysis. The following three arc welding processes are used to fabricate v-groove butt joint of mild steel (0.2%C): (a) gas tungsten arc welding, (b) gas metal arc welding, and (c) plasma arc welding. From these three processes the best welding process has been selected by GTMA. In the present case the best welding process is PAW.**

Keywords—welding process selection, GTMA, MADM.

I. INTRODUCTION

Welding is a process of joining different materials by heating to a suitable temperature, with or without the use of pressure and with or without the use of filler metal. Therefore, the welding process selection is very important today. For the selection of welding weld quality is the main selection criterion and also while selection cost is also considered. A good welded joint is as strong as the parent metal and the product is known as weld metal. The selection of welding is not on the basis of welded joint properties but also on the basis of economic analysis so these two factors are considered while selection of a welding process. The properties of weld joint are mechanical and metallurgical. All these factors are based on quantitative approach but the qualitative factor are also important so the analysis of qualitative approach is very meaningful [9].

II. SELECTION OF THE WELDING PROCESS

In this paper, the focus of the research is on selection of a welding technique to fabricate the v-groove butt joints mild steel (0.2% C) of 20 mm thickness (with V groove butt weld) using graph theory and matrices approach(MADM technique), This metal is known to be the best weld able metal in arc welding processes. Many of the structural components in machines, pressure vessels, transport vehicles, earthmoving equipment, spacecraft, etc., are made of welded joints. The v-groove butt welds are the most common ones in the fabrication and construction of many structures. The following three welding processes from arc welding family are commonly employed to fabricate the butt welds of mild steel alloys:(i) gas metal arc welding (GMAW), (ii) gas tungsten arc welding (GTAW), and (iii) plasma arc welding.

Description of process attributes which can be taken for selection of a suitable welding technique is explained here below.

- Initial preparation required (IP): Clamping joints in fixtures, setting welding parameters;
- Availability of consumables (AC): Electrodes, filler wires, shielding gases;
- Welder skill requirements (SR): Fully skilled ,semiskilled & ordinary welder;
- Welding procedures (WP): Pre-heating requirements, root pass requirements;
- Weld quality (WQ): Weld bead appearance, percentage of rejects;
- Operator fatigue (OF): Arc glare, smoke and fumes, electrode changing, nozzle cleaning.[2]

III. GRAPH THEORY AND MATRIX APPROACH

Graph theory is a logical and systematic approach and understanding of graph theory is very helpful in decision making. It turns out to be very difficult to analyse if the graph is complex so for solving these graphs a matrix method is used. It gives a better visual with the help of matrix approach. Graph theory and the matrix approach give better visual views of the attributes and also held for finding the attributes [8].

This approach involves less calculations prove great decision making method for the results and it gives more consistent results. Instead of this it also useful for differentiating attributes in terms of their similarity/ dissimilarity can be carried out. The multiple attribute decision-making methods (MADM) have four main parts, namely :(a) attributes, (b) alternatives (c) measures of performance of alternatives with respect to the attributes, and (d) weight or relative importance of each attribute (i.e., weight).

IV. PROCESS SELECTION ATTRIBUTES (DIGRAPH)

A graph is consist of vertices and edges and each edge consist of two vertices the vertices are denoted by V (v1, v2 …) and edges are denoted by E (e1, e2, ….).The line which join two end vertices are called edge of that graph. A graph is denoted by G = (V, E). The edges give relative importance

among the attributes. For example node 'i' is more important than node 'j' then a directed edge is drawn from node i to j and the edge is denoted by aij. [8].

The process attributes considered are: weld quality (WQ), operator fatigue (OF), skill required (SR), cleaning required after welding (CR), availability of consumables (AC) and initial preparation required (IP). As these are the subjective attributes are considered while doing this topic. As OF, SR, CR, IP are considered as non-beneficial attributes so the lower values is preferred for these attributes and other attributes WQ, AC are considered as beneficial attributes and higher values are preferred.

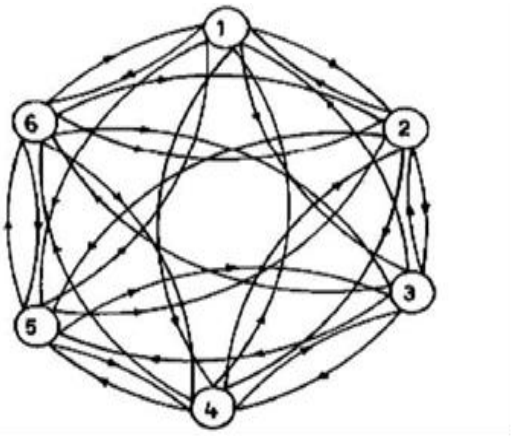

Fig.1 process selection attribute digraph

Digraph representing process selection attributes is shown in figure so 6 nodes are considered and are represented as 1, 2, 3, 4, 5, 6. These six nodes represents process selection attributes These nodes are represents attributes as WQ, OF, SR, CR, AC, IP respectively.

V. MATRIX REPRESENTATION OF THE PROCESS SELECTION ATTRIBUTE DIGRAPH

Digraph can be represented in matrix form where each attribute gives relation between each other in rows and columns. For a matrix relative importance between two attributes defined which is represented by a_{ij}. The matrix A for the process selection attribute digraph shown in Fig. 1 is represented as:

A=

attributes	WQ	OF	SR	CR	AC	IP
WQ	A_1	a_{12}	a_{13}	a_{14}	a_{15}	a_{16}
OF	a_{21}	A_2	a_{23}	a_{24}	a_{25}	a_{26}
SR	a_{31}	a_{32}	A_3	a_{34}	a_{35}	a_{36}
CR	a_{41}	a_{42}	a_{43}	A_4	a_{45}	a_{46}
AC	a_{51}	a_{52}	a_{53}	a_{54}	A_5	a_{56}
IP	a_{61}	a_{62}	a_{63}	a_{64}	a_{65}	A_6

(1)

Where A_i is the process selection attributes the values of which has taken from research paper Dinesh Singh et. al (2011) table 3 and a_{ij} is the relative importance so for the selection of relative importance values scale is selected for study. This is the permanent matrix where no negative sign appears in the matrix and hence no information is lost. This is the complete expression of the matrix by the process selection attributes and the relative importance values. This expression is the determinant of 6*6 matrixes by considering all positive signs.

$$
\begin{aligned}
&\text{Per}(H) = \prod_{i=1}^{6} A_i \\
&+ \sum_{i=1}^{5}\sum_{j=i+1}^{6}\sum_{k=1}^{3}\sum_{l=k+1}^{4}\sum_{m=l+1}^{5}\sum_{n=m+1}^{6} (a_{ji}a_{ij})A_kA_lA_mA_n \\
&+ \sum_{i=1}^{4}\sum_{j=i+1}^{5}\sum_{k=j+1}^{6}\sum_{l=1}^{4}\sum_{m=l+1}^{5}\sum_{n=m+1}^{6} (a_{ij}a_{ji}a_{ik} + a_{jk}a_{ki}a_{ji})\, A_lA_mA_n \\
&+ \{\sum_{i=1}^{3}\sum_{j=i+1}^{6}\sum_{k=i+1}^{5}\sum_{l=i+2}^{6}\sum_{m=1}^{3}\sum_{n=m+1}^{6} (a_{ji}a_{ij})\,(a_{ki}\,a_{lk})\, A_mA_n \\
&+ \sum_{i=1}^{3}\sum_{j=i+1}^{5}\sum_{k=i+1}^{6}\sum_{l=j+1}^{6}\sum_{m=1}^{5}\sum_{n=m+1}^{6} (a_{ij}\,a_{jk}a_{ki}\,a_{li} + a_{ij}\,a_{jk}a_{kl}\,a_{ji})\, A_mA_n\} \\
&+ \{\sum_{i=1}^{4}\sum_{j=i+1}^{5}\sum_{k=i+1}^{6}\sum_{l=1}^{5}\sum_{m=l+1}^{6}\sum_{n=1}^{6} (a_{ij}\,a_{jk}a_{ki} + a_{jk}a_{kl}a_{lj})\, a_{lm}\,a_{ml}\,A_n \\
&+ \sum_{i=1}^{2}\sum_{j=i+1}^{5}\sum_{k=i+1}^{6}\sum_{l=i+1}^{6}\sum_{m=j+1}^{6}\sum_{n=1}^{6} (a_{ij}\,a_{jk}\,a_{kl}\,a_{lm}\,a_{mi} + a_{im}a_{ml}\,a_{lk}a_{kj}a_{ji})\, A_n\} \\
&+ \{\sum_{i=1}^{3}\sum_{j=i+1}^{5}\sum_{k=i+1}^{6}\sum_{l=j+1}^{6}\sum_{m=1}^{5}\sum_{n=m+1}^{6} (a_{ij}\,a_{jk}\,a_{kl}a_{li} + a_{ij}\,a_{jk}\,a_{kl}\,a_{ji})\, a_{mn}\,a_{nm} \\
&+ \sum_{i=1}^{1}\sum_{j=i+1}^{5}\sum_{k=j+1}^{6}\sum_{l=1}^{4}\sum_{m=l+1}^{5}\sum_{n=m+1}^{6} (a_{ij}\,a_{jk}a_{ki} + a_{jk}\,a_{kl}\,a_{li})\,(a_{lm}\,a_{mn}\,a_{nl} + a_{ln}\,a_{nm}\,a_{ml}) \\
&+ \sum_{i=1}^{1}\sum_{j=i+1}^{6}\sum_{k=j+1}^{3}\sum_{l=i+2}^{5}\sum_{m=k+1}^{6}\sum_{n=k+2}^{6} (a_{ji}a_{ij})\,(a_{kl}\,a_{lk})\,(a_{mn}\,a_{nm}) \\
&+ \sum_{i=1}^{1}\sum_{j=i+1}^{5}\sum_{k=i+1}^{6}\sum_{l=i+1}^{6}\sum_{m=i+1}^{6}\sum_{n=j+1}^{6} a_{ii}\,a_{ik}\,a_{kl}\,a_{lm}\,a_{mn}\,a_{ni} + a_{in}\,a_{nm}\,a_{ml}\,a_{lk}\,a_{ki}\,a_{ii}\}
\end{aligned}
$$

(2)

Table 1 : Value of attributes

Subjective measure of attribute	Assigned value
Exceptionally low	0.0
Extremely low	0.1
Very low	0.2
Low	0.3
Below average	0.4
Average	0.5
Above average	0.6
High	0.7
Very high	0.8
Extremely high	0.9
Exceptionally high	1.0

VI. PROCESS SELECTION INDEX

The process selection index is defined as the index which is used to find out the process which can do its operation satisfactorily. The process selection index calculated with the help of equation which is written in equation (2). To calculate the process selection index requires relative importance values for the process selection attributes and the process selection attributes which is taken from table 3. The values a_{ij} is assigned between scale 0 and 1 and is arranged. a_{ij} means the i-th process selection attribute relative importance over j-th process selection attribute. Now with the help of table 1, the relative importance of attributed are assigned value for example if i-th process selection attribute is strongly more important than the j-th process selection attribute then a_{ij}=0.7 and the other attribute as a_{ji}=0.3. The relative importance of process selection attributes are expressed in eleven classes [10], which is used for the selection of relative importance between process selection attribute. The process selection index can be calculated using equation (2) for any type of material and the values of A_i and a_{ij} are substituted in equation (2) and the final answer will be found. The value of process selection index obtained using equation (2) will be final answer based on which the final conclusion made. The values of process selection index arranged in ascending or

descending order based on the ranking method. The higher value of process selection index is the better choice from the number of alternatives. But the final decision will be made based on the other factors also such as environment, cost, availability, maintainability, constraints, repair etc. Then, finalise the decision based on all these factors but the final decision will be made with higher process selection index.

Table 2: Conversion of Linguistic Terms into Fuzzy Scores (Relative Importance Value on an 11-Point Scale)

LINGUISTIC TERM	CRISP SCORE
One attribute is exceptionally less important than the other	0.045
One attribute is extremely less important than the other	0.135
One attribute is very less important than the other	0.255
One attribute is less important than the other	0.335
One attribute is slightly less important than the other	0.410
Two attributes are equally important than the other	0.500
One attribute is slightly more important than the other	0.590
One attribute is more important than the other	0.665
One attribute is much more important than the other	0.745
One attribute is extremely more important than the other	0.865
One attribute is exceptionally more important than the other	0.955

VII. METHODOLOGY

- Identify the process selection attribute for the given welding process selection. A qualitative values based on the linguistic scale selected for the attributes. A welding process with each of its attributes shortlisted based on the selection criterion.
- After shortlisting find out the relation between relative importance a_{ij} and the process selection attributes A_i.
- Develop the process selection attribute digraph based on the relative importance and process selection attributes. The no. of nodes is equal to no. of attributes in the digraph.
- Develop the process selection attributes matrix of M*M size. The diagonal elements in the matrix are A_i and off diagonal elements are a_{ij}.
- Obtain the process selection attribute function for the process selection attribute matrix.
- Substitute values of a_{ij} and normalised values of A_i in the process selection attribute function to find out the process selection index.
- Arrange the process selection index in descending order. Highest value is the best choice for the process.
- Take a final decision based on the practical considerations and the other constraints based on the availability, economical constraints etc.

Table 3: Welding Process Attribute Values are[1]

Welding process	WQ	OF	SR	CR	AC	IP
GMAW	0.0545	0.637	0.1047	0.0603	0.1094	0.1702
GTAW	0.772	0.2583	0.637	0.7085	0.5816	0.7383
PAW	0.1734	0.1047	0.2583	0.2311	0.309	0.0915

Table 4: Normalized Data of the Welding Process Attributes are:

Welding process	WQ	OF	SR	CR	AC	IP
GMAW	0.0705	0.1643	1	1	0.1818	0.5376
GTAW	1	0.4053	0.1643	0.0851	1	0.1239
PAW	0.2246	1	0.4053	0.2609	0.5312	1

VIII. MATRIX REPRESENTATION OF THE DIGRAPH WITH LINGUISTIC TERMS:

Matrix representation of the digraph with the help of table 1 and 2 is shown in equation (3).

Attributes	WQ	OF	SR	CR	AC	IP
WQ	-	0.135	0.500	0.255	0.500	0.41
OF	0.865	-	0.335	0.41	0.255	0.335
SR	0.500	0.665	-	0.590	0.255	0.500
CR	0.745	0.590	0.41	-	0.255	0.500
AC	0.500	0.745	0.745	0.745	-	0.665
IP	0.590	0.665	0.500	0.500	0.335	-

(3)

IX. EXAMPLE

- In the present work the attributes considered are: weld quality (WQ), operator fatigue (OF), skill required (SR), cleaning required after welding (CR), availability of consumables (AC) and initial preparation required (IP).
- The quantitative values of the process selection attributes are normalised based on the beneficial and non-beneficial attributes.
- The process selection attributes digraph showing the presence of relative importance a_{ij} and process selection attribute A_i.
- The process selection attributes matrix of the digraph is shown in equation (3).
- Calculate the permanent function based on the matrix and with the help of computer program by considering all positive signs.
- The process selection index is calculated and based on the values the final decision made. The process selection index is shown below:

Table 5: Descending order of the welding process selection index

PAW	11.2023
GMAW	9.4930
GTAW	8.5828

From the above values of the welding process selection index, it is interpreted that the PAW process is the preferred process, followed by GMAW and GTAW for the considered problem, selection of a welding technique to fabricate the v groove butt joints mild steel (0.2% C) of 20 mm thickness (with V groove butt weld), known to be the best wieldable metal in arc welding processes, based on the qualitative factors of welding processes.

X. CONCLUSION

The proposed GTMA method considers the values of the attributes and their relative importance together, and hence it provides a better accurate evaluation of the alternatives. The proposed GTMA method is a general method and can consider any number of quantitative and qualitative selections attributes, simultaneously. The suggested methodology can be extended to other decision making situations involving any number of alternatives and the selection attributes

REFERENCES

[1] Dinesh Singh and R. Venkata Rao, A hybrid multiple attribute decision making method for solving problems of industrial environment. International Journal of Industrial Engineering Computations 2 (2011) 631–644.

[2] Muralidharan C, Anantharaman N, Balasubramanian V, Deshmukh SG (1999) Selection of welding process using analytic hierarchy process. Institution of Engineers (India), Mechanical Engineering Division 80:151–154

[3] M.F.Wani and O.P.Gandhi, Development of maintainability index for mechanical systems, Journal of Reliability Engineering and System Safety, 65, 259-270, 1999.

[4] O.P.Gandhi and V.P.Agrawal, FMEA-A digraph and matrix approach, Journal of Reliability Engineering and System Safety, 35, 47-158, 1992.

[5] R.K.Garg,V.P.Agrawal and V.K.Gupta, Selection of Power plants by evaluation and comparison using graph theoretical methodology, Electric power and energy systems, 28, 429 435, 2006.

[6] Rao RV (2006) A material selection model using graph theory and matrix approach. Materials Science and Engineering A 431:248–255.

[7] R.Venkata Rao and K.K.Padmanabhan, Rapid prototyping process selection using graph theory and matrix approach, Journal of material processing technology, 194(1-3), 81-88, 2007.

[8] R.Venkata Rao, A material selection model using graph theory an matrix approach, Material Science and Engineering, A431, 248-255, 2006

[9] Ravisankar, V., Balasubramanian, V. & Muralidharan C. (2006). Selection of welding process to fabricate butt joints of high strength aluminium alloys using analytic hierarchic process. Materials and Design, 27, 373-380.

[10] S.J. Chen, C.L. Hwang, Fuzzy Multiple Attribute Decision Making-Methods and Applications. Lecture Notes in Economics and Mathematical Systems, Springer-Verlag, Berlin, 1992.

[11] Yeo SH, Neo KG (1998) Inclusion of environmental performance for decision making of welding processes. Journal of Materials Processing Technology 82:78–88.

The Effect of Thermal Stresses on Gate Valve and Its Optimization using New Wedge Design

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***Abstract*— Thermal stresses are one of important consideration while determining different properties of valves. a model of each element of gate valve is developed in solid works, and analyzed in Ansys. Thermal heat analysis is done by FEA using Ansys and validation is supported by stress analysis using classical theory of mechanics. Finally, the result obtained from Fea software and classical analytical theory is compared.**
Main objectives are
To know effect of varying temperature on gate valve
To see modification in wedge design.

Keywords— Thermal Stress Analysis; FEA; Gate Valve.

I. INTRODUCTION

A Gate Valve, is a valve that opens by lifting a round or rectangular gate/wedge out of the path of the fluid. The distinct feature of a gate valve is the sealing surfaces between the gate and seats are planar. The gate faces can form a wedge shape or they can be parallel. Gate valves are sometimes used for regulating flow, but many are not suited for that purpose, having been designed to be fully opened or closed. When fully open, the typical gate valve has no obstruction in the flow path, resulting in very low friction loss and when the gate valve is closed there are many obstructions in the flow path which in turn produces high frictional losses.

II. PROBLEM IDENTIFICATION & SOLUTION METHODOLOGY

The various components of the gate valve as follows:

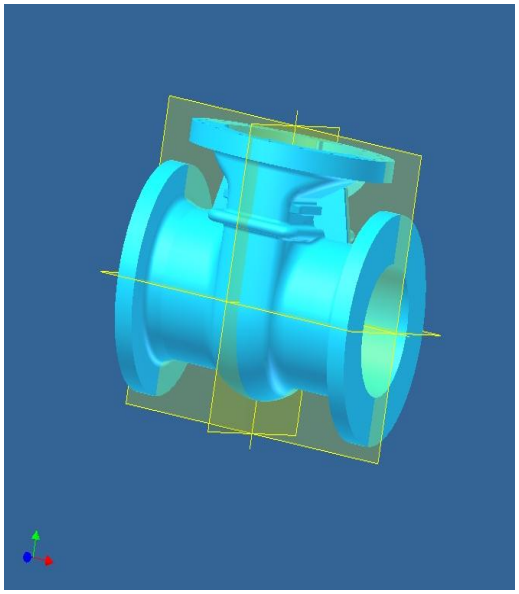

Fig1: Valve body, valve bonnet, gate, stem, hand wheel, wedge

III. MODULES OF PROJECT

Modeling

3D models of critical components of Gate Valves are prepared using (SOLID WORKS). The detailed dimensions are taken from its 2D drawings.

Importing 3d Model

3D model prepared using SOLID WORKS is imported into FEA software (ANSYS).

Preferences:

Thermal analysis method is selected.

Pre-processing:

Define Element Type

Apply Material Properties

Table 1. Valve body (details before modification)

Name	Material	Nonlinear Material Effects	Bounding Box(mm)
"Part 1"	*"Stainless Steel"*	Yes	762.0, 703.32, 620.0

"Part 2"	*"Stainless Steel"*	Yes	46.78, 371.69, 372.0
"Part 3"	*"Stainless Steel"*	Yes	46.79, 372.51, 371.46
"Part 4"	*"Stainless Steel"*	Yes	110.0, 451.93, 418.0

Name	Mass (kg)	Volume (mm^3)	Nodes	Elements
"Part 1"	471.41	6.08×107	37141	20785
"Part 2"	3.78	488,077.31	2950	1456
"Part 3"	3.78	488,077.3	2967	1471
"Part 4"	57.42	7.41×106	12799	7117

Table 2. Thermal Loading (Before)

Name	*Description*	*Value*	*Reaction*	*Associated Bodies*
"Temperature"	*Surface Temperature*	*-196.0 °C*	*-3.49×10-10 W*	"Part 1"
"Temperature 2"	*Surface Temperature*	*-196.0 °C*	*-159,036.03 W*	"Part 2" *and* "Part 3"
"Temperature 3"	*Surface Temperature*	*0.0 °C*	*159,036.03 W*	"Part 4"

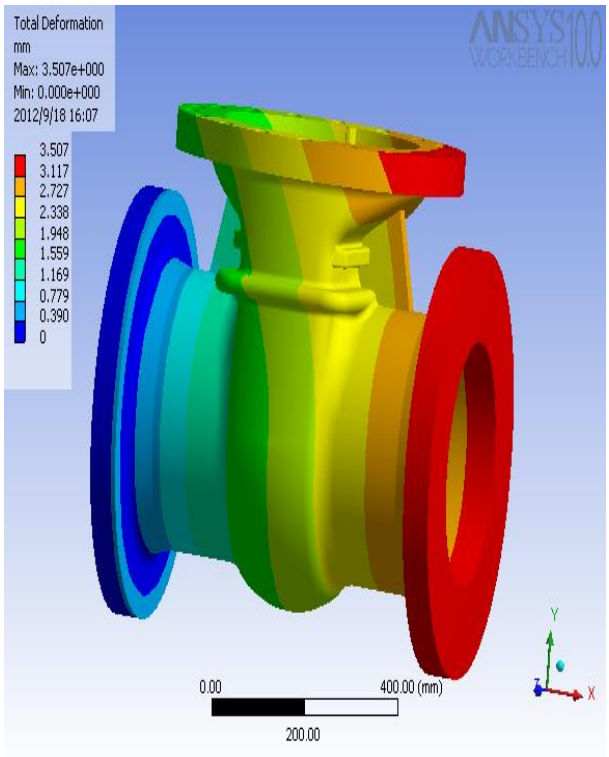

Fig2 Thermal Load Effect On Valve Body (Before Modification)

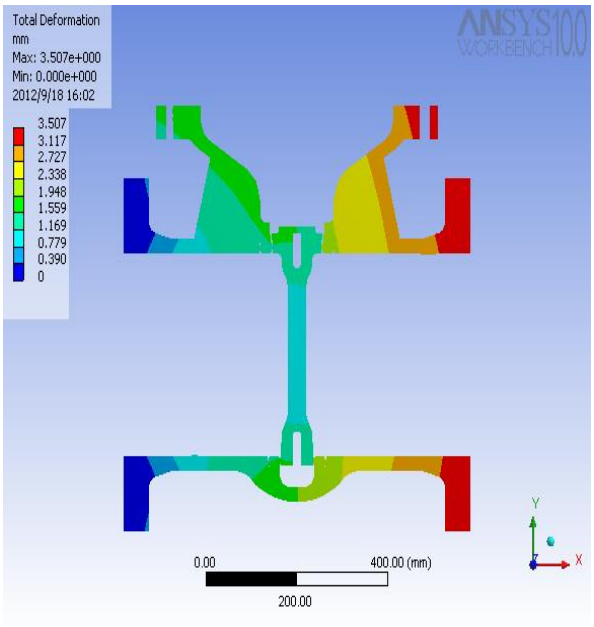

Fig3 Thermal Load Effect on Valve Body View 2 (Before Modification)

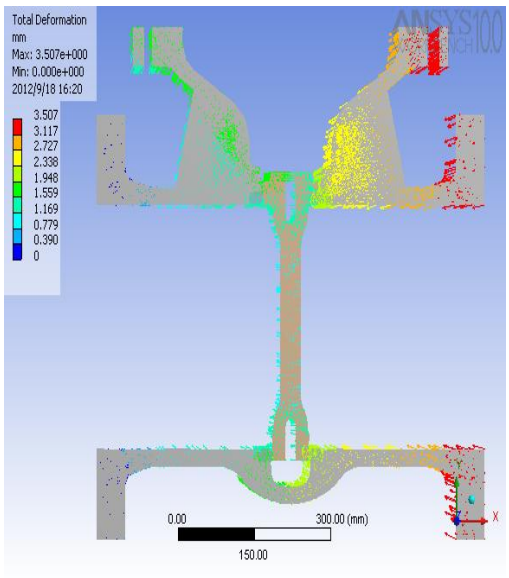

Fig3 Thermal Load Effect On Valve Body View 3 (Before Modification)

From above readings we observe that there is problem in contraction of wedge with the changing temperature conditions

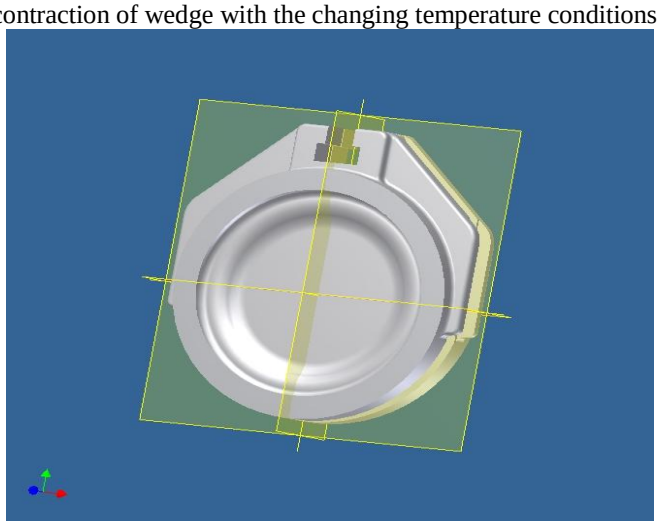

Fig4 Wedge Design (Before Modification)

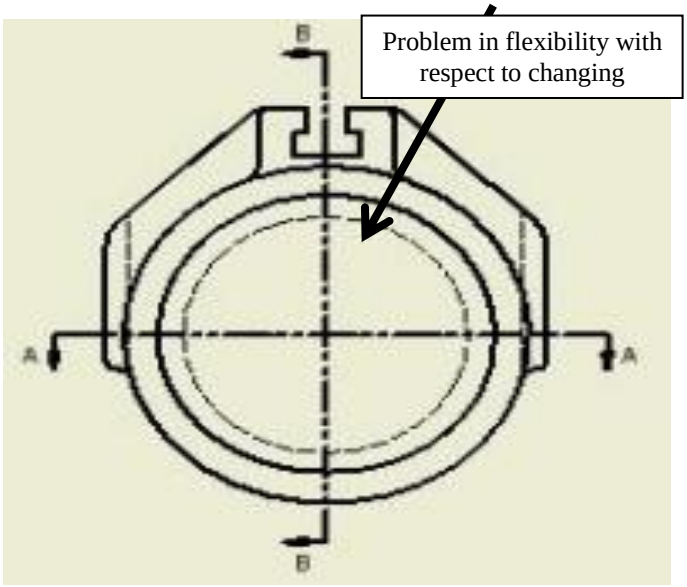

Fig5 Wedge Design (Before Modification)

Heading towards modification with new results solution as there was problem in flexibility of wedge with different temperature conditions a new design of wedge is introduced which provide more flexibilty with cahnging temperature conditions

Table 3. Valve body details (after modification)

Name	Material	Nonlinear Material Effects	Bounding Box(mm)
"Part 1"	*"Stainless Steel"*	Yes	0.0, 0.0, 0.0
"Part 2"	*"Stainless Steel"*	Yes	0.0, 0.0, 0.0
"Part 3"	*"Stainless Steel"*	Yes	0.0, 0.0, 0.0
"Part 4"	*"Stainless Steel"*	Yes	110.0, 451.93, 418.0

Name	Mass (kg)	Volume (mm^3)	Nodes	Elements
"Part 1"	471.41	6.08×107	37047	20711
"Part 2"	3.78	488,077.31	2972	1474
"Part 3"	3.78	488,077.3	2912	1426
"Part 4"	56.09	7.24×106	13564	7548

Change observed as we can see clearly that mass of part 4 is reduced after modification.

Table 4. Thermal load (after modification)

Name	Description	Value	Reaction	Associated Bodies
"Temperature"	Surface Temperature	-196.0 °C	-2.91×10-11 W	*"Part 1"*
"Temperature 2"	Surface Temperature	-196.0 °C	4.69×10-11 W	*"Part 2"* and *"Part 3"*
"Temperature 3"	Surface Temperature	-196.0 °C	5.76×10-12 W	*"Part 4"*

Change observed as we can see clearly that reaction with respect to thermal load is increased which helps in increasing flexibility.

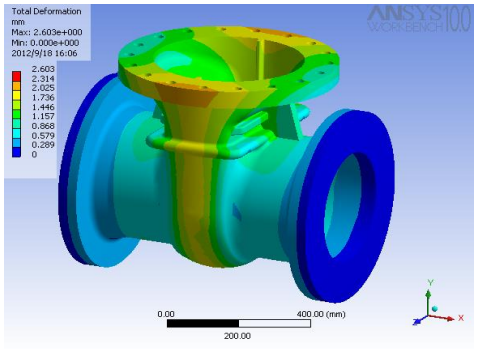

Fig6 Thermal load effect on valve body (after modification)

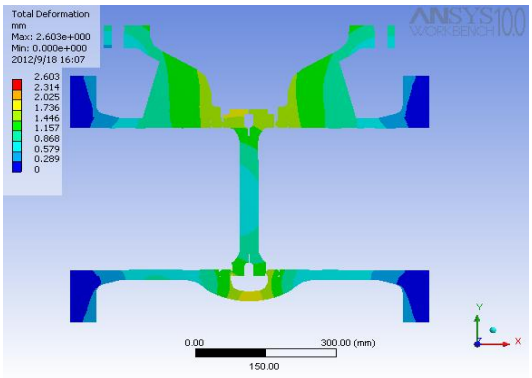

Fig7 Thermal load effect on valve body view 1 (after modification)

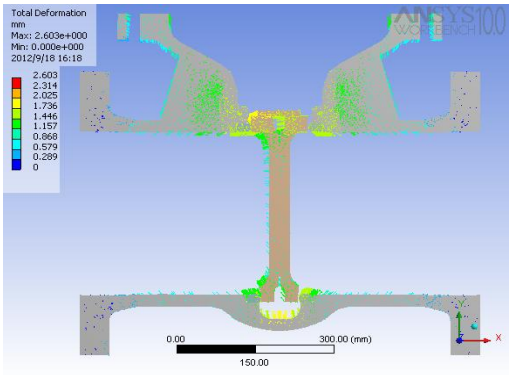

Fig8 thermal load effect on valve body view 2 (after modification)

Modified wedge design for more flexibility with temperature conditions.

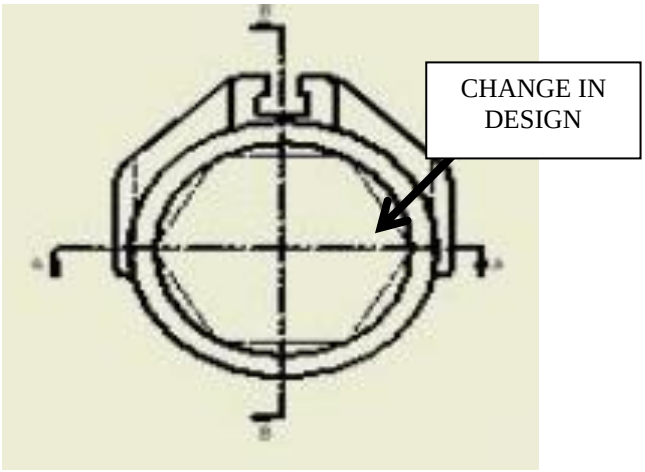

Fig 9 Change in design

As we can see that new wedge design lead to more flexibility with respect to changing thermal load and also lead to reduction in mass

IV. CONCLUSION

- Thermal stress analysis plays a vital role in checking behavior of valve with respect to different temperature conditions
- Modern Fea analysis helps in decreasing overall mass of body and also helps in optimizing design.

REFRENCES.

[1] Valve handbook by GH pearson

[2] Valve handbook by Philipl.skousen

[3] Schweitzer, Philip A., Handbook of Valves

[4] 4.Heat Transfer, Thermodynamics and Fluid Flow Fundamentals, Columbia, MD, General. Physics Corporation, Library of Congress Card #A 326517, 1982

Some Studies on Investigating The Concept Of Aspects, Principles, Phases or Areas, Challenges of The Green Tribology Along with The Implementation of Tribology in Automobile Industry

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***Abstract*—Every system is a part of surrounding. The changes in this contact leading to degradation in processes that will affect the safety of the system. To ensure the safety of the system, processes of these changes are in steady state. Sustainability & green chemistry enhances & improve the quality. All tribological aspects in the field of science & technology maintain the ecological balance in nature and reduce environmental impacts. With the use of Green tribology, we can save energy and materials, as well as improve the environment and quality of life. Green tribology is based upon the principle as follows, firstly find out & identify that what are the safety related needs or necessities earlier in the development of the system, than with the use of new advanced & innovative technologies & special purpose designs better quality, development of life can be achieved throughout the entire system. In this introductory paper for the topic on green tribology, we describe the concept, principles & areas of green tribology as well as other 'green' disciplines, namely, sustainability, green engineering and green chemistry. We describe the 12 fundamental principles of green tribology: (i) minimization of heat & energy dissipation (ii) minimization of wear, (iii) complete removal or elimination of lubrication as well as self-lubrication (iv) using natural lubrication (v) using biodegradable lubrication , (vi) using concepts, ideas & fundamental principles of green engineering & sustainable chemistry, (vii) using biomimetic approaches, (viii) to enhance & control the surface properties, surface texturing should be implemented, (ix) consideration & investigation of coating of environmental implications, (x) real-time inspection, checking & monitoring, (xi) design for degradation of surfaces & tribological components and (xii) use of green & sustainable energy applications. In this paper we further discuss various areas of green tribology: (i) imitation of the models, systems, & elements of nature for the purpose of solving complex human problems for tribological applications, (ii) environment-friendly lubrication, and (iii) the tribology of renewable-energy application. The combination of these areas still remains a biggest challenge for this novel area of research. We also discuss the various challenges of green tribology and future directions of research**

Keywords— tribology, alternative energy, biomimetics, quality of life, sustainability and safety of systems.

I. INTRODUCTION

Tribology is derived from the greek word "tribos" which means rubbing & "logy" means knowledge. Recently, the new concept of 'green tribology' has been defined as 'the saving energy, material by reducing waste & thus maintains ecological balance in nature or environment & improves the quality of life. Tribology is defined as 'The science of interacting surfaces which consists of the processes of friction, wear, lubrication. Tribology is also defined as "the science & technology of interacting surfaces in relative motion. It concerns with the phenomena that takes place between contact surfaces which are in relative motion. The term 'tribology' was firstly described by Prof. H. Peter Jost in 1966 in his report for the UK Department of Education and Science. Many new areas of tribology studies have been formulated at the distinction of various scientific principles, and various aspects of contact surfaces have been the emphasis of tribology. For example, nanotribology, biotribology, the tribology of microelectromechanical systems (MEMS)/ nanoelectromechanical systems, etc. Green tribology means saving material, energy & improving environment & quality of the life.

The earlier past thought was "ecotribology" that describes mainly the interaction of contact systems with the environment [2, 3]. Green tribology means saving materials, energy, by reducing waste & carbon footprint of mechanical system & thus improves the environment and the quality of life which further leads in maintaining environmental, ecological, economical balance & sustainability [4].

II. ASPECTS OF GREEN TRIBOLOGY AREAS

- A tribological technology resembles eco-friendly & describes the living nature.
- Friction and wear control for the minimum energy & the resources conservation.
- Surface modification technique in environmental aspects of lubrication and tribological aspects of green engineering applications, such as wind turbines, tidal turbines or solar panels.

Green tribology can be classified in the wider context of two other 'green' areas: green engineering and green chemistry. Green engineering is defined as 'the decision making activity and use of processes and products that are technically feasible & cheaper while minimizing pollution at

the source and risk to human health and the environment' [6-7].

Green chemistry is also known as sustainable chemistry, which is defined as any decision making activity regarding chemical products and processes that eliminates the use of hazardous and dangerous substances and negative environmental impacts [6].

All non-value adding activities, unnecessary use of energy & resources & waste are completely reduced by using sustainable chemistry which leads to safety of products. All the principles of green engineering and green chemistry are applicable to green tribology.

III. TWELVE PRINCIPLES OF GREEN TRIBOLOGY

There are 12 principles of green tribology which plays an important role in the design & manufacturing of tribological applications & operations. The principles of green tribology are formulated as shown below.

A. Minimization of heat and energy dissipation

Friction is the primary source of energy dissipation. In USA, about one-third of the energy consumption is used to reduce friction. Large amount of energy is dissipated by friction is converted into heat which leads to the pollution & degradation of atmosphere and the environment. In order to conserve energy& resources friction should be controlled or should be minimized. In order to prevent damage to the environment which further leads to the heat pollution, friction should be controlled. It is approved or recognized that for some of tribological applications i.e. car brakes and clutches, high friction is required.

B. Minimization of wear

It is the second most essential task that has related to green tribology. As we know that wear is undesirable in most of industrial applications. Wear decreases the lifetime of parts or components and thus leads to the problem of recycling & catastrophic failure of that particular part or component. Also, wear creates debris and particles that pollute the environment and can be harmful for humans in certain situations. For example, after human joint-replacement surgery, wear debris is formed which is the primary source of long-term complications in patients.

C. Complete elimination of lubrication and self-lubrication

Lubrication is a focus of tribology since it leads to the reduction of friction and wear. However, lubrication can also lead to environmental degradation which includes hazards & pollution. It is necessary to reduce lubrication or achieve the self-lubricating, when no external supply of lubrication is required. In living nature, tribological system operates in the self-lubricating regime. For example, joints form essentially a closed self-sustainable system.

D. Use of Natural lubrication

In green tribology we mostly prefer use of Natural lubrication (e.g. vegetable-oil-based) as it is eco-friendly or environmentally friendly.

E. Use of Biodegradable lubrication

In green tribology, Biodegradable lubrication should be used to avoid environmental degradation & contamination..

F. Use of Sustainable chemistry and green engineering principles

This principle should be used for the production of new parts or components for tribological applications, coatings and lubricants.

G. Use of Biomimetic approaches

This principle should be used whenever complex human problems can be arises. These includes imitation of models, system or elements of nature, biomimetic surfaces, materials and other biomimetic principles, as they are more ecologically friendly & also doesn't harmful to environment.

H. Surface texturing

This principle should be used to enhance & control surface properties & thus making tribological system more eco-friendly. Traditional engineered surfaces have wavy, random roughness, which leads to makes it impossible to overcome friction and wear. On the other hand, many biological functional surfaces have complex structures with surface roughness, which describes their properties.

I. Environmental implications of coatings

Environmental implications of coatings and other various criteria of surface modification (texturing, depositions, etc.) should be analysed & used to control surface properties & makes system more eco-friendly.

J. Design for degradation

In this principle design for degradation of surfaces, coatings and tribological components should be investigated & taken into consideration. Also in green chemistry applications, the final utilization should be taken into consideration during decision making activity.

K. Real-time monitoring

During the operation of tribological components proper real-time inspection, checking, monitoring, analysis and control should be implemented to prevent the formation of hazardous substances & thus makes tribological component more safe & eco-friendly.

L. Sustainable energy applications

Sustainable energy applications should be our first preference in the tribological design as well as engineering design to make component more eco-friendly & chances of reduction of environment should be prevented.

IV. LUBRICATION

Lubrication is an example of green tribology. Lubrication is a process or technique which is used to reduce the friction between one or both the surfaces & also reduces the wear between one or both surfaces in a close contact & moving relative to each other by introducing a substance called lubricant between the two surfaces. The lubricants are of three types:

- Solid lubricants (Molybdenum disulphide MoS_2)
- Liquid lubricants (Oil, water)
- Liquid-liquid dispersion or gas (grease)

In case of fluid lubricant applied load is either carried by pressurized liquid pumped between the surfaces or by the pressure generated within liquid due to the frictional viscous resistance to the motion of lubricating fluid between the surfaces. Lubrication also explains the phenomenon of reduction of friction, which can be more dangerous & hazardous in hydroplaning of the road. The interface between surface & lubricant is of vital role in metal working tribology. At low speeds, natural lubrication has low coefficients of friction. We have to do hard work to understand the importance & efforts of composition & structure of bio molecules on the tribology. For e.g. process of copying natural lubricants, e.g. glyco-proteins in synovial fluid [8].

In metal forming, contact between tool & work-piece plays an important role for determining behaviour at the interface. Deformation speeds & coefficient of the friction are the factors which explain lubrication.

Lubrication is a part of tribology since it leads to the reduction of friction and wear & makes tribological components more safer & eco-friendly in nature. However, lubrication can also lead to environmental degradation resulting heat pollution & disturbs the eco-logical balance of nature. It is necessary to reduce lubrication or achieve the self-lubricating regime, when no external supply of lubrication is required. In living nature tribological systems operate in the self-lubricating regime. For example, joints form essentially a closed self-sustainable system.

Natural lubrication should be most preferably used in green tribology, as it is more eco-friendly or environmentally friendly. For e.g. vegetable based oil, mineral oil, paraffins etc.

Biodegradable lubrication should be used in green tribology to reduce environmental degradation & contamination.

Fig. 1. EU Ecolabel

Fig. 2. Green Seal (USA)

V. TRIBOLOGY IN RENEWABLE ENERGY RESOURCES (RES)

Today, Europe's energy supply is characterized by structural weaknesses and geopolitical, social and environmental shortcomings, particularly as regards security of supply and climate change. Whilst energy remains a major component of economic growth, such deficiencies can have a direct impact on EU stability and the quality of life of Europe's citizens. These elements provide the main drivers for energy research, within the context of sustainable development. In helping to meet these goals, research & development will contribute directly to the success of EU policy, e.g. achieving a reduction in greenhouse gas emissions as per Kyoto protocol; increasing the share of renewable energy systems (RES); increasing the share of liquid biofuels, etc.

Sustainable energy applications should also become priority of the tribological design, as well as of the engineering design in general.

Tribology of renewable sources of energy is a relatively new field of tribology. Unlike in the case of the biomimetic approach and environment-friendly lubrication, it is not the manufacturing or operation, but the very application of the tribological system that involves green issues, namely, environmentally friendly energy production. If we throw attention on the wind power's share of total installed power capacity over the last decade in Europe, it has increased more than fourfold from 2.2% in 2000 to 10.5% in 2011, as per data of the European Wind Energy Association [9].The transformation of wind energy will be in the spotlight, as a pivotal element in the transition to a green growth economy, and some of the tribological problems and issues related thereto. Wind turbines have a number of specific problems related to their tribology and constitute a well-established area of tribological research. The problems include water contamination, electric arcing on generator bearings, issues related to the wear of the main shaft and gearbox bearings and gears, the erosion of blades (solid particles, cavitation, rain, hail stones), etc. Most frequently observed and considered tribological problems in wind turbines are in the transmission system, in the gearbox. They are mainly a consequence of inadequate lubrication and/or lack of routine maintenance having in view the extremeness of the working conditions. An issue out of this trouble is to meet the demand of lubricants with improved characteristics [26].

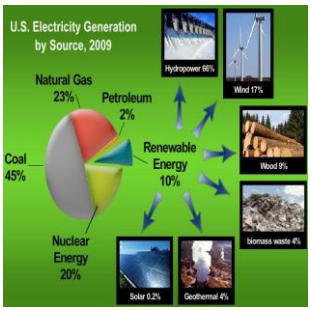

Fig. 3. Implementation OF Green Energy in USA

VI. FRICTION

For the enhancement of tribology, heat & energy dissipation should be minimum. Friction is defined as "resistance that one surface or object encounters when moving over another". Friction is an integral part of tribology and is closely related to lubrication and wear. In general, friction measurement is much easier to conduct than lubrication and wear. Therefore friction studies are widely carried out to reveal the underlying tribological mechanism. It is important to recognize that a systematic approach should be adopted in friction studies due to the close links between friction, lubrication, and wear. Friction is the primary source of energy dissipation. Large amount of energy is dissipated by friction is converted into heat which leads to the pollution & degradation of atmosphere and the environment. In order to conserve energy& resources friction should be controlled or should be minimized. In USA, about one-third of the energy consumption is used to reduce friction. In order to conserve energy& resources friction should be controlled or should be minimized. In order to prevent damage to the environment which further leads to the heat pollution, friction should be controlled. It is approved or recognized that for some of tribological applications i.e. car brakes and clutches, high friction is required

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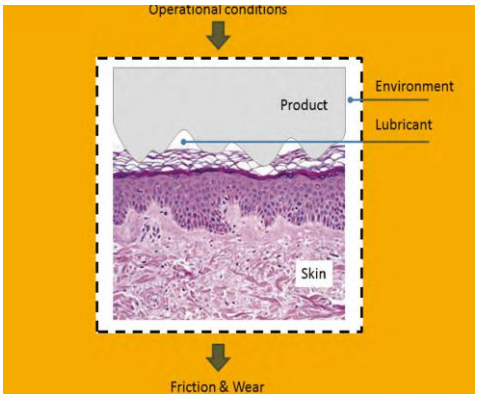

Fig. 4. Friction

Friction is not itself a fundamental force but arises from fundamental electromagnetic forces between the charged particles on the contacting surfaces. It is generally very difficult to calculate friction from first principles due to the complexity of these interactions, despite a number of attempts. For example, molecular dynamics simulation has been used recently to predict friction [1]. Instead, friction is usually measured experimentally.

VII. WEAR

Wear should be minimized for enhancement of tribology. Wear decreases the lifetime of parts or components and thus leads to the problem of recycling & catastrophic failure of that particular part or component. Also, wear produces debris and particles that pollute the environment and can be harmful for humans in certain situations.

For example, after human joint-replacement surgery, wear debris is formed which is the primary source of long-term complications in patients.

VIII. MATERIAL & SURFACE PRODUCTION & TREATEMENT

Green chemistry, green engineering principles Sustainable energy applications should be our first preference to use in the tribological design as well as engineering design to make component more eco-friendly & chances of reduction of environment should be prevented. This principle should be used for the production of new parts or components for tribological applications, coatings and lubricants. Principle of surface texturing should be used to enhance & control surface properties & thus making tribological system more eco-friendly. Traditional engineered surfaces have wavy, random roughness, which leads to makes it impossible to overcome friction and wear. Biomimetic approaches includes imitation of models, system or elements of nature, biomimetic surfaces, materials and other biomimetic principles, as they are more ecologically friendly & also doesn't harmful to environment.

IX. FOCUS AREAS OF THE GREEN TRIBOLOGY

There are basically three focus areas of tribology which made greatest impact on environmental issues, and, thus they play a vital role in green tribology:

- Biomimetic and self-lubricating materials/surfaces,
- Biodegradable and environment-friendly lubricants, and
- Tribology of green sustainable sources of energy.

X. GREEN TRIBOLOGY IN RENEWABLE ENERGY RESOURCES

Our main aim is to promote tribological R&D in the area of RES in order to promote economic development, protection of the environment and to ensure betterment & the quality of life.

XI. PHASES, PROBLEMS & CHALLENGES OF GREEN TRIBOLOGY

In the above sections, we have discussed the necessity for green tribology, its various concepts & principles and focus areas of research. From this paper it is now clear that green tribology has a number of problems & challenges. One of the most big challenge is the development of the fields in such a way that they could take advantage from each other except case where combination of parts is to be performed, than it is difficult to achieve self-sustained property of green tribology. In the tribological principles like biomimetic approach, microstructuring, biodegradable lubrication, self-lubrication

and various other principles, there is clearly use of potential energy. So, more & more research should be done for the development of these areas & fields. Some concepts should be taken from the field of sustainable chemistry, for example, quantitative metrics should be developed to inherent the environmental issues & impact of tribological advanced innovative technologies.

Green tribology is broadly divided into world science and makes its adverse effects on the results & conclusions for worldwide problems. For e.g. weather or climatic conditions changes and lack of food and drinking water. H. P. Jost in 2009, (unpublished data) describes the economical capability of the green tribology: 'All approaches & principles of green tribology alone are not capable of solving complex problems of worldwide. Complex worldwide problems can be solved by achievements or appreciation of major scientific principles. If above mentioned task is to be achieved than all the applications & approaches of green tribology can provides breathing space for all the scientists & technologists to identify & determine the results of the complex worldwide problems regarding mankind and also permits time for them to be formulated by governments, organizations in order to find out the complex worldwide problems & leads to the betterment of this field. Green tribology will play a vital role in its part to guide science to gain the required solutions of mankind's crucial problems and for policy makers to formulate them'.

XII. IMPROVEMENT IN THE TRIBOLOGICAL PERFORMANCE IN AN AUTOMOBILE INDUSTRY

- Increased engine power output
- Reduced fuel consumption
- Reduction in harmful exhaust emissions
- Improved engine durability and its life.
- Reduced maintenance requirements and longer service intervals.

XIII. CONCLUSIONS

Green tribology is a new creation & innovation in the field of science and technology. It comprises tribological areas as well as other sustainable principles, i.e. green engineering and green chemistry. We made the 12 fundamental principles of green tribology and discuss the focus areas of green tribology. The broadly classification of these focus areas is biggest challenge for green tribology and tells us regarding future perspective & directions of research.

The main aim of green tribology is to save energy, material by reducing waste & thus maintains ecological balance in nature or environment & thus improves the quality of life. In order to fulfill these goals, the following approaches or principles has to be applied:

- Minimize heat, energy dissipation and wear.
- Lubricant should be made less harmful in order to maintain eco-logical balance in the nature. Use natural lubrication and biodegradable lubrication, if possible.
- Use sustainable chemistry and green engineering principles.
- Use biometric principles of engineering whenever possible.
- Appropriate environmental protection is to be maintained by implementing Environmental implications of coatings and other various criteria of surface modification (texturing, depositions, etc.) should be analysed & used to control surface properties & makes system more eco-friendly.
- Decision making activity is to be made in an early step for prevention of the degradation of materials & surfaces. Implement green energy approaches, principles & methods to maintain product safer & to maintain eco-logical balance in the nature.

All these above mentioned approaches & principles can reduce the environmental issues or impact of tribological process's components to large extent. The main objective of this paper is to bring your attention towards the science & technology behind green tribology and formulate a new achievement for these approaches in order to ensure safety and sustainability of our environment or ecosystem & maintains eco-logical balance in the nature& thus leads to better quality of the life.

REFERENCES

[1] Knowledge for Sustainable Development: An Insight into the Encyclopedia of Life Support Systems, Volumes I, II, III, UNESCO Publishing-EOLSS Publishers, Oxford, 2002.

[2] Bartz, W.J., Ecotribology: Environmentally acceptable tribological practices, Tribology International, Vol. 39, No. 8, pp. 728-733, 2006.

[3] Kandeva, M., Assenova, E., Daneva, M., Triboecology as a methodological center of modern science, in: Proceedings of the 2nd European Conference on Tribology ECOTRIB 2009, Pisa, Italy, 07-10.06.2009.

[4] Wood, R., Green tribology, NCats Newsletter, Ed. 6, October 2011.

[5] Nosonovsky, M., Bhushan, B., Green tribology: Principles, research areas and challenges, Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, Vol. 368, No. 1929, pp. 4677-4694, 2010.

[6] US Environmental Protection Agency, Green Engineering, www.epa.gov/oppt/greenengineering

[7] Nosonovsky, M., Bhushan, B. (Eds.), Green Tribology: Biomimetics, Energy Conservation and Sustainability, Springer, Berlin, 2012.

[8] Spencer, N.D., Understanding and imitating lubrication in nature, in: Proceedings of the 2nd European Conference on Tribology ECOTRIB 2009, Pisa, Italy, 07-10.06.2009.

[9] Statistics of the European Wind Energy Association,http://www.ewea.org/fileadmin/ewea_documents/documents/publications/statistics/Stats_2011.pdf

Solar Sorption Refrigeration Methods

(An overview of Modern Techniques)

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Abstract: **- In the modern era, there is increase in the demand of air cooling and refrigeration system which put a huge load on the present energy resources present on the earth. The energy resources available with us are not able to cope with the present need. This review paper focuses on the utilization of Solar Energy as an alternative to meet our demands for increasing refrigeration and cooling systems. A comparison is made between traditional method and modern solar cooling technologies which can fulfill our energy needs in future.**

Keywords : Refrigeration and Cooling System; Solar Energy; Traditional methods

I. INTRODUCTION

Energy is life line of modern world. The demand for cooling is increasing day by day both in developed and developing countries. So there is ever increasing demand of energy resources, especially in the developing countries. Only the Solar energy, which is present in abundant form, can cope with the energy requirements. The daily solar energy which the earth receives is equivalent to 50,000 billion oil barrels [1]. This thing has attracted the researchers & has opened innumerable options of using solar energy as alternative source of energy. Moreover the Solar Energy is easily available, eco friendly & renewable source of energy. In case of air cooling & refrigeration purposes, Solar cooling system can be used which will cut the energy requirements. Solar cooling system will be beneficial in hotter areas as plenty of sunlight is available there. This method uses Vapor Absorption/Adsorption System in which use of compressor is eliminated to create two pressure levels in the system. The two pressure levels are that of Evaporation and Condensation of Refrigerant.

The work required is relatively large because of compression of vapor which undergoes large changes in Specific Volume. Thus if means are available for raising pressure of refrigerant from evaporative pressure to condenser
Pressure without much changing its volume it is possible to reduce shaft-work. The same thing is done in Vapor sorption techniques.

II. TRADITIONAL REFRIGERATION SYSTEM

In case of Traditional refrigeration system, a compressor, a condenser, a thermal expansion valve (also called a throttle valve or metering device), and an evaporator are used.

Circulating refrigerant enters the compressor in the thermodynamic state known as a saturated vapor and is compressed to a higher pressure, resulting in a higher temperature as well. The hot, compressed vapor is then in the thermodynamic state known as a superheated vapor and it is at a temperature and pressure at which it can be condensed with either cooling water or cooling air. That hot vapor is routed through a condenser where it is cooled and condensed into a liquid by flowing through a coil or tubes with cool water or cool air flowing across the coil or tubes. This is where the circulating refrigerant rejects heat from the system and the rejected heat is carried away by either the water or the air. The electric power is to be supplied to compressor for its working.

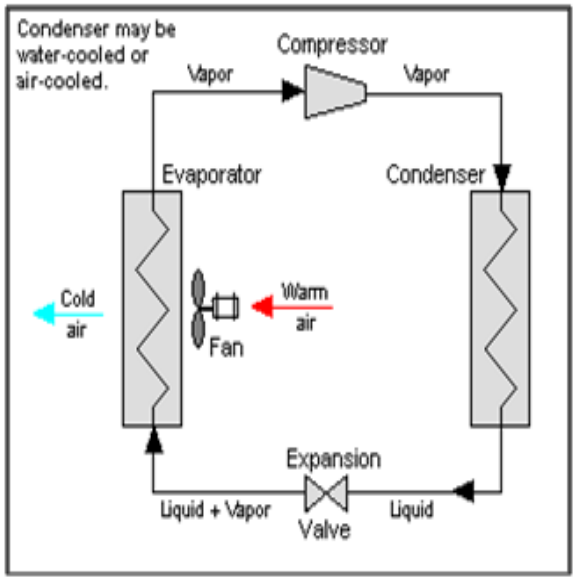

Fig. 1 Traditional VCRS[2]

III. APPLICATION OF SOLAR ENERGY IN COOLING

The use of solar energy can be made by elimination of the energy supplied to the compressor. In order to increase the pressure of refrigerant vapor, it is dissolved in an inert liquid at the same pressure as the evaporator and solution thus formed is pumped to a condenser pressure. The liquid which is practically incompressible and undergoes practically no change in specific volume require very little work for raising its pressure. After raising the pressure the refrigerant is separated from the solution by heating. This heat is provided with the help of Solar Energy. The various methods of using solar heat energy are:- a) Solar Absorption

Refrigeration System. b) Solar Adsorption Refrigeration System.

A. Solar Absorption Refrigeration System

In this system the absorber receives the refrigerant in vapor form and creates a rich mixture. The pump is used to forward this mixture to the generator (which is also known as disorber) which consume a small amount of power only. In the generator the refrigerator & absorber got separated with the help of heat supplied to it. The generator receives the heat from the solar apparatus in which the solar radiations are absorbed in solar collector which gives heat to the working fluid that moves through pipes in the collector. The fluid in pipes passes its heat to the generator .The high pressure & temperature refrigerator then passes through condenser & rest of the procedure is same as that of traditional VCRS. With the help of pressure relief valve the weaker solution return back to absorber through Heat Exchanger. Heat Exchanger improves the COP of the system upto 60%. [1]

The required temperature for operation of absorption chillers is generally more than 70^0 C with COP ranging between 0.6 & 0.8. [3]

Properties of Ideal Refrigerant-Absorbent Combination"

1. The refrigerant should have high affinity for absorber at low temperature and less affinity at high temperature.
2. Mixture should have low freezing point.
3. There should be large difference in the boiling points of refrigerants and the absorbent.

Types of absorbent-refrigerant pairs [4]

1. Lithium Bromide (Absorbent) & Water (Refrigerant)
2. Ammonia (Refrigerant) & Water (Absorbent).

Ammonia-Water combination is widely used as it posses most desirable properties .

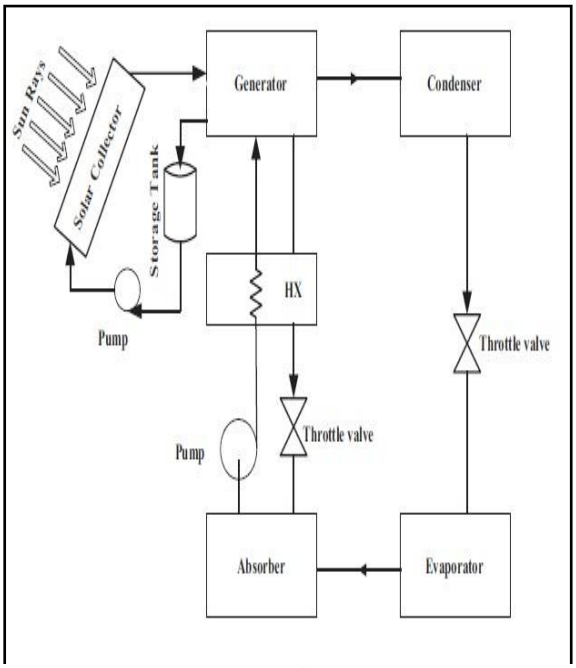

Fig. 2: Absorption Refrigeration System

ABSORBENT-REFRIGERANT PAIR	ADVANTAGES	DISADVANTAGES
Lithium Bromide & water	1. Comparatively Higher COP. 2. Large Latent Heat of Vapourisation. 3. Lower Operating Pressures	1. Corrosive so inhibitor like Lithium Chromate is to be used for metal parts. 2. Comparatively Expensive. 3. Evaportor operates above 0^0C.
Ammonia & Water	1. Evaporator operates below 0^0 C.	1. Hydrogen is to be used to maintain pressure in the evaporator. 2. Ammonia is toxic & dangerous for human health.

B. Adsorption Refrigeration System

Adsorption is the adhesion of gas, liquid or a dissolved solid to surface which creates a thin adsorbent layer on the surface of the adsorbent. In adsorption type of Refrigeration system the refrigerator is adsorbed on the surface of some suitable adsorbent such as silica gel & zeolite. The apparatus consists of evaporator, condenser & generator (in which adsorbent is present). The vaporised refrigerant is adsorbed in the pores of the adsorbent in the reaction chamber (or generator). The adsorption process takes place in following steps:

1.) In the first step refrigerant vapors which are adsorbed on the adsorber are desorbed using heating coils.The heat obtained is from solar energy using suitable apparatus. This results in increase in the temperature & pressure of refrigerant which then moves to the condenser. So the refrigerant is compressed in the similar way as that by mechanica compressor.

2.) In the second step Condensation take place as in traditional process where Vapor changes to liquid with the help of cooling coils.

3.) In next step the adsorber is cooled by the cooling coils to maintain its pressure below the condenser pressure (or equivalent to pressure of refrigerant vapors) & also at low temperature. There is also decrease in the pressure of refrigerant vapors in the expansion valve as in Traditional VCRS.

4.) In the last step low pressure refrigerant vapors from vaporator are adsorbed by the adsorbent (which is maintained at low temperature with the help of cooling coils).

The main advantage of adsorption type refrigeration is its wide range from 500C and 5000C. There is no need of electrical pump or generator to be installed in this type. Moreover, there is no corrosion problem in this system. Also the amount of refrigerant cycled in relation to amount of absorbent is larger.

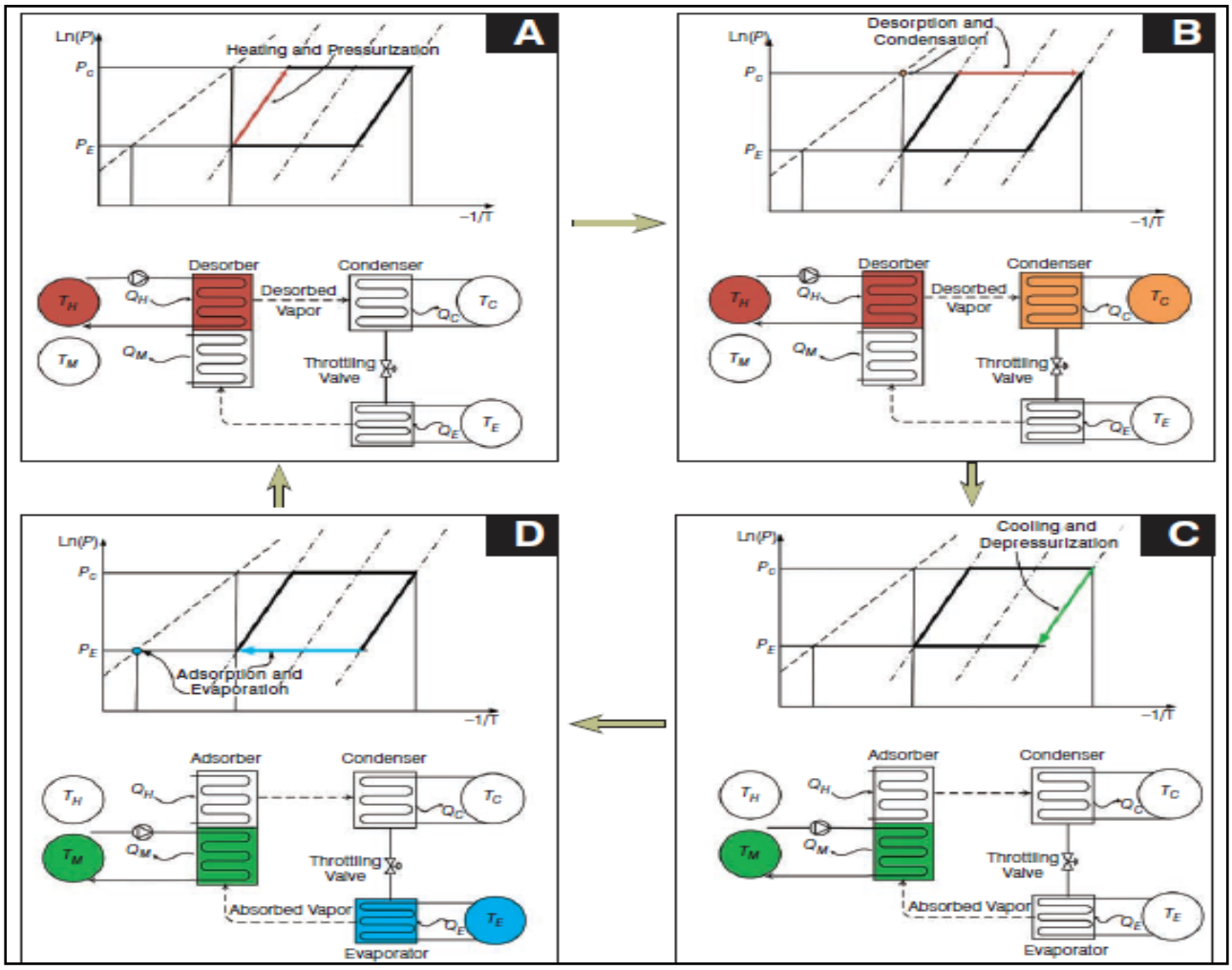

Fig. 3 Adsorption Refrigeration System [5]

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REFERENCES

[1] V Mittal "The study of solar absorption air-conditioning systems" Southern Africa ,Vol 16 No 4 , November 2005 .

[2] The open source Wikipedia (wiki Vapor compression refrigeration).

[3] Limkokwing University "Solar vs. Conventional Air-Conditioning Systems", Journal of Creative Sustainable Architecture & Built Environment Vol. 2, December, 2012.

[4] Ali Al-Karaghouli National Renewable Energy Laboratory, USA Oman ECO-House Workshop Oc10.

[5] Kai Wang," New Opportunities Foe Solar Air Refrigeration System.

Reduction of Moisture Content in Bagasse- A review

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***Abstract*—In every type of industry, there is a requirement of fuel. A fuel in different industries for different purpose is used like for heating, moisturizing, drying the materials and for boilers also. Similarly in sugar mills also a wet bagasse is used as a fuel in sugar industries worldwide. The moisture contents present on the bagasse affected the calorific value of the bagasse and the efficiency of the boiler. Many industries and the institutes are trying to reduce the moisture content from the bagasse and increase the CV of the fuel. As from the before researches we know that the moisture contents present in the bagasse are about 50-52%. To make a bagasse as a good fuel having good calorific value, some drying processes are used. In this review paper the dryer has been installed by which about 3-4% of the moisture contents are removed from the bagasse. In this paper the installation and operation of the bagasse dryer had been explained.**

Keywords*— *Moisture in Bagasse, Gross Calorific Value, Flue Gas Temperature, Bagasse Dryer, Mechanical Methods, Direct and Indirect Methods, Thermocouples.

I. INTRODUCTION

As per the data provided by the mills, they say that bagasse contains Gross Calorific Value around 2270KCal/kg (approx. 9900 KJ/kg) when the moisture content is reduced around 46% from 50%. For the generation of steam, the bagasse is directly supplied to the boiler and the bagasse which has been operated must store in the bagasse yard.

This is the main effect that the Gross Calorific Value depends on the moisture content presents in the bagasse. If the moisture content in the bagasse increased then the Gross Calorific Value decreases of the bagasse fuel. Due to this also energy lose acts in high quantity because the fuel moisture carries that latent heat of vaporization up the stack.

The Gross Calorific Value can be determined by the following equation.

The bagasse dryer options available were

- Indirect method dryer
- Direct contact dryer stationary/rotary method

A. Indirect Method Dryer

G_{cv} [1] =196.05 × (100-W_w %-W_a%)-31.14 × W_{rds} KJ/Kg

Where

W_w= Moisture Content

W_a= Ash Content

W_{rds}= Brix

With the help of above equation, the gross calorific value of bagasse decreases about 196 KJ/kg (47KCal/kg) for every 1% increase in moisture content. Figure 1 shows variation of Gross Calorific Value with bagasse moisture for a typical bagasse sample with 2.5 % ash on air dried basis.

This all has been done in the review paper of J. Sudhakar. P. Vijay from KL University. In his work he was involved only in the reducing the moisture content from bagasse as mentioned in the figure 3 and 4 and the results are shown in the Figure 1 and Figure 2.

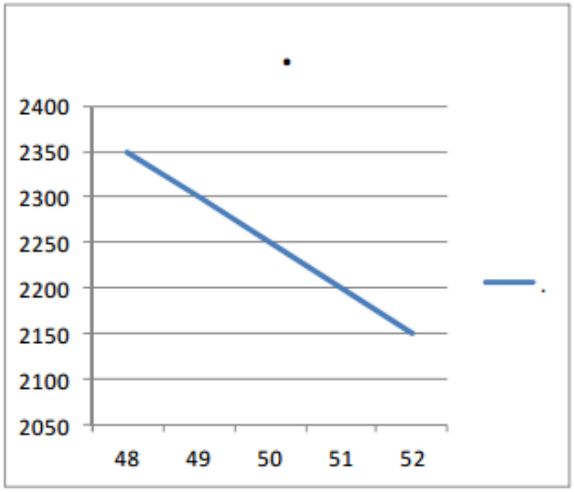

Fig 1. % age of moisture content and gross calorific value.

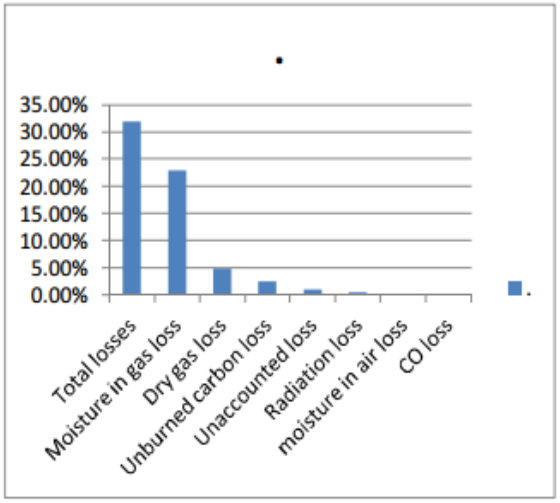

Fig. 2 Losses and % age of losses.

But in my review paper, I have also examine the stage where the bagasse becomes ash and at which stage the temperature varies and stay steady with different period of time. In this above mentioned paper in the figure 1. The x-axis is represented by moisture content in percentage (%).

And the y-axis is represented by Gross Calorific Value in Kcal/kg. Similarly in figure 2. The relation is the x-axis is represented by type of losses and the y-axis represented the percentage of the losses.

The above results indicate that more than 90 % of losses from the boiler are stack losses and out of these losses the moisture loss is the most significant. Therefore by reducing the moisture content in the bagasse, the efficiency os the boiler can be improved and extra bagasse saved will be available for other use.

The stack losses are related to the fuel gas temperature and the extend of loss is directly proportional to the final fuel gas temperature-higher the exit temperature, higher are the losses.most of the boilers have economizer and air heaters which substaincially reduce the fuel gas temperature.the temperature varies from 150 degree Celsius to 165 degree Celsius passing the fuel gas through a bagasse dryer rather than adding heating surface in an effecting wayof reducing both the bagasse moisture and the final gas exit temperature.

B. Direct contact dryer stationary/ rotary method

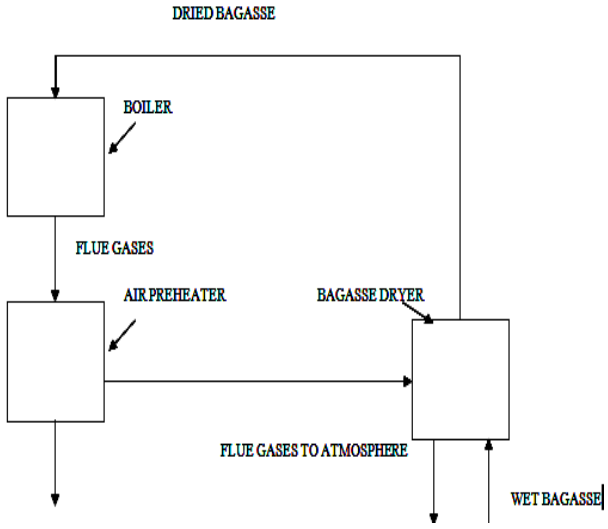

Figure 3 In series.

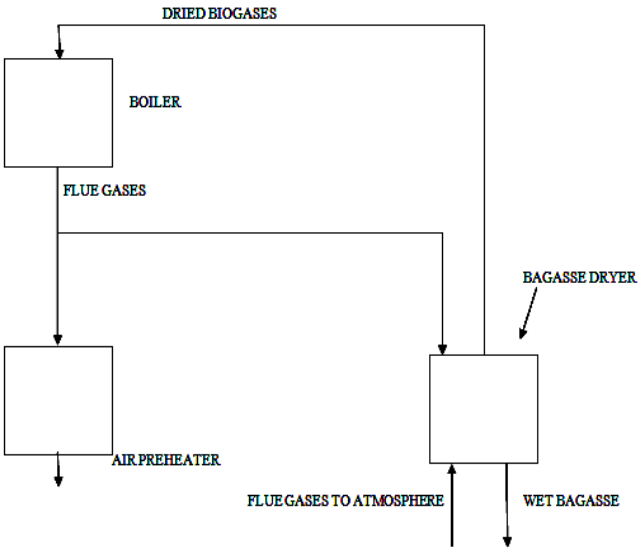

Figure4. In parallel

Now according to my review paper the preparation and the working of the drying bagasse with the help of bagasse dryer is in the following.

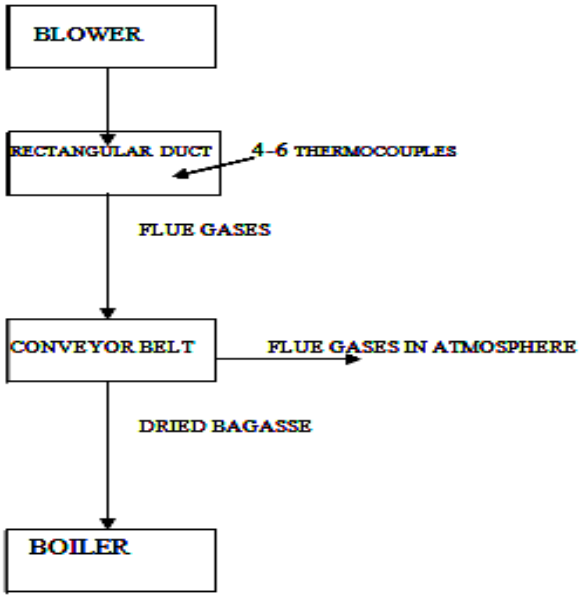

Figure 5. Sequence

In the figure 5. The operation is to examine the temperature at different stages of the duct with the help of thermocouples by attaching them at some constant distances. Suppose T1, T2, T3, T4... are the thermocouples. These devices are used to examine the temperature of air moving from the duct in constant speed. The flue gases exits from the rectangular duct and strikes to the conveyor belt carrying bagasse. After this the dried bagasse with some reduction of moisture will dropped out and ready to use as a fuel with increasing in calorific value.

The functions of the thermocouples are to measure the temperature at the individual stage and can examine also at which temperature the bagasse starts converting into an ash

II. FOR SELECTION OF THE DRYER THE FOLLOWING PARAMETERS WERE CONSIDERED.

- Heat transfer rate
- Retention time
- Uniformity of drying
- Number of insulations
- Operating results
- Mass flow rate
- Rotations per minute
- Density of hot air
- Flow velocity
- Flow area.

III. DRYER OPERATION

It is cleared that the main process or goal of the bagasse drying action is done according to the design is to get fuel gas temperature at 75 degree celsius minimum rather than any

bagasse moisture content. Dryer operation is controlled through a control loop which regulates the quantity of bagasse fed to the dryer through the pipe and gate of bagasse elevator. the quantity of fuel gas is controlled by regulating the rpm of dryer fan in order to keep the fuel gas temperature close to 75 degree celsius. The bagasse dryer can be put in and out of operation without disturbing the operation and does not required any extra man power for operation. Also the dryer doesn't require any special maintenance.

IV. OPERATIONAL SAFETY

In this operation some type of safety precautions has to be taken like to control the flying ash and bagasse in the setup. The time period of the dryer working is a very short. The main care in the setup is to prevent the fire in the dryer while working. The main reason of the fire occurring while operation performing is to bagasse jammed in the dryer outlet and the process continuously interrupted. Some quantity of the bagasse remains inside the dryer. Mostly in the cyclone and is exposed to larger than normal residence or contact time with the fuel gases. As a result moisture content of the bagasse is getting reduced. Under these conditions bagasse is susptible to catch fire. Therefore the flow of bagasse in and out of the dryer should be monitored continuously during operations.

V. CONCLUSION

This paper displays the use of the bagasse dryer and how to bagasse dryer method is working and reduced the moisture content in bagasse and know the stage at which temperature the bagasse starts coming in an ash stage. It gives the explanation of the operational safety. By using this concept the efficiencies of increasing gross calorific values also increases.

REFERENCES

[1]. Cane sugar engineering peter rein page no. 621, 625-627

[2]. Proceeding of 14th international drying symposium, 2004 Brazil page no. 994

[3]. Hand book of cane sugar engineering E.Hugot.

[4]. Batala sugar mill.

[5]. International journal of engineering trends and technology (IJETT)-volume41 issue5- may 2013.

[6]. Chartered institution of building services engineers, london (cibse) and american society of heating,

[7]. Refrigerating and air conditioning engineers (ashrae) handbooks.

[8]. Bagasse dryer as energy saver R.Nand Kumar, Dr. Rn.

[9]. Proceeding the sugar technologist handbook.

[10]. Mashoka, C. Mbohwa, V.M. Thomas, life cycle inventory of electricity cogeneration from bagasse in the South African sugar industry, Journal of cleaner production 39 (2013) 42e49.

Mechanical Characterization of Natural Fiber Composites: An Experimental Approach

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***Abstract*- The objective of present experimentation is to learn the mechanical behavior of hybrid natural fiber composites. Hand layup method is used to manufacture the samples Jute-Bagasse-Epoxy & Jute-Lantana camara-Epoxy hybrids. The weight ratio of matrix and fibre was 65%-35%.and stacking of plies was alternate. The cutting of specimens from the fabricated laminate for different experiments was done as per ASTM standards. Dog bone shape sample was cut for tensile test and Flat bar shape sample was made for flexural test. Universal testing Machine (UTM) was employed to conduct to determine the flexural strength and tensile strength. The results were compared to standard value of polymer to find the change in strength..**

I. INTRODUCTION

Natural fiber usage in industry promotes a sustainable material development through utilization of renewable resources. Composite reinforcement with natural fibers becomes an interest to many researchers and designers because of the positive aspects of the product. Nowadays, all of these natural fibers are beginning to find their way into commercial applications such as in automotive industries, marine hardware and household applications [1]. From a mechanical point of view, natural fibers are good substitutes for polymeric composites due to advantageous characteristics in certain aspects such as renewable nature resources, low weight, cost, density and easily available. Another advantage is on the ease of modification chemically and mechanically [1, 2].

In hybrid composites there is more than one reinforcing phase and single matrix phase or single reinforcing phase with multiple matrix phases or multiple reinforcing with multiple matrix phase. In hybrid composites there is a combination of single and multiple reinforcing phase and a matrix. The advantage of hybrid composites over other fiber reinforced composites is that they have better flexibility. Generally it possesses high modulus fiber with low modulus fiber. They have better flexibility as compared to other fiber reinforced composites. Normally it contains a high modulus fiber with low modulus fiber. The high modulus fiber has the ability to provide stiffness and load bearing quality. The low modulus fiber helps in cutting the cost along with making the composite more damage tolerant. The ratio of volume and sequence of stacking of different plies governs the mechanical properties of a hybrid composites.

Li et al. [3] done a research which reveals that mechanical properties, especially interfacial performances of the composites depends on natural fibers due to the poor interfacial bonding between the hydrophilic natural fibers and the hydrophobic polymer matrices. Joshi et al. [4] found in their study that life cycle environmental performance of natural fiber composites as compared to glass fiber reinforced composites are environmentally superior with respect to specific applications studied. Rana et al. [5] concluded that the use of compatibiliser in jute fibers increases its mechanical properties. At 60% by weight of fiber loading, the use of the compatibiliser improved the flexural strength as high by 100%, tensile strength by 120%, and impact strength by 175%.

Saha et al. [6] investigated that physic-chemical property of jute. In this experiment the jute fibers were treated with alkali sodium hydroxide solution under high pressure and temperature at ambient as well as elevated. It was found that tensile strength increased by upto 65% for alkali steam treatment as compared to the treatment without steaming. Physico-chemical characterization of fibers showed that the increase in tensile strength was due to the removal of non-cellulosic matters like lignin, pectin and hemicellulose

A. Jute Fiber

Jute is a long, soft, shiny plant fiber that can be spun into coarse, strong threads. Jute is obtained from the plants in the produced genus Corchorus. Jute is one of the most commonly used and cheapest natural fiber next to cotton. It has plenty of application. Jute fiber is extracted from plant material like cellulose and lignin. Jute is a crop of rainy season and warm as well as humid climatic conditions are best suited for its growth.

B. Bagasse Fiber

Bagasse , waste of sugar cane and is obtained in abundance in agro based industry. The residue of cane stalks after the juice is extracted from the sugar cane forms the baggase fiber. Bagasse can be identified from its colour which is generally gray yellow to pale green. Its particle size is generally non uniform and it is bulky in size. The sugar cane residue bagasse is an under utilized, renewable agricultural material that consist of two distinct cellular constituents. It includes cellulose, hemi cellulose and lignin as its main constituents.

The main chemical ingredients of bagasse are cellulose, hemicellulose and lignin. The 70% of the total chemical constituents present in the bagasse is hemicellulose and cellulose. The role of other main constituents, Lignin is to act as binder for the cellulose fiber and also acts as an energy storage system.

C. *Lantana Camara*:

These weeds are available in abundance everywhere and can be danger for the greenery of surrounding. It has been cut between two nodes after the removal of its outer shell. Lantana camara has number of application such as, utility articles, mosquito repellent, cheap furniture and as a medicine for various cures, especially for skin-related diseases. People also use it as a bamboo however it is a weed.

D. Polymer: Epoxy Resin:

Araldite LY 556 is used as Epoxy resin manufactured by CIBA GUGYE Limited, as it has the following outstanding properties.

i. Excellent adhesion to different materials

ii. Great strength, toughness resistance

iii. Excellent resistance to chemical attack and to moisture

iv. Excellent mechanical and electrical properties.

v. Odorless, tasteless and completely nontoxic.

vi. Negligible shrinkage.

E. Hardener:

In this work Hardener (araldite) HY 951 is used as it has a viscosity of 10-20 poise at 250C.

II. APPARATUS AND EXPERIMENTAL PROCEDURE

A. Material Preparation

Hand lay-up technique is used to make the composite fiber.

First fiber plies were cut from the jute fiber cloth as per the required size and two plies were used to make the composite. The resin and hardener has been weighed corresponding to the weight of fiber.. Epoxy and hardener were mixed in a bowl with the help of glass rod. No bubbles should be formed as they are trapped in a matrix and lead to failure of the material. The next step was to put a releasing film on the mo surface of mould. Then a coating of polymer was applied on the sheets. Next fiber ply of one kind was put and proper rolling has to be done. Then resin has to be again applied, next to it fiber ply of another kind was put and properly rolled. Cylindrical mild steel rod is used for rolling. This process was repeated till eight alternate fibers were laid. A polymer coating is done on the top of the last ply which serves to have a good surface finish. At last a releasing sheet was put on the top and a light rolling was done. Then weight of 20 kgf was applied on the composite. It was remained as it is for 72 hrs so as to get a sufficient time for curing and proper hardening.

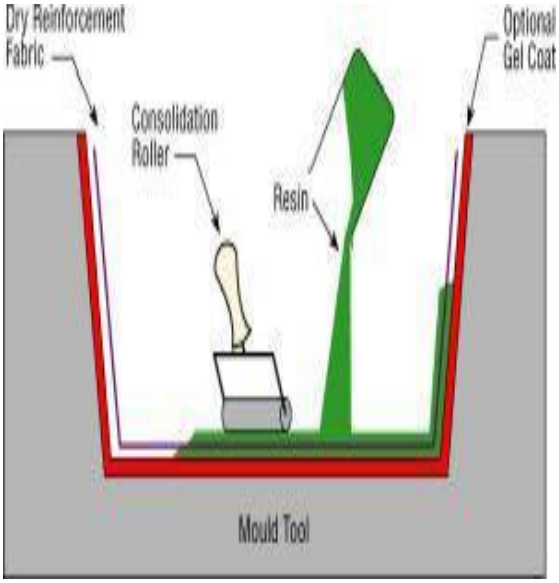

Fig. 1: Hand Lay up technique

The composites sheets have been fabricated from jute fiber, with bagasse/lantana camera and resin matrix. The weight ratio of composites was maintained at 35% fiber and 65% resin. Two number of plies was used for each fiber i.e. total number of plies in hybrid composite were four. Two natural hybrid composites were made i.e. J-B-J (jute bagasse jute) & J-LC-J (jute lantana camera jute). Table 1 indicates the weight fraction of the composites.

Table 1: weight fraction of the composites.

S.No.	Jute (%)	Lantana Camara (%)	Bagasse (%)	Epoxy (%)
1	17		18	65
2	17	18		65

B. Fiber Preparation

Raw Bagasse and lantana camara which were brought and cleaned with water and then dried. Then the aggregations were gently dispersed with hand sitting patiently. Then its outer shell was removed with the knife and it was cut into required dimension. After that it was measured for proper weight .

C. Polymer-Hardner Mixture Preparation

Accurate amount of polymer wass taken which have calculated earlier and 10% of its hardener. Then this mixture was stirred thoroughly until it became a bit warm. A little extra amount of hardener was taken for the wastage in the process. Hardener should be taken very minutely as little extra amount of hardener can spoil the composite.

D. Casting

Moulds of size 150 x 60 x 5 mm fabricated for the preparation of required composite. The voids were filled with polymer in the prepared sample.

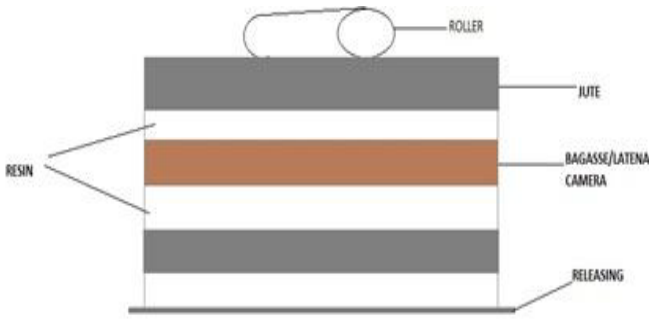

Fig. 2 : Hybrid natural Fiber composite

E. Cutting of Laminates into Samples of Desired Dimensions

A wire hacksaw blade has been used to cut each laminate into smaller pieces, for various experiments:

Tensile test - Sample was cut into a dog bone shape with dimensions of 150 x10 x 5 mm.

Flexural test - Sample was cut into flat bar shape with dimensions of (20x150x5)mm, as per ASTM standards.

Fig. 3 : Dog bone shape sample for Tensile Test

F. Tensile Test

The tensile strength of a material is expressed as the maximum amount of tensile stress that it can be applied before failure. The specimen for tensile test wass the dog-bone shape of size 150x10x5 mm. The tensile test was performed on the universal testing machine (UTM) Instron 1195 and results were analyzed to interpret the tensile strength of composite samples.

Fig. 4 : UTM machine with specimen loaded condition for tensile testing.

G. Flexural Test

Flexural strength of a material is the ability to resist deformation under load. The short beam shear (SBS) tests were performed on the composites samples to interpret the value of inter-laminar shear strength (ILSS). It was a 3-point bend test, which generally leads to failure by inter-laminar shear. This test was conducted as per standards of ASTM using UTM.

Fig. 5 : Flat bar shape sample for Flex

III. RESULT AND DISCUSSION

A. Result of Tensile Test

The results are tabulated in the table 2.

Sample Name	Length (mm)	Breadth (mm)	Thickness(mm)	Extension(mm)	Max.Load (N)
J-B-J	150	20-10	5	2.506	862.3
J-LC-J	150	20-10	5	3.462	1645.7

B. Result of Flexural test

Three point bend test was performed on UTM machine as per the standards of ASTM to interpret the flexural strength of the composites. All the samples of composites were of rectangular shape having dimension of 150x20x5 mm . The s length of span was 75mm. The experiments was conducted on both specimens of jute-bagasse and jute-lantana camara combinations. The results are shown in the table 3

Table3: 3-point bend test data

Sample Name	Length (mm)	Breadth (mm)	Thickness(mm)	Extension(mm)	Max. Load (N)
J-B-J	150	20	5	1.45	701
J-LC-J	150	20	5	1.86	691.1

It is observed that the flexural strength for jute-bagasse was 155.5MPa and for jute-lantana camara was 310.9MPa.

IV. CONCLUSION

The jute, bagasse and lantana camara fibers were successfully used to fabricate hybrid natural composites with 35% fiber and 65 % resin. The flexural strength of pure epoxy resin is 130-135 MPa with (7 to 9.5)% elongation.

When the fiber loading capacity was increased by 20%, the flexural strength value increased to 155.5MPa for Jute-bagasse and 310.9MPa for jute-lantana camara. The tensile strength of epoxy is 60-70 MPa wit 3 to 4 % elongation and when fiber loading capacity was increased by 20 % the tensile strength increases. So, it is clearly interpreted that adding of natural fibers improves the load bearing capacity i.e. tensile strength) and the ability of bear bending i.e. flexural strength of the composites.

In the flexural test, Jute lantana camara combination bears more elongation than jute-bagasse combination, but there is no much difference in maximum load of both specimens. Due to more elongation in jute-lantana combination it has more flexural strength than jute bagasse specimen.

In tensile test again it was concluded that jute-lantana has more elongation than jute-bagasse combination, and therefore the tensile strength of jute lantana camara is more than jute-bagasse sample

REFERENCES

[1] M. Maleque, F. Belal, and S. Sapuan, "Mechanical property study of pseudo stem banana fiber reinforced epoxy composite," The Arabian journal for science and engineering, vol. 32, pp. 359-364, 2007

[2] H. Ismail, M. Edyham, and B. Wirjosentono, "Bamboo fibre filled natural rubber composites: the effects of filler loading and bonding agent," Polymer testing, vol. 21, pp. 139-144, 2002.

[3] S.V. Joshi, L.T. Drzal, A.K. Mohanty, S. Arora "The mechanical properties of vinylester resin matrix composites reinforced with alkali-treated jute fibres" Part A 32 (2001) 119–127.

[4] Yan Li , Chunjing Hu, Yehong Yu "Interfacial study of sisal fiber reinforced high density polyethylene (HDPE) composites" Part A 39 (2008) 570–578

[5] A. K. Rana, A. Mandal, B.C. Mitra, R. Jacbson, R. Rowell, A. N. Banerjee "Short Jute Fiber Reinforced Polypropylene Composites: Effect of Compatibiliser" Journal of Applied Polymer Science, Vol. 69, 329-338 (1998).

[6] Prosenjit Saha, Suvenda Manna, Sougata Roy Chowdhary, Ramkrishna Sen, Debasis Roy, Basudam Adhikari "Enhancement of tensile strength of lingo cellulosic jute fiber by alkali steam treatments" 101 (2010) 3182–3188

[7] A. N. Shah and S. C. Lakad, Mechanical Properties of Jute Reinforced Plastics, Fibre Science and Technology 15 (1981) 41 46.

[8] Hassan M.L., Rowell R.M., Fadl A.W. "Thermo plasticization of Bagasse. II. Dimensional Stability and Mechanical Properties of Esterified Bagasse Composite." Journal of applied polymer science, Volume 76, (2000): p. 575-586.

[9] BC Ray Loading Rate Sensitivity of Glass Fiber epoxy Composite at Ambient and Sub ambient Temperature Department of Metallurgical and Materials Engineering, National Institute of Technology, Rourkela

[10] D. Ray, B.K. Sarkra, A.K. Rana, N.R. Bose "The mechanical properties of vinyl ester resin matrix composites reinforced with alkali-treated jute fibres" Part A 32 (2001) 119–127

[11] W. Wan Nik, J. Y. Wira, S. Syahrullail, and W. Fawwaz, "Friction Characteristics of RBD Palm Olein Using Four-Ball Tribotester," Applied Mechanics and Materials, vol. 315, pp. 936-940, 2013

[12] S. Kasolang, M. A. Ahmed, M. A. Abu Bakar, and A. H. Abdul Hamid, "Specific Wear Rate of Kenaf EpoxyComposite and Oil Palm Empty Fruit Bunch (OPEFB) Epoxy Composite in Dry Sliding," JurnalTeknologi, vol. 58, 2012.

[13] S. Kasolang, A. Kalam, M. Ahmad, N. Rahman, and W. Suhadah, "Abrasive wear: The efects of fibres size on oil palm empty fruit bunch polyester composite," in AIP Conference Proceedings, 2012, pp. 1169

[14] Saroya A.S, Acharya SK "Study of Mechanical Property of Hybrid Natural Fiber Composites. 2011

Factors Affecting the Performance of Ground Heat Exchanger- A Review

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***Abstract*— This paper shows effect of parameter which affect the performance of ground heat exchanger. Factors like rising electricity prices and the environmental factors have forced us to look for cheaper and cleaner alternatives to various applications. Ground heat exchanger is such a alternative. Ground heat exchangers uses underground soil as a heat sink or source. Ground temperature below a certain depth remains relatively constant throughout the year. When water flows through pipes, heat is transferred from the earth to the water or from the water to the earth depending upon the temperature of water relative to temperature of earth that remains nearly constant at the annual mean temperature of that place. This paper mainly deal with parameters like type of soil, configurations of pipe, velocity, depth, mass flow rate, grouting material, thermal resistance.**

***Keywords*— Keywords: heat exchange rate, Performance , ground heat exchanger, temperature.**

I. INTRODUCTION

Ground temperature below a certain depth remains relatively constant throughout the year because temperature fluctuations at the surface of the ground are diminished as the depth of the ground increases because of the high thermal inertia of the soil. Therefore ground temperature is always higher than that of the outside environment in winter and is lower in summer at a sufficient depth. The difference in temperature between the outside environment and the ground can be utilized as a preheating means in winter and pre-cooling in summer by operating a ground heat exchanger. Efficiency of a heat pump is higher than conventional natural gas or oil heating systems, a heat pump may be used in winter to extract heat from the ground and pump it into the conditioned space. In summer, the process may be reversed and the heat pump may extract heat from the conditioned space and send it out to a ground heat exchanger that warms the relatively cool ground. A ground source heat pump extracts heat from the ground – whose temperature will be warmer than the air in winter (and cooler than the air in summer). Therefore ground heat exchangers are more efficient than air source heat pumps, especially in the coldest weather when they are most needed. Ground heat exchangers generate very little noise and should last for many years with minimal servicing. Factors like rising electricity prices and the environmental factors have forced us to look for cheaper and cleaner alternatives to various applications. Air Conditioner is one such device that heavily consumes electricity and its emissions are detrimental to the environment. The high current requirements of the heating and cooling require the installation of the high capacity electric cables. Also, because of the intermittent starting and stopping of the air-conditioners the installed capacity of the electricity has to be much higher than required for the actual running. Moreover, the gap in the demand and supply of the electricity in our country limits the suitability of the heating and cooling. One of the alternatives that can address the above mentioned concerns and the most promising energy resources available to man is ground heat exchanger. It is a form of clean energy because using it doesn't emit any type of pollutions, and renewable energy because the heat within the ground goes around in a cycle so we are assured that there will always be heat available to us. Fig. 1 represents the mechanism of heat transfer in ground heat exchanger.

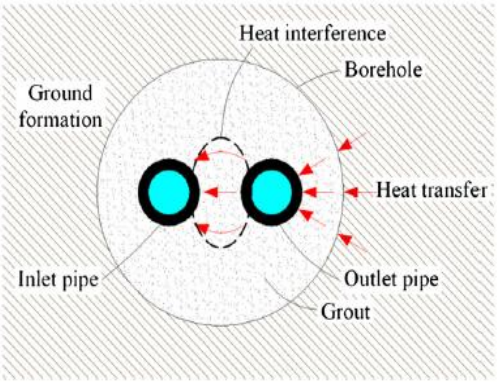

Fig 1: Mechanism of heat transfer [1]

The use of direct or indirect earth-coupling techniques for buildings and agricultural greenhouses requires knowledge of the ground temperature profile at the surface and at various depths. Fig. 2 represents the temperature profile below the ground surface affected by ambient conditions of the climate and need to be considered when designing a ground heat exchanger. Ground temperature distribution is affected by the structure and physical properties of the ground, the ground surface cover (e.g., bare ground, lawn, snow, etc.) and the climate interaction (i.e., boundary conditions) determined by

air temperature, solar radiation, wind, rainfall and air humidity.

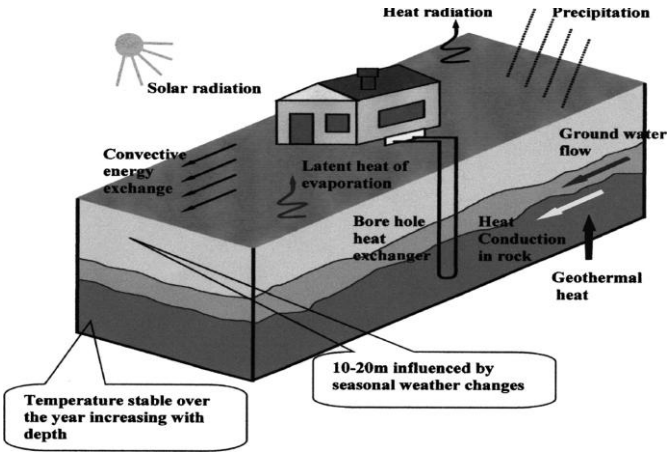

Figure 2: Energy flows in ground [2]

II. PARAMETERS WHCH AFFECT THE PERFORMANCE OF GROUND HEAT EXCHANGER

A. TYPE OF SOIL

Zonghe zheng et al [3] investigated effect of thermal conductivity of soil on the performance of vertical U tube ground heat exchanger. From the Fig. 3, we know that the maximum temperature rise in clay, reaching about 5.8 ℃, and the minimum temperature rise in sandstone, only about 3 ℃. The reason is thermal conductivity and thermal diffusivity of the clay is the smallest, the more close to the pipe the more the heat accumulation of the soil, the higher the resulting temperature rise. And high thermal conductivity of the sandstone can well transfer heat with the pipe, while the heat is spread out and then the temperature increment near the pipe is also lower.

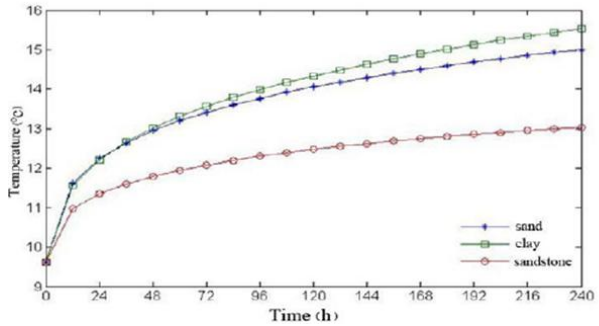

Fig. 3: Soil Temprature curve [3]

B. TYPE OF CONFIGURATION OF PIPE

G. Colangleo et al [4] works deals with the efficiency and the energy behavior of Ground Source Heat Pumps (GSHPs) used for heating and cooling of buildings. In particular horizontal type heat exchangers have been investigated for different configurations, in order to evaluate the characteristics of these systems in the most common layouts and in different working conditions. The helical ground heat exchanger here simulated is a long polyethylene pipe with helical shape with an outer diameter of the spires of 0.4 m and different pitch: 0.2 m and 0.3 m. Dimensions were chosen to be consistent with the geometry of the ground modeled around the pipes in all the arrangements considered and to satisfy the needing of a cheap excavation. For the helical geometry the depth in the ground was referred to the axis of the spiral and set at three values 1.5 m, 2.0 m and 2.5 m. The slinky pipe configuration is obtained by flattened coils of overlapping piping, that are spread out and laid vertically. This configuration has the ability to focus the area of heat transfer into small volume, reducing the length of the trenches and hence the quantity of ground needed. The helical heat exchanger arrangement resulted as the best performing one.

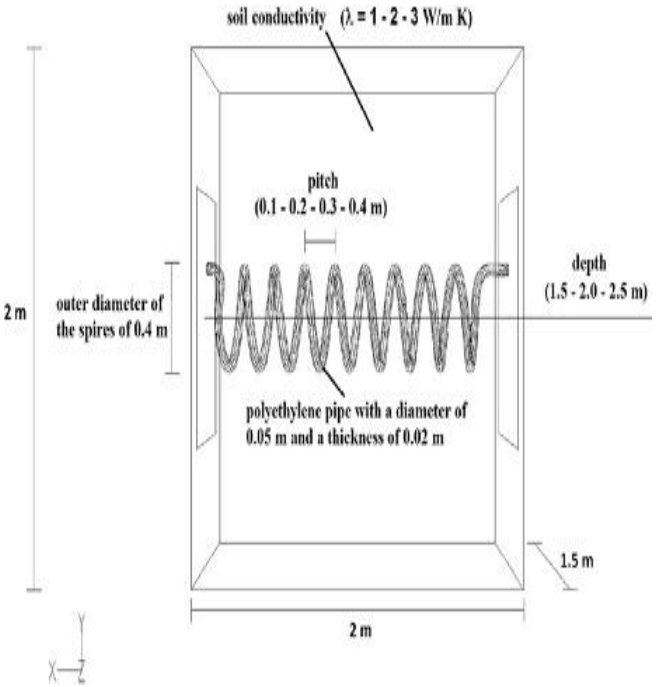

Fig. 4: Helical Configuration [4]

C. TYPE OF GROUTING MATERIAL

Hangseok Choi et al [5] suggested that cement grouting has a higher effective thermal conductivity than that of bentonite grouting, and graphite better performs over silica sand as a thermally enhancing additive.

TABLE 1 [5]

GROUT	ADDITIVE	THERMAL CONDUCTIVITY, (W/Mk)
Cement	Silica sand Silica sand + graphite	2.10 2.59
Bentonite	Silica sand Silica sand + graphite	0.73 0.74

The dummy pipe is expected to function as a thermal insulation zone.Water is filled in the dummy pipe to overcome buoyant force during inserting a bundle of the GHEX pipes in the borehole. The schematic diagram of the new 3 pipe-type GHEX system is presented in Fig. 5.

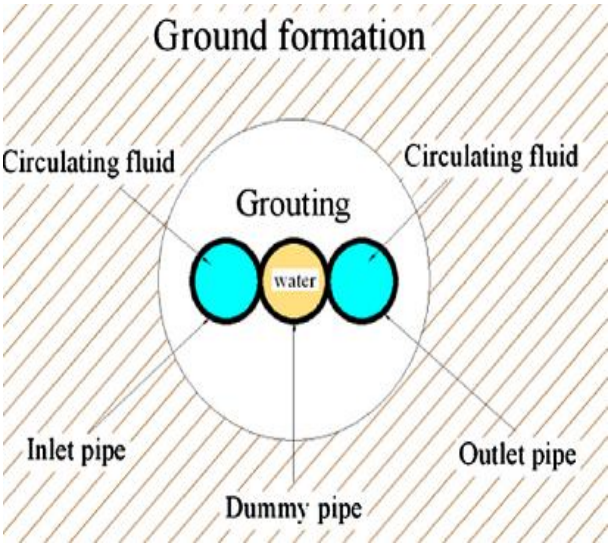

Fig 5. Schematic diagram 3 pipe type [5]

D. DEPTH

Sotares et al [4] discussed various types of ground heat exchanger and stated that temperature at a certain depth in the ground remains nearly constant throughout the year. The ground capacitance can be regarded as a passive means of heating and cooling of buildings. A vertical borehole heat exchanger was drilled to a depth of 20–300 m with a diameter of 10–15 cm. It was found that performance of ground heat exchanger was affected by length of bore hole. Hikmet Esen et al study vertical drilling of bore was carried for three different depth as 30, 60 and 90 meter. The best performance of the system was obtained at a depth of 90 meter but optimum depth is about 60 meter. Design length and performance of heat exchanger strongly depend on the thermal conductivity of the backfill material.

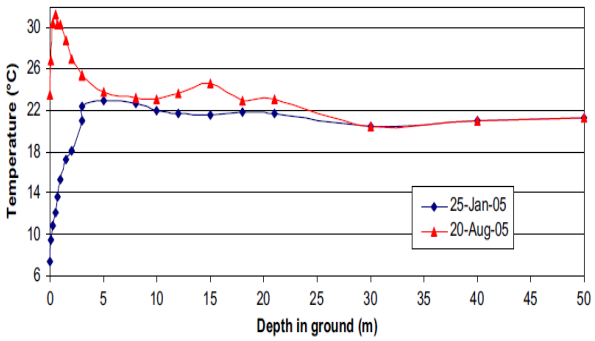

Fig 6: Temperature variation with depth [4]

E. TYPE OF MATERIAL

Francesco Minichiello et al [6] and Bansal et al [7] study that convective heat transfer is more important than conductive heat transfer and therefore performance of the system does not depend on the type of material. The thermal exchange between the ground and the air crossing the tube increases with the length of the buried tubes. The obtained results show that concrete, plastic or metallic materials lead to very similar energy performances. In fact, due to the small thickness ofthe tubes (5 mm in the case of PVC, 7 mm for the metallic material, 7 cm for the concrete), the different thermal conductivity values scarcely influence the heat exchange, if the right depths and lengths are used.

Resistance offer by tube

Rcond-tube =[1/(2Π L Kp)] .ln [(r1+r2)/r1]

Where L is legth of pipe, Kp is thermal conductivity of pipe, r1 and r2 are inner and outer radius of pipe.

F. VELOCITY

Ascione et al [8] investigated the energy performances of an earth-to-air heat exchanger for an air conditioned building for both winter and summer conditions. The performance of the systems have been analyzed for different boundary conditions such as the type of soil, pipe material, pipe length, depth, velocity of the air crossing the pipe, ventilation air flow rates. Low speeds (about 8 m/s) of the air flow inside the tubes are preferable, as the pressure drops and fan electric energy requirements decrease; the higher energy costs due to the use of intake fans instead of exhaust ones are negligible.

G. GROUND WATER FLOW

Wang et al [9] investigated that due to ground water flow performance of borehole heat exchanger increased and based on the measurement of the natural ground temperature profile, a theoretical model was presented to estimate the affect of groundwater flow.

H. MASS FLOW RATE

Amanpreet et al investigated the effect of mass flow rate. Heat Exchange rate is measured by using following equation:

$$Q = m \times C_p \times (T_{in} - T_{out})$$

Where, Q : Heat Exchange Rate (KW), m : Mass flow rate (Lt/sec), C_p : Specific heat of the fluid at constant pressure (kJ/kgK),T_{in} : Temperature of water at the inlet ($^{\circ}$C),T_{out} : Temperature of water at the outlet ($^{\circ}$C).

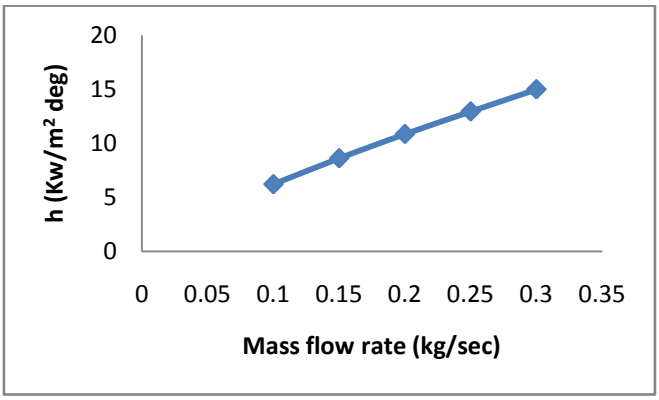

Fig. 6 : Variation of heat transfer coefficent with mass flow rate [10]

I. THERMAL RESISTANCE

Thermal resistance [10] is a heat property and a measurement of a temperature difference by which an object or material resists a heat flow. Assuming a horizontal pipe of inside diameter Di and outside diameter Do buried at a depth

d from the ground surface. The total thermal resistances per pipe length are as follows:

Fig. 7 : Thermal Resistance Model [10]

$$R_{total} = R_{conv} + R_{pipe} + R_{soil}$$

Where

$$R_{conv} = \frac{1}{\pi D i h}$$

$$R_{pipe} = \frac{\ln \frac{Do}{Di}}{2\pi Kpipe}$$

$$R_{soil} = \frac{1}{S\ Ksoil}$$

S is the conduction shape factor of the pipe

Where, Rtotal = Total thermal resistance, Rconv = Convective thermal resistance, Rsoil = Thermal resistance due to ground soil conduction, h = Convective heat transfer coefficient, Ksoil = Soil Thermal conductivity, Kpipe = Pipe thermal conductivity.

$h = Nu \times Kw / Di$

Where Nu= Nuselt Number = $0.023\ (Re)^{0.8}(Pr)^{0.4}$

Having calculated the heat transfer coefficient h we can now utilise the realtion derived earlier for finding the thermal resistance due to convection heat transfer.

III. COCLUSIONS

From the result of this study, the following conclusion is drawn:

- Maximum temperature rise take place in clay sand
- Helical arrangement offer maximum performance in horizontal ground heat exchanger.
- Cement grouting has higher thermal conductivity
- Optimum depth for vertical ground heat exchanger is 60 meter.
- Material has no effect on the performance.
- Performance decrease with increase in velocity and mass flow rate.
- Presence of ground water improve the performance.

REFERENCES

[1] Geothermal Heat Pump Consortium. www.geoexchange.org.2005

[2] Georgios Florides, Sctris Kalogrirou, Ground heat exchanger-A review of system model and applications , Renewable energy 2006

[3] Zonghe Zheng, Weixiao Wang, Chao Ji, A Study on the Thermal Performance of Vertical U-Tube Ground Heat Exchangers,Energy Procedia 12(2011) 906-914

[4] P.M. Congedo, G. Colangelo, G. Starace, CFD simulations of horizontal ground heat exchangers: A comparison among different configurations, Applied Thermal Engineering 33-34 (2012) 24-32

[5] Chulho Lee, Moonseo Park , Sunhong Mina, Shin-Hyung Kang , Byonghu Sohn , Hangseok Choi , Comparison of effective thermal conductivity in closed-loop vertical ground heat exchangers, Applied Thermal Engineering 31 (2011) 3669-3676

[6] Fabrizio Ascione , Laura Bellia , Francesco Minichiello , Earth-to-air heat exchangers for Italian climates, Renewable Energy 36 (2011) 2177-2188

[7] Vikas Bansal, Rohit Mishra, Ghanshyam Das Agarwal, Jyotirmay Mathur , Performance analysis of integrated earth–air-tunnel-evaporative cooling system in hot and dry climate, Energy and Buildings 47 (2012) 525–532

[8] Fabrizio Ascione , Laura Bellia , Francesco Minichiello , Earth-to-air heat exchangers for Italian climates, Renewable Energy 36 (2011) 2177-2188

[9] Huajun Wang , Chengying Qi, Hongpu Du, Jihao Gu, Thermal performance of borehole heat exchanger under groundwater flow, Energy and Buildings 41 (2009) 1368–1373

[10] Amanpreet Singh, Sumit Sharma, T.K. Jndal, Experimental study of ground heat exchanger,, International Journal of Mechanical Science and Civil Engineering, Volume 2 Issue 3 (September 2013 Issue), 2320-2424

Effect of Weld Groove Volume on Tensile Performance of Gas Tungsten Arc Welded Martensitic Stainless Steel (AISI 410 SS) Joints

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Abstract-The present work was undertaken with an aim of studying the effect of two different weld groove volumes on the tensile behavior of 6mm thick butt welded martensitic stainless steel joints. Welding heat input variation corresponding to each joint configuration was kept to a minimal such that the objective of investigating, exclusively, the effect of varied weld volume on the tensile performance of these joints could be accomplished. Tensile performance of these joints was evaluated by subjecting them to transverse tensile testing. Since heat dissipation for each joint was different, it was anticipated that the thermal gradients developed during welding across different zones of the weldments would be different that would affect the cooling rate and hence the tensile performance of these joints. Experimental results obtained from this research work indicate that variation in the weld groove volume exerts a significant influence on the tensile performance of these joints. The results obtained from this study shows that all the weld joints of different groove volumes exhibited different UTS (ultimate tensile strength). It was found that, weld joint made using the smallest groove volume possessed maximum UTS.

Keywords: AISI 410 SS, Gas tungsten arc welding process, Groove Volume, Tensile performance.

I. INTRODUCTION

Martensitic stainless steels are commonly used for manufacturing components with high mechanical properties and moderate corrosion resistance, operating under conditions of either high or low temperature. As their properties can be changed by heat treatment, these steels are suitable for a wide range of applications such as steam generators, pressure vessels, cutting tools, and offshore platforms for oil extraction **[1]**.GMAW (Gas metal arc welding), GTAW (Gas tungsten arc welding), SMAW (Shielded metal arc welding) & FCAW (Flux cored arc welding) are the commonly used processes used to weld this category of steels [18**]**. In engineering context welding is a process of joining two or more individual components to form one structurally integral component. Over the years welding methods and techniques have developed to very great extent. Now it is feasible to weld starting from thin metal sheets of fraction of mm to very thick plates of virtually any thickness **[2]**. The properties of weld metal is generally depends upon the weld metal microstructure after completely solidification of weld pool. The most required weld metal properties are the strength and toughness. The mechanical properties of the weld metal is greatly depends upon the grain size. The fine grain size has normally higher tensile strength, higher hardness at the expense of ductility as compared to coarser grain size. In addition segregation of the particles and coming out the solute or second phase particles from the matrix also contribute the higher strength or ductility of the weld metal than there will be more grain boundary area due to that there is much segregation of the solute atoms which restrict the motion of dislocations, consequently there is increase in mechanical properties of the weld metal **[5]**. Based upon the literature reviewed in this area it was found that no systematic studies have been reported where the effect of changing the weld groove volume on tensile performance is studied especially for the AISI 410 SS welded joints.

II. EXPERIMENTAL DETAILS

A. Base and filler material combination

The base material used in the present investigation was in the form of AISI 410 SS cold rolled plates of size 300mm × 75mm × 6mm and the filler was AISI 304 L for root pass and AISI 410SS solid filler wire of 1.6mm diameter. The chemical composition of the both materials is provided in the Table 1.

TABLE 1: CHEMICAL COMPOSITION OF BASE METAL AND FILLER WIRES

Elements	C	S	Mn	Cr	Ni	Si	P	Fe
Base Metal (AISI 410 SS)	0.029	0.005	0.349	11.861	_	0.387	0.023	Balance
Filler Metal (AISI 304LSS)	0.028	0.032	1.396	18.521	9.536	0.973	0.045	Balance
Filler Metal (AISI 410 SS)	0.121	0.035	0.615	12.516	_	0.512	0.031	Balance

B. Welding procedure

In the present work single V-groove design of different groove volumes were used so that welding could be

accomplished in four passes (one root pass and three cover passes) ensuring full penetration with gas tungsten arc welding (GTAW) process. Grooves were prepared as shown in Figure 1 and the groove design parameters were mentioned in the Table 2. Before welding the edges were thoroughly cleaned to avoid any source of contamination like oil, moisture, rust, etc. After tacking the plates, pre-heating (250°C) **[5]** was provided on the back side of the plates with LPG gas burners, then the root pass was given using AISI 304 L (ER 410) solid filler wire of 1.6 mm diameter and cover passes were given using AISI 410 (ER 410) solid filler wires of 1.6 mm diameter **[6].** The inter-pass temperature 150°C was maintained during the welding. The welding parameters are mentioned in the Table3.

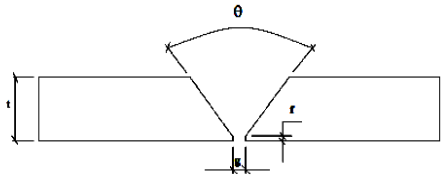

Figure 1: Schematic showing the groove design

TABLE 2: WELD GROOVE GEOMETRY (SINGLE-V) PARAMETERS.

S. No.	Groove angle (θ) (degrees)	Root gap (g) (mm)	Root face (f) (mm)	Groove volume (GV) (mm^3)
WJ_{GV-1}	45	2.0	0.5	7358.7
WJ_{GV-2}	75	3.0	1.5	10061.4

TABLE 3: WELDING PARAMETERS

Groove Volume	Weld pass number	Filler used	I Amp	V volt	S (mm/s)	Heat Input (kJ/mm)	Total Heat Input (kJ/m)
WJ_{GV-1}	1 (Root pass)	AISI 304L SS	80	12	0.974	0.788	3.772
	2	AISI 410 SS	120	12	1.185	0.972	
	3				1.149	1.002	
	4				1.140	1.010	
WJ_{GV-2}	1 (Root pass)	AISI 304L SS	80	12	0.952	0.806	3.793
	2	AISI 410 SS	120	12	1.176	0.971	
	3				1.162	0.991	
	4				1.123	1.025	

III. RESULTS AND DISCUSSION

A. Transverse tensile testing

Total three specimens (sub-sized) were machined out from each welded plate for transverse tensile testing in the as welded condition (AW). These specimens were prepared according to ASTM E-08 (*Tension testing of metallic materials*)and are schematically shown in Fig.2. All the tensile specimens were prepared using a wire-cut EDM. 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 of 600kN capacity. The results of the transverse tensile testing of different welded specimens are mentioned in Table 4. The values reported corresponding to the average three tensile specimens for each joint in the as welded conditions.

B. Analysis of transverse tensile testing results

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 weld zones in case of all the joints were stronger than the base metal, thus resulting into joint efficiencies of more than 100%. The maximum UTS value of 758.34MPa was possessed by the welded joint WJ_{GV-1} and the minimum UTS value of 677.49 MPa was possessed by the welded joint WJ_{GV-2}. The maximum percentage elongation of 11.16% was possessed by the joint WJ_{GV-1} in the as welded condition whereas minimum percentage elongation of 7.83% was possessed by the welded joint WJ_{GV-2}.

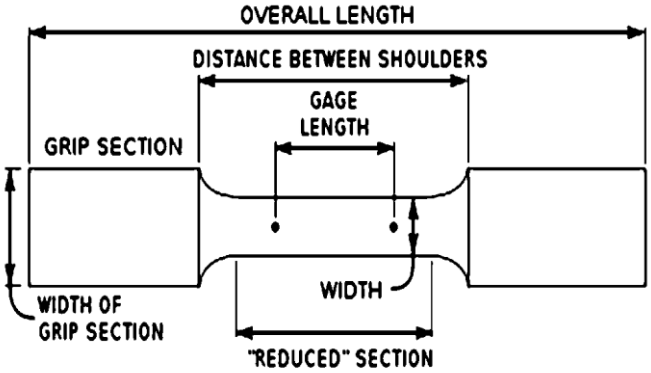

Fig. 2: Schematic showing the tensile specimen as per ASTM E-08 standard

Overall Length= (150±1) mm; Distance between Shoulders = (80±1) mm; Gauge Length = (50±1) mm; Reduced Section = (60±1) mm; Width of Grip Section = (20±0.25) mm; Width of Reduced Section = (12±0.25) mm.

The main trend as indicated by these joints is that small groove volume as used in the present case 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, firstly corresponding to joint WJ_{GV-1}, since the groove volume is relatively less, welding arc heat dissipates at a relatively faster rate, thus resulting into fine grained microstructure of the weld zone which increases the overall stress carrying capacity of this joint.

Table 4: Transverse tensile testing results of the welded specimens

Specimen code	UTS value (MPa)	% Elongation	Location of fracture
WJ_{GV-1}	758.34	11.16	Base metal
WJ_{GV-2}	677.49	7.83	Base metal

IV. CONCLUSIONS

All the welded joints fractured from the base metal during tensile testing thus achieving a joint efficiency of more than 100%, so weld metal in each case was found to be stronger than the base metal for all combinations of the groove volumes used.

Among all the joints, the weld joints made using the smallest groove volume (7358.7mm^3) possessed the maximum ultimate tensile strength (758.34 MPa) with maximum percentage elongation 11.16. Based on the present work, it is recommended that while designing welding procedure specifications for AISI 410SS, the joint design leading to relatively smaller groove volume should be preferred as it helps in improving the overall mechanical strength of these joints without any additional cost.

V. NOMENCLATURE

I	Welding current (in amperes)
V	Arc voltage (in volts)
s	Welding speed (mm/sec.)
g	Root gap (mm)
f	Root face (mm)
t	Base plate thickness (mm)
θ	Groove angle (mm)
WJ_{GV-1}	Weld joint of groovevolume-1
WJ_{GV-2}	Weld joint of groove volume-2

REFERENCES

[1] D.H. Mesa, A. Toro, A.P. Tschiptschin; The effect of testing temperature on corrosion-erosion resistance resistance of martensitic stainless steels, *Wear*255 (2003) 139–145.

[2] J. Chen, C.Schwenk, C.S. Wu, M. Rethmeier; Predicting the influence of groove angle on heat transfer and fluid flow for new gas metal arc welding process. International Journal of *Heat and Mass Transfer* 55(2012) 102-111.

[3] S. Murugan, Sanjai K. Rai, P.V. Kumar. T. Jayakumar, Baldev Raj, M.S.C. Bose; Temperature distribution and residual stresses due to multipass welding in type 304 stainless steel and low carbon steel weld pads. International Journal of *Pressure Vessels and Piping*78(2001) 307-317.

[4] A.S. Olabi and M.S. Hashmi; Effects of post weld heat-treatments soaking temperature on the mechanical properties and residual stress of martensitic stainless steel (AISI 410SS) welded component. Journal of *Material Processing Technology*, 38(1993) 387-398.

[5] M.A. Neri and R. Colas; analysis of martensitic stainless steel that failed due to the presence of coarse carbides. *Material characterization* 47(2001) 283-289.

[6] A.K. Bhaduri, T.P.S. Gill, S.K. Albert, K. Shunmugam, DR Iyer; Repair welding of cracked steam turbine blades using austenitic and martensitic stainless steel consumables *Nuclear Engineering and Design*206 (2001) 249-259.

[7] A. NaseryIsfahany, H.Saghafian and G. Borhani; the effects of heat treatment on mechanical properties and corrosion behaviour of AISI 420SS martensitic stainless steel. Journal of *Alloys and Compounds*509 (2011) 3931-3936.

[8] C.G. Garcis, De Andres, G. Caruana, Lf. Alvarlz; Control of $M_{23}C_6$ carbide in 0.45C-13Cr. martensitic stainless steel by means of three represented heat treatment parameters. *Material Science and Engineering*A241 (1998) 211-215.

[9] B.Vamikrishna and Amit Bandhophyay; Surface modification of AISI 410SS using laser engineered net shaping (LENS). *Material and Design*30 (2009)1490-1496.

[10] P. Wang, S.P. Lu, N.M. Xiao, D.Z. Li, Y.Y. Li; Effect of delta ferrite on impact properties of low carbon 13Cr-4Ni martensitic stainless steel. *Material Science and Engineering*A527 (2010) 3210-3216.

[11] S. Kou, Welding Metallurgy, New York; Jhon Wiley & Sons, Inc., Second edition, 2002.

[12] Howard B. Carry, Modern Welding Technology, Prentice Hall, Upper Saddle River, New Jersey, Columbus, Ohio; Fifth edition.

[13] Welding Brazing and Soldering, *ASME handbook*, volume 6, 1993.

[14] ASTM International E08-03. Standard test method for tension testing of metallic material

[15] Welding Handbook, 7TH Edition. VOL 4, *American Welding Society*, 1982, Page 87-93.

[16] R.S. Parmar, Welding Processes and Technology, *Khanna Publishers*, second edition, 2008.

[17] M.C. Tsai, C.S. Chiou, J.S. Du and J.R. Yang Phase transformation in AISI410 stainless steel. *Material Science and Engineering* A332 (2002) 1-10.

[18] Specification for welding earthmoving and construction equipments. AWS D14.3-94, *American Welding Society* 1994

Comparison of Tool Tip Temperature and Cutting Forces using Uncoated and Alcrn Single Layer Coated Cutting Tool Inserts in Turning

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***Abstract*— The manufacturing industry is continuously striving to decrease its cutting cost and increase the quality and production of machined parts. The main driving force to increase the production is growing demand of high quality cutting tool material. Coatings on the cutting tool are one of the methods, which is being most preferred to improve the cutting tools. In this study the comparison between uncoated and single layered coating(AlCrN) has been done. The tool tip temperature and main cutting force are evaluated during the turning under dry machining. This comparative study provided insight on the effect of different speeds and feed rates on change in temperature and cutting forces during the machining. The cutting tool temperature and cutting forces in case of uncoated inserts were found higher as compared to AlCrN coated inserts.**

***Keywords*— PVD coating; Carbide tools; AlCrN; Turning.**

I. INTRODUCTION

The manufacturing industry is continuously striving to decrease its cutting cost and increase the quality and production of machined parts. For high speed machining cemented carbide tools are generally used. The machining properties of the carbide tools can be enhanced by coating the cutting tool. Physical vapor deposition (PVD) is a method of depositing thin films by the condensation of a vaporized form of the desired film material onto various work piece surfaces. The various coating methods which are used for coating the work material ares 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. In an automotive industry, coating is the newest alternative to the chrome plating. Physical vapor deposition has been proven to increase durability and weight less than chrome coating. It is gaining in popularity for enhancing a product's durability and the lifespan of an unprotected product. The use of coating materials to enhance the performance of cutting tools is not a new concept. Coated hard metals had a great impact on the metal cutting industries. After their introduction in 1969, the productivity of metal cutting industry has increased tremendously.[3].Due to their significantly higher hardness Due to their significantly higher hardness; today carbide-cutting tools are more widely used in the manufacturing industries than high-speed steels. For most of the turning operations coated and uncoated carbides provide the best alternative and are widely used in the metal working industry [4]. All types of PVD and CVD processes can be used to deposit coatings due to their heat resistance [5]. The important properties such as wear, abrasion resistance and adhesion strength of a coating can be deterined by the combined substrate-coating properties. A hard wear resistant coating cannot perform well unless complimented by a hard and tough substrate. Thus, a hard coating deposited on a soft substrate leads to poor properties [1, 2]. J.Lima,J.G. et al [6] has investigated the machinability of hardened steels at different levels of hardness by using a different range of cutting tool materials. They have proved that the 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. Rech, J et al [7] 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. Devillez A et al [8] 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 behavior limits welding and unstable built-up-edge phenomena; abrasive wear is also reduced by its very high hardness due to its ultra-fine crystallinity. Sharma,S et al [9] investigated the machining AISI 52100 steel using a carbide-coated tool. It was found that as the feed rate and depth of cut increses the cutting forces also increases. Cutting forces decreases slightly as the cutting speed goes on increasing. There is also a very little effect of approach angle on cutting force. With the increase in depth of cut, the feed force increases and decreases with increasing approach angle, speed, and feed rate. In the present investigation an attempt has been made to find out the cutting forces and temperature associated with the hard turning of EN31 work piece in dry conditions. Turning of the workpiece has been done using coated and uncoated carbide tools. Liew Willey

Y.H. et al. [10] examines the frictional and wear behavior of AlCrN, TiN, TiAlN single-layer coatings, and TiAlN/AlCrN, AlN/TiNnano-multilayer coatings in dry sliding. Comparative studies on the coatings sliding in air and vacuum environment at different speeds provided important insight on the effect of oxidation and temperature on the frictional and wear behavior of the coatings has done. Among all the single-layer coatings tested in vacuum, TiN gave the lowest coefficient of friction (COF), followed by TiAlN and AlCrN. This indicated that TiN was the most lubricous coating. At 10 m/min in ambient air in which oxidation took place, AlCrN gave the lowest COF, followed by TiN and TiAlN. Among the two types of nano-multilayer coatings tested in vacuum and air, the AlCrN/TiAlN produced lower COF. The characteristic of the COF produced by AlCrN/TiAlN and AlN/TiN in vacuum and air was similar to those produced by TiAlN and TiN, respectively. The experiments showed that the COF of these nano-multilayer coatings was governed by TiAlN and TiN. AlCrN exhibited the highest wear resistance. TiAlN had the lowest wear resistance. TiN, TiAlN/AlCrN and AlN/TiN which exhibited similar wear resistance, had lower wear resistance than AlCrN but higher wear resistance than TiAlN. In air, increasing the speed from 10 m/min to 100 m/min resulted in a reduction in COF for all coatings, except AlCrN. Denkena et al. [11] investigate the influence of two different edge preparation methods (plunge-face grinding and brushing) on the performance of TiAlN-coated cemented tungsten carbide inserts during hard turning is investigated. In general, higher values of surface roughness (Rz ≅0.3 µm) and edge chipping (Rk ≅4.5 µm) were observed for brushed inserts in comparison to the ground tools (Rz ≅0.2 µm, Rk ≅ 3.7 µm). Moreover, higher compressive residual stresses are induced by brushing in comparison to grinding (≅500 MPa against ≅ 400 MPa). In turning tests, cutting forces for the ground inserts are approximately 10% higher than for the brushed inserts. However, higher wear values are better related to lower compressive residual stresses in the substrate than to higher cutting forces. Pujante et al. [12] examines a simple and a robust test for the mechanical characterization of hard PVD coatings at high temperature and open atmosphere has been developed, based on a modification of the scratch test where the diamond tip is replaced by a WC indenter. The test has been used to evaluate the effect of temperature up to 500 °C on commercial PVD AlCrN coating deposited on tool steel subject to different surface treatments. Results show a decrease in the failure load Lc2 with increasing temperature, and a very noticeable effect of substrate nitriding.

II. EXPERIMENTATION

All the experiments were performed on Capstan Lathe machine (HMT CHAMANDI) under dry conditions using TiN and AlCrN coated carbide cutting inserts. In this experiment two process parameters cutting speeds and feed rate were varied and the third parameter i.e. depth of cut was remains constant. Process parameters along with their levels are shown in the table 1.The forces have been measured with the help of IEICOS Multi Component Digital Force Measurement Dynamometer. RPM were measured by using Tachometer.

TABLE I. PARAMETERS AND THEIR LEVELS

Parameter	Level 1	Level 2
Cutting Speed	147	272
Feed rate (mm/rev)	0.1	0.13
Depth of Cut (mm)	0.1	0.1

III. RESULT & DISCUSSION

Fig. 1-8 shows the variation of temperature and cutting forces with respect to time for AlCrN and uncoated in dry conditions at different cutting speeds and feed rate. A notable feature of results obtained in dry conditions is the gradual increase in the temperature followed by the decrease in cutting forces tests involving AlCrN single layer coated and uncoated at 272 rev/min and 147 rev/min and depth of cut at 0.1 mm respectively.

A. Comparison of Temperature

Fig. 1-4 shows the variation of tool tip temperature of AlCrN at different cutting speeds i.e. 147 rev/min and 272 rev/min with respect to time. At lower cutting speeds i.e. 147 rev/min the tool temperature of the cutting tool is lower than the cutting speed of 272 rev/min. The process is carried out on EN31 workpiece.

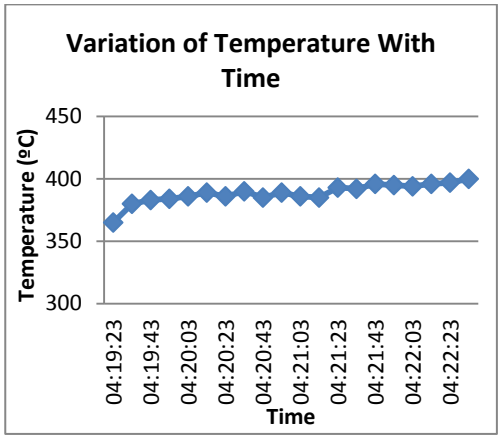

Fig. 1 Variation of Temprature of AlCrN at 147 rev/min.

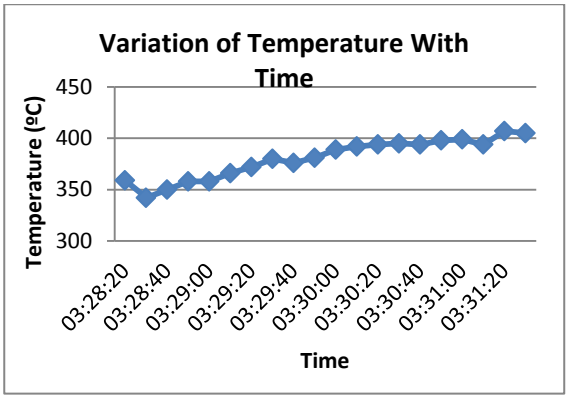

Fig. 2 Variation of Temprature of AlCrN at 272 rev/min.

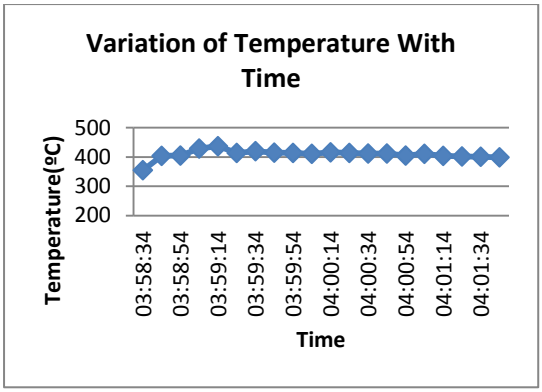

Fig. 3 Variation of Temprature of Uncoated at 147rev/min.

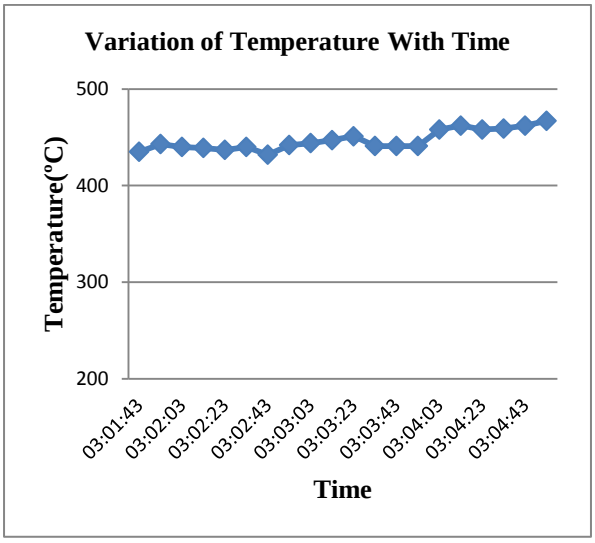

Fig. 4 Variation of Temprature of Uncoated at 272 rev/min.

B. Comparison of Forces

Fig. 5-8 shows that the cutting forces in case of uncoated inserts are higher than the cutting forces in case of AlCrN at different cutting speeds and feed rate. The cutting forces go on decreasing as the process proceeds.

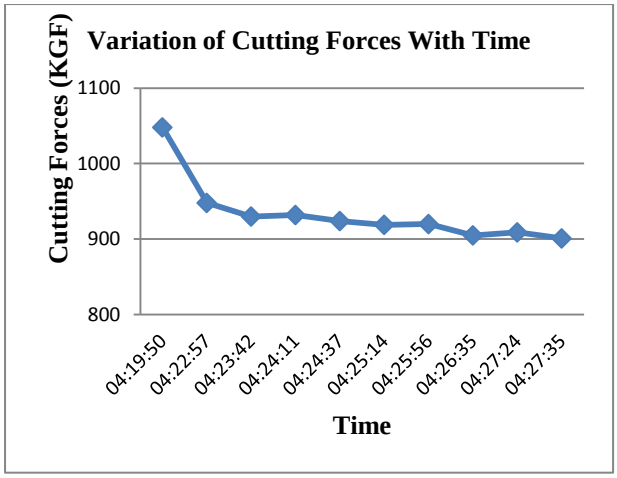

Fig. 5 Variation of Cutting Forces of AlCrN at 147 rev/min.

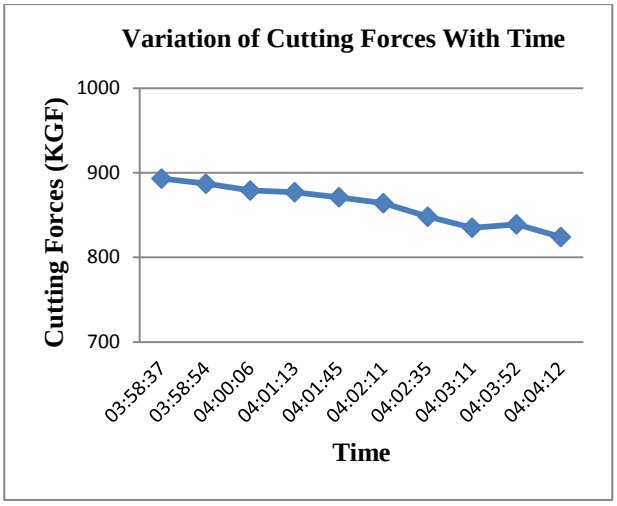

Fig. 6 Variation of Cutting Forces of AlCrN at 272 rev/min.

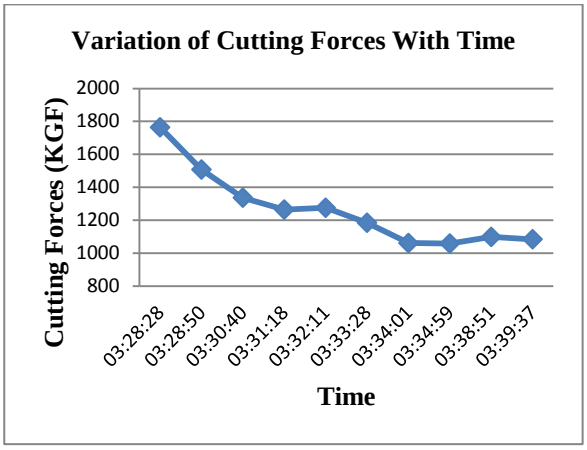

Fig. 7 Variation of Cutting Forces of Uncoated at 147 rev/min.

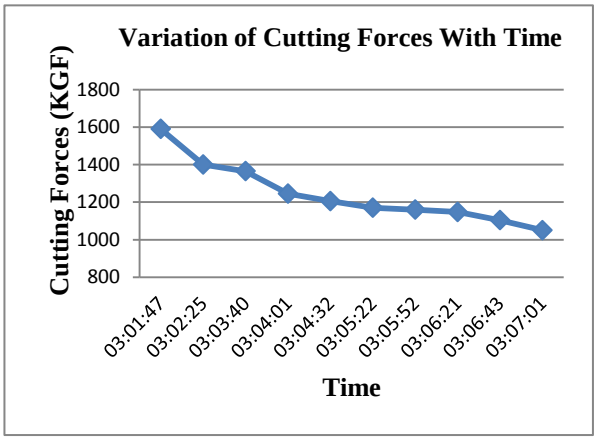

Fig. 8 Variation of Cutting Forces of Uncoated at 272 rev/min.

IV. CONCLUSION

In the present investigations, the performance of Uncoated and AlCrN coated tools in an aggressive machining operation, at dry conditions was observed. The result of these investigations is as follows.

- There is a little variation of temperature at different cutting speeds i.e. at 147 rev/min and 272 rev/min respectively between the Uncoated and AlCrN coatings.

- Cutting forces are high in case of uncoated inserts as compared to AlCrN coated inserts. As we increase the cutting speeds from 147 rev/min to 272 rev/min cutting forces goes on decreasing gradually. Cutting feed has a direct effect on cutting forces. As the feed increases there is a direct increase in cutting forces.

REFERENCES

[1] Smith, G. T., Advanced Machining: The Handbook of Cutting Technology, IFS Publications, 1989.

[2] Cho. S. S., Komvopoulos, K., Wear Mechanisms of Multi-Layer Coated Cemented Carbide Cutting Tools, Journal of Tribology 119 (1997) 8-17.

[3] Soderberg, S., Sjostrand, M., Ljungberg, B., Advances in coating technology for metal cutting tools, Metal Powder Report 56 (2001) 24-30.

[4] Haron, C. H., Ginting, A., Goh, J. H., Wear of coated and uncoated carbides in turning tool steel, Journal of materials processing technology 116 (2001) 49-54.

[5] Armarego, E. J. A., Verezub, S., Samaranayake, P., The effect of coatings on the cutting process, friction, forces and predictive cutting models in machining operations, Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture 216 (2002) 347-356.

[6] Lima, J.G., Avila, R.F., Abrao, A.M., Faustino, M. ,Davim, J.P. "Hard turning: AISI 4340 high strength low alloy steel and AISI D2 cold work tool steel", Journal of Materials Processing Technology, Volume 169 (2005) 388–395.

[7] Rech J. "A approach multiview to the tribologicalcharacterisation of cutting tool coatings for steels in high-speed dry turning", Int. Journal of Machining and Machinability of Materials, Volume 1, No. 1, (2006).

[8] Devillez, A., Schneider, F., Dominiak, S., Dudzinski, D., Larrouquere, D. "Cutting forces and wear in dry machining of Inconel 718 with coated carbide tools", Wear 262 (2007) 931–942.

[9] Sharma, V. S., Dhiman, S., Sehgal, R. and Sharma, K. "Assessment and Optimization of Cutting Parameters while Turning AISI 52100 Steel," International Journal of Precision Engineering and Manufacturing, Volume 9, No. 2, (2008) 54–62.

[10] Liew Willey Y.H., Jie Jester Ling Lih, Yan Lim Yee, Dayou J., Sipaut C.S., Faizah Bin MadlanMohd. "Frictional and wear behaviour of AlCrN ,TiN, TiAlN single-layer coatings and TiAlN/AlCrN, AlN/TiNnano-multilayer coatings in dry sliding, " Procedia Engineering 68, (2013) 512-517.

[11] Denkena, B., Kohler, J., Breidenstein, B., Abrao, A.M., Ventura, C.E.H., "Influence of the cutting edge preparation method on characteristics and performance of PVD coated carbide inserts in hard turning," Surface & Coatings Technology 254, (2014) 447–454.

[12] Pujante, J., Vilaseca, M., Casellas, D., Riera, M.D., "High temperature scratch testing of hard PVD coatings deposited on surface treated tool steel," Surface & Coatings Technology 254, (2014) 352–357.

Effect of Titanium Abrasive Mixed Electricel Diacharge Machining on Wear Ratio of AISI P20 Steel

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***Abstract*— AISI P20 steel is widely used for tooling purposes for injection molding industries. In present work, experimental investigation on electrical discharge machining of AISI P20 steel has been carried out to investigate the wear ratio. Orthogonal array (OA) technique is used to vary various input parameters i.e. (polarity, peak current, pulse on time, gap voltage and concentration of abrasives). Percentage contribution of electrical discharge machining variables has been identified by using analysis of variance (ANOVA) technique. Experimental results are presented to show the effect of variables on wear ratio of AISI P20 steel.**

Keywords—Electrical Discharge Machining, AISI P20 steel, Wear ratio

I. INTRODUCTION

In last five decades, technology of EDM 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 the 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 1943, soviet scientists B. R. Lazarenko and N. I. Lazarenko reversed the effect of metal removal from electric circuit breakers and optimized this phenomenon for material removal purposes. 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. Powders in the dielectric fluid enlarge the gap between the work piece and electrode and improve the surface finish by reducing the spark energy and dispersing the discharges more uniformly throughout the surface of work piece to be machined [1]. M. L. Jeswani [2] is noted 60% improvement in MRR and 15% reduction in electrode wear ratio when 4 g/l graphite powder was added in dielectric fluid (kerosene oil) of EDM process. Y. S. Wong et al. [3] noted that appropriate settings of electrode polarity and pulse parameters and the correct combination of work piece material and powder characteristics have a significant influence on the mirror-finish condition. The negative electrode polarity is necessary to achieve the mirror-finish surface. B. H. Yan et al. [4] Noted that peak currents of EDM-drilling and volume fraction of Al_2O_3 were confirmed to have significant affects on the material removal rate (MRR), electrode wear rate and surface roughness. In comparison, the flushing pressure and electrode rotation speed have minor affects on the MRR, electrode wear rate and surface roughness. Y. Chen et al. [5] noted that the current value and the ratio of the pulse duration and the pulse interval exert the greatest influence on surface quality. It was also concluded that to achieve the desired surface finish, a multi-stage erosion machining process is advisable. However, a relatively large gap voltage is more suitable to achieve a super- fine surface finish. W. S. Zhao et al. [6] Experimentally observes that PMEDM makes loss of discharge energy in the gap leads to reduction in melting the material so machining efficiency becomes lower and so the surface roughness becomes smaller in comparison with conventional EDM process. P. Singh et al. [7] investigated the effect of Al powder mixed in the dielectric fluid of during EDM of hastelloy using copper electrode tool. Author used process input parameters e: g (concentrations of Al powder and grain size of powder). MRR, TWR, %age wear rate, surface roughness was taken as output parameters to measure process performance. Results concluded that both the input parameters strongly affect the machining performance of hastelloy. The addition of aluminum powder in dielectric fluid increases MRR decreases TWR and improves surface finish of hastelloy. Singh et al. [8] investigated effect of electrical parameters on the performance of EDM of hastelloy using copper tool electrode. Author used process machining parameters e: g (Peak current, gap voltage, pulses on time and duty cycle). MRR, TWR, % wear ratio and surface roughness are taken as response parameters to measure process performance. Results indicated that all the input machining parameters strongly affect the machining performance of hastelloy. V. Kumar et al. [9] investigated process performance of EDM using powder metallurgy tool electrode during the machining of hastelloy using positive polarity. Author used current and voltage as process input parameters and MRR, TWR, % wear rate, surface roughness were taken as output parameters. Results showed that the maximum MRR is at the average value of current and above average value of voltage within selected range of process input parameters, the minimum TWR is with the minimum value of current and voltage, the minimum % wear rate for below average value of

current and minimum voltage, the minimum average surface roughness for average value of current and voltage. B. Singh et al. [10] investigated the effect of input parameters on surface roughness of H11 steel using aluminum abrasives mixed in dielectric fluid with copper tool electrode. The results show that negative polarity of tool electrode is desirable lowering of surface roughness. Moreover, abrasive powder suspension in dielectric fluid improves surface roughness and higher peak currents produce more rough surfaces in EDM process. G. Singh et al. [11] studied the effect of input parameters on surface roughness of H13 steel using aluminum abrasives mixed in dielectric fluid with copper tool electrode. The results show that negative polarity of tool electrode is desirable for lowering the surface roughness. Moreover, abrasive powder suspension in dielectric fluid improves surface roughness. However, increasing pulse on time and higher peak currents produce more rough surfaces during sinking operation of EDM process. S. Kumar et al. [12] investigated three die steel materials to surface modification by EDM method with tungsten powder mixed in the dielectric medium was done. Peak current, pulse on-time and pulse off time were taken as variable factors and hardness of the machined surface was taken as the response parameter. Breakdown of the hydrocarbon dielectric contributes carbon to the plasma channel which may also cause surface modification. Favorable machining conditions for material transfer by EDM were found to be low discharge current (less than 5A), shorter pulse on-time (less than 10 µs), longer pulse off-time (more than 50 µs) and negative polarity of the tool electrode. Peak current was found to be the most significant factor for the phenomenon of surface modification.

II. EXPERIMENTAL PROCEDURE

A. Equipment and work-piece material used

A number of experiments runs were conducted on ZNC (OSCARMAX-S645 CNC EDM Machine) shown in figure no. 1.Dimensions of dielectric tank (LxWxH: 1500mm x 940mm x 520mm) with a capacity of 1200 liters. The work-piece material was used for experimentations i.e. AISI P20 steel having size of 40x40x10 mm and tool electrode material i.e. copper having diameter of 9.5 mm. physical and mechanical properties of copper i.e. density 8.96g/cm^3, thermal expansion at 25°C µm/m/k, electrical resistivity at 20°C 16.78n.Ω-m, tensile strength 90MPa, thermal conductivity 401W/m/K. The surface of work-piece material i.e. AISI P20 steel was machined on lathe machine and finishing was done on grinding machine. Tool electrode material i.e. copper was first faced on lathe machine and then fixed on fixture of EDM machine for experimentation. The properties of titanium abrasive are: dark grey color, density 9.3g/m^3, electrical resistivity at 20°C 420n.Ω-m, thermal conductivity 21.9W/m/K. A steel tank of mild steel material having capacity of 8 liters was made in workshop to carry out the abrasive mixed experiments. The steel tank was filled with 6 liters dielectric and placed on the bed of EDM machine at proper place. Titanium abrasives size having 100mesh with measured quantity was mixed in dielectric tank for experimentation work as per Orthogonal.

Fig. 1. OSCARMAX-S645 CNC EDM Machine

Array plan. Table 1 depicts properties and composition of AISI P20 steel.

TABLE 1. PROPERTIES, COMPOSITION OF AISI P20 STEEL

Workpiece (steel)	**AISI P20**
Hardness (HRC)	48
Density (g/cm^3)	7.85
Elastic modulus (GPa)	207
Yield tensile strength (MPa)	827-862
Ultimate tensile strength (MPa)	965-1030
Compressive strength (MPa)	862
Thermal conductivity (W/m/K)	41.5
Poisson ratio	0.28
C(%)=0.40, Mn(%)=1.00, Si(%)=0.40, P(%)=0.03, Mo(%)=0.35, Cr(%)=12.0, Co(%)=0.25, S(%)=0.03	

B. Equipmental design

Table 2 depicts the various conditions of experiments used in the abrasive electrical discharge machining of AISI P20 steel. Five EDM input machining variables were selected i.e. (tool electrode polarity, peak current, pulse on time, gap voltage, and abrasive concentration in EDM dielectric fluid).

All the variables are varied at three levels except polarity which varied at only two possible levels namely positive and negative. Table 3 depicts values of these variables; their symbols used and selected range.

TABLE 2. SETUP OF EXPERIMENTS AND OPERATING CONDITIONS

CONDITION	DESCRIPTION
Workpiece	AISI P20 mold steel
Tool electrode material	Copper
Tool electrode diameter	9.5mm (solid rod)
Dielectric fluid	EDM oil
Grain size of abrasives	100 mesh
Polarity	+ve and -ve
Peak current	6-12
Pulse on time	120-200
Gap voltage	40-80
Abrasive concentration	0-12

TABLE 3. DESIGN SCHEME OF MACHINING VARIABLES

Symbol	Control Variable	Level 1	Level 2	Level 3
A	Polarity	+ve	-ve	-
B (amp)	Peak current	6	9	12
C (μs)	Pulse on time	120	150	200
D (volt)	Gap voltage	40	60	80
E (g/l)	Abrasive concentration	0	6	12

C. *Orthogonal array*

According to Taguchi methodology, the effect of different input machining variables on the performance characteristic in a condensed set of experiments can be examined by using the orthogonal array (OA). Orthogonal arrays of Taguchi design makes it possible to carry out fractional factorial experiments in order to avoid numerous experimental works as well as to provide shortcuts for optimizing input variables. In the present work, L_{18} orthogonal array is selected in which one variable varied at two levels and four variables varied at three levels. This orthogonal array has 5 columns and 18 rows. The experiments are performed as per this orthogonal array and results are noted down for surface roughness values of bottom of machined blind holes. Table 4 shows the variation of input variables as per selected orthogonal matrix.

D. *Signal to noise (S/N) ratio*

In the Taguchi methodology, the S/N ratio is used to find the deviation of the performance characteristic from its desired value. Usually, there are three kinds of the performance characteristics in the analysis of the S/N ratio, i.e., (a) lower-the-better, (b) higher-the-better, and (c) nominal-the-better. In machining operations the lower the surface roughness is always desirable. So, the lower-the-better surface roughness is selected. For lower-the-better category the signal-to-noise ratio for the i^{th} performance characteristic in the j^{th} experiment at the k^{th} test can be expressed as:

$$(S/N)_{ij} = -10*\mathrm{Log}_{10}\left\{\frac{1}{n}\sum_{k=1}^{n} y_{ijk}^2\right\}$$

Where 'n' is the number of tests.

E. *Analysis of variance*

Significance of input machining variables as well as their contribution to affect output response characteristic is tabulated using analysis of variance technique. Range of variation of signal to noise ratio of input variables are calculated as delta values in response table.

TABLE 4. DESIGN LAYOUT: L_{18} ORTHOGONAL ARRAY (LEVEL VALUE)

Exp. No.	Coded Variable Levels				
	(A)	(B)	(C)	(D)	(E)
1	1	1	1	1	1
2	1	1	2	2	2
3	1	1	3	3	3
4	1	2	1	1	2
5	1	2	2	2	3
6	1	2	3	3	1
7	1	3	1	2	1
8	1	3	2	3	2
9	1	3	3	1	3
10	2	1	1	1	3
11	2	1	2	2	1
12	2	1	3	2	2
13	2	2	1	2	3
14	2	2	2	3	1
15	2	2	3	1	2
16	2	3	1	3	2
17	2	3	2	1	3
18	2	3	3	2	1

III. RESULTS AND DISCUSSION

Table 5 depicts the actual values of experimental results for wear ratio. Influence of each input machining variables on the wear ratio is presented in response graph called main effect plots. The value of each blind hole was put in Minitab 16.1 to generate main effect plots.

Table 5. Design layout: L_{18} orthogonal array (actual values) and experimental results for wear ratio

Experiment no as per orthogonal array	Material removal rate (MRR) (g/min)	Tool wear rate(TWR) (g/min)	Wear ratio (TWR/MRR)
1	0.06977	0.00233	0.03333
2	0.04412	0.00163	0.03704
3	0.16620	0.00139	0.00833
4	0.10164	0.00328	0.03226
5	0.07789	0.00251	0.03226
6	0.09275	0.00290	0.03125
7	0.11741	0.00405	0.03448

8	0.12810	0.00413	0.03226
9	0.16489	0.00532	0.03226
10	0.00468	0.00090	0.19231
11	0.00480	0.00100	0.20833
12	0.00717	0.00143	0.20000
13	0.00469	0.00049	0.10345
14	0.00439	0.00051	0.11538
15	0.00948	0.00152	0.16000
16	0.00490	0.00054	0.11111
17	0.00533	0.00070	0.13043
18	0.00473	0.00053	0.11111

Figure 2 depicts the main effect plots for means under smaller the better criteria. In this mean data main effect plot, the slope of each line which connects between the levels shows the power of influence of concerned input machining variables on performance measure.

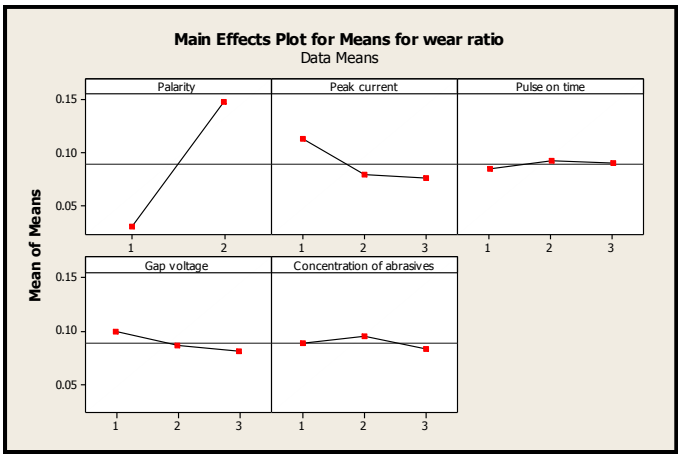

Fig. 2. Main effects plot for means for wear ratio

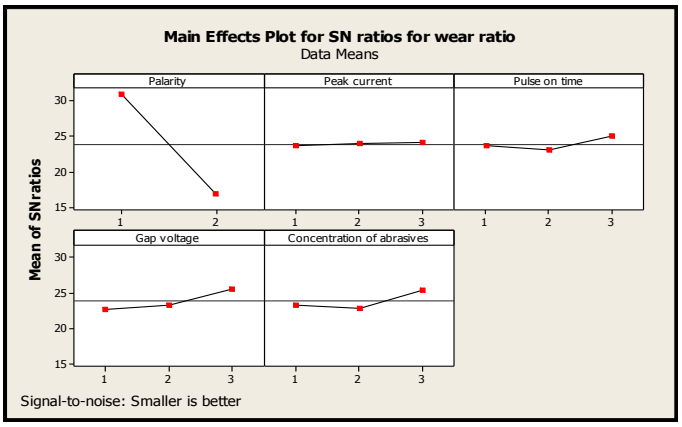

Fig. 3. Main effects plot for for S/N ratios for wear ratio

Main effect plot for means depicts that the wear ratio is minimum at 1st level of polarity, 3rd level of peak current, 1st level of pulse on time, 3rd level of gap voltage, 3rd level of concentration of abrasive. Therefore minimum condition for input machining variables is $A_1B_3C_1D_3E_3$. Main effect plot using signal to noise ratio (Fig. 3) is also generated to see the output results. A larger signal to noise ratio corresponds to better response characteristic regardless of the category of the response characteristic. Therefore, the optimal level of the input machining variables is the level with highest signal to noise ratio. The same results are confirmed from main effects plot for Signal to noise ratios. Table 6 shows the analysis of variance results, where the contribution of each input machining variables was calculated. It is observed statistically that the tool electrode polarity had maximum percentage contribution of 83.30%, percentage contribution of peak current 0.08% and pulse on time, gap voltage, concentration of abrasives in dielectric fluid as of 1.23%, 2.55%, and 2.17% respectively towards the concerned performance measure. F-ratio values and p-values of polarity confirmed the significant effect of this variable. On the other hand these values corresponding to Pulse on time, gap voltage and abrasive concentration confirmed their almost insignificant effect. Table 7 is the response table for signal to noise ratio values. In this table the signal to noise ratio values calculated at each level of input machining variable. The range of variation of signal to noise ratio for an input variable is calculated as the difference between signal to noise ratio values corresponding to lowest and highest level of that input variable. This range is presented as 'delta' values.

TABLE 6. ANALYSIS OF VARIANCE RESULTS FOR WR (S/N DATA)

Source	DF	Seq SS	Adj SS	Adj MS	F-value	F-critical	P	% age contr.
Polarity	1	885.46	885.460	885.460	62.49	5.32	0.000	83.30
Peak current	2	0.89	0.887	0.444	0.03	4.46	0.969	0.08
Pulse on time	2	13.09	13.090	6.545	0.46	4.46	0.646	1.23
Gap voltage	2	27.11	27.113	13.556	0.96	4.46	0.424	2.55
Concentration of abrasives	2	23.03	23.027	11.514	0.81	4.46	0.477	2.17
Residual Error	8	113.36	113.359	14.170				
Total	17	1062.94						

TABLE 7. RESPONSE TABLE FOR WR (S/N DATA)

Level	Polarity (A)	Peak Current (B)	Pulse on time (C)	Gap voltage (D)	Concentration of abrasives (E)
1	30.93	23.61	23.62	22.74	23.39
2	16.91	24.02	23.06	23.41	22.88
3		24.13	25.08	25.61	25.49
Delta	14.03	0.51	2.02	2.87	2.62
Rank	1	5	4	2	3

The higher the range the stronger is the effect of that variable. Highest 'delta' value of tool electrode polarity and lowest value for peak current categorized them as most influential input variable and least influential input machining variable.

IV. CONCLUSIONS

In the present study, the effect of titanium abrasives mixed in EDM dielectric fluid along with other important input variables of EDM are experimentally investigated for wear ratio of AISI P20 steel. It is evident from experimental results that there is much higher influence of type of tool electrode polarity and peak current has less influence as input machining variables during the process. Taguchi method employed enabled the identification of significant input machining variables and their associated levels on specific output performance characteristics. In sinking electrical discharge machining of AISI P20 steel the effect of pulse on time, gap voltage and concentration of titanium abrasives has a little effect on the wear ratio as compare to tool electrode polarity.

REFERENCES

[1] H. K. Kansal, S. Singh and P. Kumar, "Parametric optimization of powder mixed electrical discharge machining by response surface methodology", Journal of materials processing technology,Volume 169, 2005, pp. 427–436.

[2] M.L. Jeswani, "Roughness and wear characteristics of spark eroded electrode surfaces", Wear, Volume 51, 1978, pp. 227 – 236.

[3] Y. S. Wong, L. C. Lim, I. Rahuman and W. M.Tee, "Near-mirror-finish phenomenon in electric discharge machining using powder-mixed dielectric", Journal of materials processing technology, Volume 79, 1998, pp. 30–40.

[4] B. H. Yan and C. C. Wang, "The machining characteristics of Al_2O_3/6061Al composite using rotary electro-discharge machining with a tube electrode", Journal of materials processing technology, Volume 95, 1999, pp. 222–231.

[5] Y. Chen and S. M. Mahdavian, "Parametric study into erosion wear in a computer numerical controlled electro-discharge machining process", Wear, Volume 236, 1999, pp. 350–354.

[6] W. S. Zhao, Q. G. Meng and Z. L. Wang, "The application of research on powder mixed electro discharge machining in rough machining", Journal of materials processing technology, Volume 129,2002, pp. 30-33.

[7] P. Singh, A. Kumar, N. Beri, V. Kumar, "Influence of electrical parameters in powder mixed EDM of hastelloy", Journal of Engineering Research and Studies, Volume 1, 2010, pp. 93-105.

[8] P. Singh, A. Kumar, N. Beri, V. Kumar, "Some experimental investigation on aluminum powder mixed EDM on machining performance of hastelloy steel", International Journal of Advance Engineering Technology, Volume 1, 2010, pp. 28-45.

[9] V. Kumar, N. Beri, A. Kumar, P. Singh**,** "Some studies on electric discharge machining of hastelloy using powder metallurgy electrode", International Journal of Advance Engineering Technology, Volume 1, 2010, pp. 16-27.

[10] Baljinder Singh, Paramjit Singh, Gaurav Tejpal, Gurtej Singh, "An experimental study of surface roughness of h11 steel in EDM process using copper tool electrode", International Journal of Advanced Engineering Technology, Volume 3, 2012, pp. 130-133.

[11] Gurtej Singh, Paramjit Singh, Gaurav Tejpal, Baljinder Singh, "Effect of machining parameters on surface roughness of h13 steel in EDM process using powder mixed fluid", International Journal of Advanced Engineering Technology, Volume 3, 2012, pp. 148-150.

[12] S. Kumar, U. Batra, "Surface modification of die steel materials by EDM method using tungsten powder-mixed dielectric", Journal of Manufacturing Processes, Volume 14, 2012, pp. 35-40.

Thermal Comfort Model of A Desert Cooler

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***Abstract*—This paper discusses the performance of a residential evaporative cooler from the thermal comfort point of view. The operational temperatures and the humidity values are taken from the hourly weather report and the achievable room temperature is referred from the Air temperature-Humidity chart. Then this temperature and other parameters like air velocity, humidity, clothing and metabolic rate are used as input variables for the CBE comfort tool. The CBE tool represents the operational conditions on a psychrometric chart and tells us that how far is the operational condition far from comfort zone. This paper also proposes a model for a residential evaporative cooler that uses a controller, which is used to run the fan to produce air velocity according to thermal comfort at a particular temperature. This controller also operates the ON/OFF operation of the water pump according to the humidity level in the room.**

Keywords—thermal comfort, DBT, humidity, metabolic rate

I. INTRODUCTION

The feeling of comfort is not merely measured by the temperature of the concerned space. The other factors that hold grave importance in thermal comfort are humidity, air movement and mean radiant temperature. There are certain other factors as well that are ignored while designing thermal comfort systems these are level of activity and the amount of clothing worn by the people in the room. And moreover with the increase in the energy requirements and environmental problems caused by the air conditioners, now achievement of thermal comfort is being looked upon by using evaporative cooling [1]

This paper discusses the performance of a common desert cooler from thermal comfort point of view. Further this paper proposes a desert cooler operated by programmable controller. This will take care of factors that are important from thermal comfort point of view.

II. SYSTEM UNDER CONSIDERATION

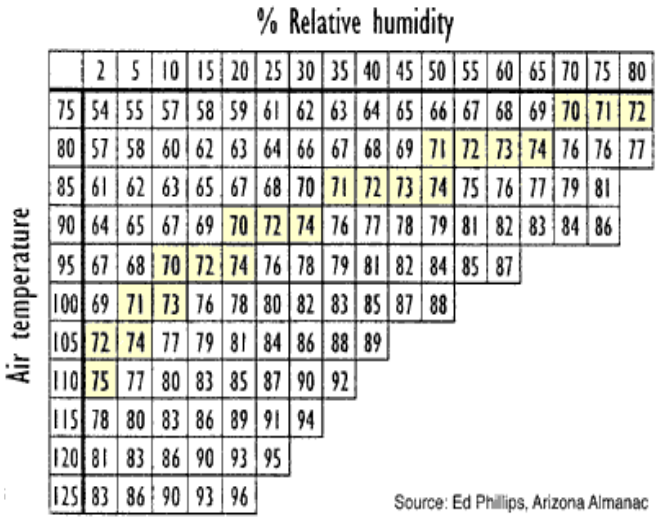
The system under consideration is a room fitted with a desert cooler having fan size 18 inches, maximum speed of 1400 rpm and capacity of 4200 cfm. (Power consumption = 220volt/50Hz)

A. Data for consideration.

Table1:Data from the weather forecast

Time of the day (04-05-2015)	Outside temperature (^oC)	Humidity (in the outside air)	Temperature Achievable (^oC)	Metabolic rate	Clothing level	Air velocity (m/s)
6:00 AM	23	51%	19	0.7	0.5	0.16
10:00 AM	31	31%	21	1.2	0.55	0.16
1:00 PM	37	18%	27	1.2	0.55	0.16

TABLE 2: TEMPERATURE ACHIEVABLE BY EVAPORATIVE COOLER



B. Observation

This paper uses CBE thermal comfort tool developed by Tyler Hoyt, Stefano Schiavon,Alberto Piccioli, Dustin Moon and Kyle Steinfeld. Based on work at Center for the Built Environment, University of California Berkeley. This web-based tool for thermal comfort calculations according to ASHRAE Standard 55-2013 is developed at The University of California at Berkeley. Its aim is to provide a free, cross-platform tool that allows designers and other practitioners to perform thermal comfort calculations. There are six primary factors that affect thermal comfort. These include environmental conditions such as air temperature, and personal factors such as metabolic rate.

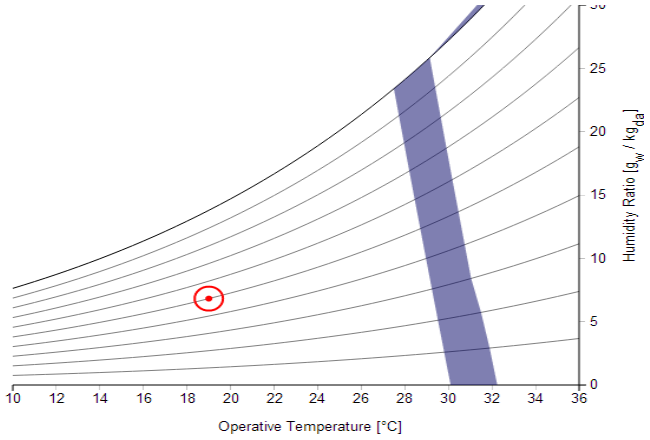


Fig 1. CBE tool result at 6 am

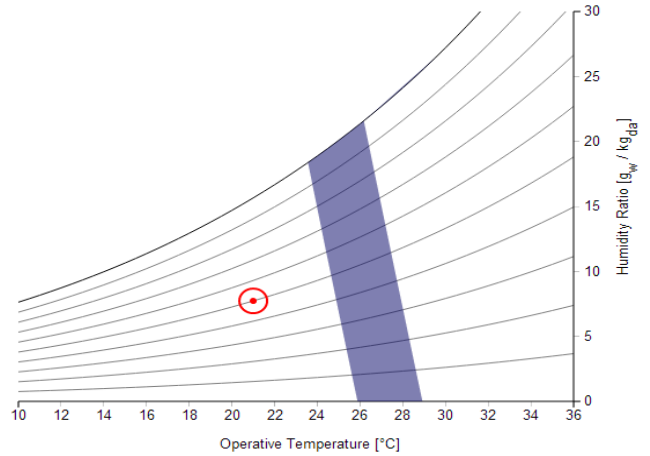


Fig 2 CBE tool result at 10 am

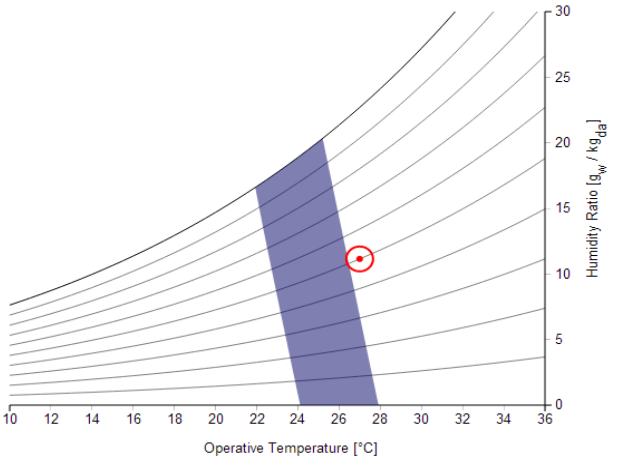


Fig 3 CBE tool result at 1 pm

The shaded region in CBE tool chart shows the comfort zone for the combination of humidity DBT, air velocity, clothing and metabolic rate and the encircled point shows the room conditions. Fig 1 shows that point of operation is way far from thermal comfort zone this point is corresponding to 6 am in the morning when the person is asleep. Similarly figure 2 again shows that point of operation is far from comfort zone but is nearer to the comfort zone as compared to the previous case this situation corresponds to the time of 10 am in the morning when the person is sitting and reading. It can be seen from figure 3 which is corresponding to 1pm in the after during this hour of the day the point of operation is more nearer to the comfort zone but still out of it.

III. PROPOSED SYSTEM

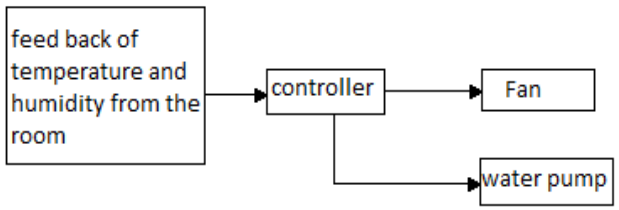


Fig 4: Proposed model

Fig 4 shows the proposed system block diagram. The proposed system uses a programmable controller. There are many such controllers such as PI controller, PID controller, Fuzzy controller etc., which can be programmed to send signals for a particular set of input values to obtain output according to thermal comfort. For example in this case the controller receives a feedback from the control space and sends the signal for corrected fan speed to the variable speed fan motor and pump operation (ON/OFF), according to the thermal comfort for operative conditions.

IV. CONCLUSION

Though evaporative cooler can cause a decrease of DBT upto 10^{o}C in dry summer days but as shown by CBE thermal comfort tool the attained conditions still don't lay in the thermal comfort zone. The proposed system can take into account various thermal comfort parameters and bring the control space well within the thermal comfort zone as depicted by by CBE thermal comfort tool. Last but not the least variable speed motor application saves a considerable amount of energy.

REFERENCES

[1] S.S. Kachhwaha and S. Prabhakar, "heat and mass transfer study in a direct evaporative cooler," Journal of Scientific and Industrial Research, Vol 69, September 2010, pp. 705-710.
[2] Hsu-Cheng Chiang, Chung-shu Pan, Hsi-Sheng Wu, Bing-Chwen Yang, "Measurement of Flow Characteristics of a Ceiling Fan with Varying Rotational Speed," Proceedings of Clima 2007 WellBeing Indoors.
[3] M.P. Poonia, A. Bhardwaj, Upender Pandel, A.S. Jethoo, "Design and Development of Energy Efficient Multi-Utility Desert Cooler," Universal Journal of Environmental Research and Technology, 2011 Vol 1 39-44
[4] Fanger, P.O. and Christensen, N.K. 1986. Perception of Draught in Ventilated Spaces,Ergonomics, Vol. 29, no. 2, pp. 215-235.
[5] Fanger, P.O., Melikov, A.K., Hanzawa, H. and Ring, J. 1988. Air Turbulence and Sensation of Draught, Energy and Building, Vol. 12, no. 1, pp. 21-39.
[6] http://smap.cbe.berkeley.edu/comforttool
[7] http://www.aavid.com/product-group/extrusions-na/flowcalc

Fabrication of Hydroxyapatite & Titanium Alloys Biomaterials for Bio Implants

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Abstract- This study represents the fabrication of composite materials of hydroxyapatite &TiO2 for bone tissue regeneration. Skeletal deficiencies, wear of bone tissues or degradation of bone tissue are quite common now days. The purpose of this study is to develop a material that may ultimately be used as orthopedic implants. Hydroxyapatite is found in bone tissue and teeth. It is non-toxic in nature and it is not targeted by the immune system as foreign body.Titanium's lightness and good mechano-chemical properties are salient features for implant application.Mixture of hydroxyapatite and TiO2 was produced in ratio 7:3 for testing purposes. Results were concluded by hardness test, porosity test and compression test.

Keywords: Bone tissue, Hydroxyapatite, Titanium oxide, Porosity, Hardness test

I. INTRODUCTION

The skeletal system forms the mechanical framework of the body. Bones are the protective and supportive structure for the body and they play an important role in shaping the body.With increase in population**,** standards of living and medicinal science continue to increase and improve**,** and the life expectancy of our population is also increasing. The inevitable result of this is an increase in geriatric population, and medical science and industries have to address more illnesses and afflictions associated with old age more frequently**,** including the wear on body tissues. One drastic example of this is the degradation of bone tissue, especially in certain joints, such as the knee or the hip, resulting in the need to replace them with orthopedic implants

Bones are formed from different types of connective tissues osseous tissue, periosteum, red Bone Marrow, etc. Osseous tissue**,** also known as bone tissue**,** it plays vital role in the human body. Like they are responsible for repositories for calcium, produce both red and white blood cells and also provides structural support for the body. Without bone tissues no one can imagine his or her life. In work-alcoholic modern era**,** hectic life is causing problems likes skeletal deficiencies, tumours, or abnormal growth, with old age. It has been seen that with old age degradation of bone tissue (especially in joints, such as the knee or the hip) is occurring and causing severe problems in body. The only easy solution of such degradationsof joints is, to replace them with orthopedic implants. While the materials used for these have a long history of success**.** But before that, better understanding of the natural structure and formation of bone tissue is needed.

Bone tissue plays a number of critical roles in the human body. Bones are repositories for calcium, produce both red and white blood cells, and provide structural support for the body. As bone tissues has a nano-scaled hierarchical structure, which consists of hydroxyapatite crystals within a matrix of collagen fibers as well as other proteins. Bones are the stratified structured composite material, that's why many material engineers are trying to develop such a composite material which can act as a substitute of bone tissue. Bone tissue has two main component hydroxyapatite crystals and collagen fiber but none of these compounds alone are half as strong, stiff or tough as bone [1].That's why we can't directly use collegen or hydroxyapatite crystals alone as a substitute of bone. Proper compositions of both the materials are requied for the formation of bone tissue. Hydroxyapatite (HA) powder can be prepared from synthesis by the dissolution-precipitation reaction of solid/liquid phase of Cao and phosphoric acid to form a composition with a Ca/P. But synthesis collegen is not possible in laboratory so we need a substitute which must be having mechanical properties and can act with HA to form a composite material, as a substitute of bone tissue.[2]

The materials which are used in current orthopedic implants are chosen because of their load bearing applications. Mainly polymers, ceramics or metals are used in orthopedic biomaterials. Polymers have low coefficients of friction and low wear rates. But lack in fracture toughness, hardness and strength where as ceramics have superior wear resistance when compared to metal-metal or metal-polymer wear rates. But it lacks in formability, and bio-compatibility. It is the metals that most often provide the strength, fracture toughness, hardness, corrosion resistance and biocompatibility needed in load-bearing situations like fracture fixation or total joint arthroplasty. For example, a typical orthopedic implant for a total hip replacement procedure would likely use titanium or a cobalt-chromium alloy. [3].

Titanium has become a popular metallic biomaterial because of its properties for many biomechanical applications including dentistry. The high cost of noble alloys and the potential biological hazards of the base metal alloys were the main reasons for the introduction of commercially pure titanium (cpTi). Pure titanium has been used in dentistry for more than five decades but still lot of research is required to improve this material . [4] Hydroxyapatite is found in bone tissues and teeth, as it is non-toxic in nature, hence it is not targeted by the immune system as foreign body. Therefore the

local tissue inflammation and eventual scarring caused by an immunological response would not be an issue if hydroxyapatite is used [5].

Hydroxyapatite is bioactive, nontoxic and also re-absorbable in body. The term bioactive refers to materials that never react with body parts and it can easily make bond with bone tissue. However, the bonding mechanism of dense hydroxyapatite implants is unique. A cellular bone matrix appears at the surface, producing a narrow amorphous electron-dense band 3-5 micrometers wide. Collagen and mineral crystals forms between this area and the cells, and as the bond matures, it shrinks to .05 to .2 micrometers. TEM images have revealed near perfect crystal alignment between the crystals in the growing bone and the crystals in the implant. Synthetic hydroxyapatite is integrated into bone tissue by the same mechanisms used in the active remodeling of healthy bone. This further develops the bond between the synthetic hydroxyapatite and the bone. Hydroxyapatite is also known to aid the adhesion and proliferation of osteoblasts [6].

Powder metallurgy can do a lot in the formation of composite material as a substitute of bone tissues.It was experimented by Professor M. Martina that, titanium–hydroxyapatite composite can be used in Dental implant. Titanium–hydroxyapatite is dense composite biomaterials which also have the improved early healing properties [7]. Much research has been done on the value of hydroxyapatite-based composite materials, their synthesis, their mechanical properties, and how the structure and properties of this material can be improved. Hydroxyapatite crystals of nano-hydroxyapatite/polymer with high porosities have been created using thermal induced phase separation (TIPS) techniques to mimic the collagen/hydroxyapatite matrix found in natural bone tissue in the hopes of achieving similar mechanical properties. Experiments have also been conducted integrating hydroxyapatite crystals with both various fibers and polymers in an attempt to strengthen the hydroxyapatite. In both cases, the ultimate strengths of the composites were improved to reach roughly 62 MPa, several times the strength of pure hydroxyapatite. [8]

II. EXPERIMENTAL DETAILS

The main objective of this study is to generate a material which can be used as implant. At present time the implants which we are having are not porous in nature**,** reason behind it is the use of metal-alloy in it. Porous implants will help in tissue growth over the joint and hence it will help in forming a strong and biocompatible bone structure**,** which can easily take place of the part of the original body structure. For the fabrication of hydroxyapatite and titanium material, we prepared six circular tablets with 12 mm dia. Hydroxyapatite and titanium oxide were purchased from the Mahavir Company in powder form. A tablet press is a mechanical device that compresses powder into tablets of uniform size and weight. Six sample tablets were made. Mixture of hydroxyapatite and TiO_2 was produced in ratio 7:3 for testing. Single punch tablet press was used to produce the sample tablets. The granulated material was filled into a cavity and the force of compression (at pressure 15.7 MPa) was delivered with high pressure compression rolls which fused and compressed the granulated material together into a hard tablet of uniform size and weight. Strength is an important requirement for bone tisues**,** so to increase the strength of sample tablets, they were sintered at 1000 -1200 ^{o}C for 3 hours and were allowed to cool down at the oven temperature.

Fig.1 Preparation of biomaterials Tablets in Single punch tablet machine

III. OBSERVATION AND DISCUSSION

Mixture of hydroxyapatite and TiO_2 was produced in ratio 7:3 for testing and to increase the strengthening character of the sample tablets, two sample tablets each at temperature 1000 -1200 ^{o}C were sintered for 3hours.Sample tablets are shown in Fig.2.

Fig.2. Tablets samples

To measure surface hardness of the samples**,** Vickers hardness and compression test were conducted and results are shown in Table.1.In these tests 6 sample tablets were tested.

Table.1. Results of VHM and Compression Test

S.No.	Temp. (^{O}C)	Compression Strength of sample (Mpa)			Vickers's Hardness of Sample (VHM)		
1.	1000	22.7	23.2	23.9	13.9	13.5	13.4
2.	1100	23.6	23.9	24	27.2	26.9	27.1
3.	1200	48.7	49.1	49.3	93.1	92.8	93.4

In bone tissues the study of strength is the major factor, the compressive strength is the capacity of a material or structure to withstand loads and to reduce size. We observed that as the temperature increased**,** the compressive strength and hardness also increased. At 1000 ºC the minimum value of compression strength was registered 22.7 Mpa, and at 1100 ºC approx 23.9 Mpa, but the maximum value of compression strength which is 49.3 was registered at 1200 ºC .We observed max hardness of 93.4 VHN was registered at 1200 ºC. We also observed there was a drastic increase in hardness value of samples from 1000 to 1200 ºC**.**

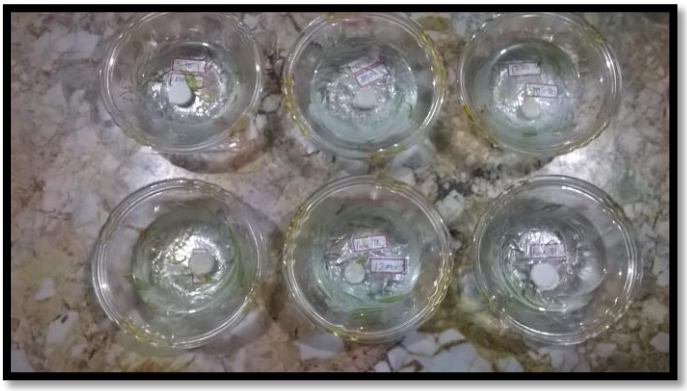

Fig.3 Porosity test

The porous percent of materials synthesized from powder sintering at different temperature is shown in table.2, we observed that minimum porosity percentage in sample tablets was registered 8% when sample was sintered at 1200ºC, whereas sample sintered at 1000ºC has a porosity percentage of 33%.Maximum porosity % was registered at 0 ºC sintering temperature.

IV. CONCLUSION

Porous implants will help in the tissue growth over the joint and hence helps in forming a strong and biocompatible bone structure which can easily take the position of the original body structure**.** The collagen fibril can get produced back if the continuous flow of blood goes through the implants hence helping in formation of a permanent natural joint. But when we compare the strengths of the synthesized composites of hydroxyapatite -titanium dioxide to the strengths of a real bone, we observed that the composite which was prepared in lab has only 49.2 MPa of compressive strength whereas the real bone has the minimum of 70MPa compressive strength. Hence we need to improve the strength of the composite either by using an additive or binders in composition or by increasing the sintering temperature. As the hardness increases with increase in temperature(from graph it is concluded), higher temperature range can be tested on sample tablets for high compression strength. Furthermore, the flexibility of the composite is also very low and is very brittle. Similarly in hardness test case it was observed that, the vicker's hardness value of the sample tablets at low sintered temperatures is less as compared to the sample which was sintered at 1200ºC, the change in the hardness value was also very small between 1000 ºC and 1100 ºC but suddenly drastic increase in the hardness was observed at 1200 ºC .

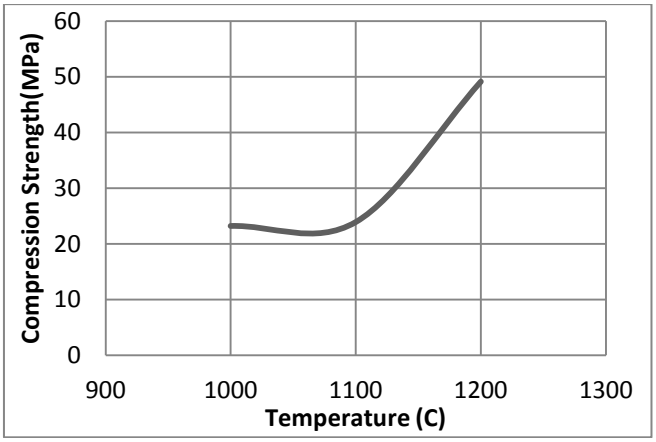

Fig.4. Graph Between Compression strength and Temperature

This means if temperature is increased more compressive strength and more hardness can be achieved .This shows that hardness and temperature has directly proportional relationship with each other. When there will be increase of temperature, hardness will also increase.

Sintering Temp. (^{O}C)	Dry Weight (g)	Wet Weight (g)	Water Immersed weight (g)	Tablet vol (cm^3)	Tablet density (g/cm^3)	Porosity Percentage (%)
0	2.45	3.06	1.74	1.324	1.85	46.07
1000	1.85	2.292	1.37	0.924	2.002	33.54
1100	2.25	2.46	1.66	0.802	2.805	26.18
1200	1.71	1.752	1.26	0.493	3.468	8.51
1200	1.802	1.932	1.375	0.558	3.22	23.29

Table.2 Porosity Test Results

Now, when we compare the porosity percentage of materials synthesized from powder sintering at different temperature to the real bones in human body .We observed that in a normal human body the porosity of the bones could be ranging from 3.5% to 79.3%. In case of our synthesized samples, minimum porosity is 8% at 1200 ºC, whereas sample sintered at 1000 ºC has a porosity percentage of 33%, but relatively the strength of

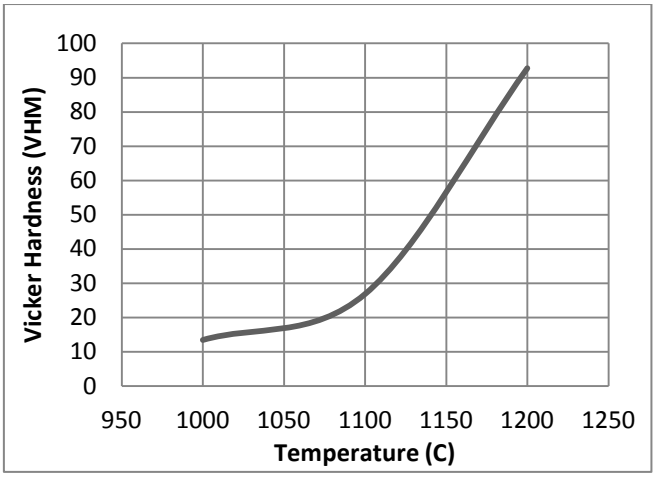

Fig.4. Graph Between VHM and Temperature

that sample is very low and finds no application in human body Hence, we need a technology to increase both the porosity and the strength of the composites which is a difficult task as both of these parameters are inversely proportional to each other. So, we need a binder which increases both strength and spatial gaps in the composite.

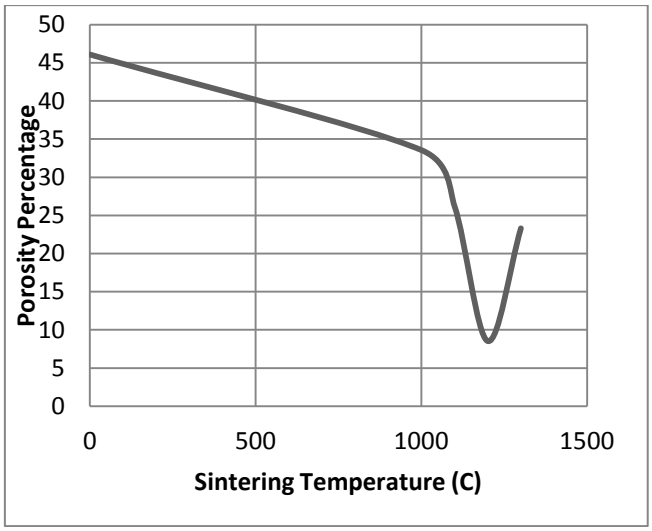

Fig.6. Graph Between Porosity percentage and Temperature

Maximum porosity 46.07 % was registered at 0 ºC sintering temperature. The study also discuss about the porosity percentage related to the composites sintered from temperature ranging 1000-1200 °C Here we have noticed that the porous volume of the samples keep on decreasing as we increase the sintering temperature. The purpose was to enable the blood cells to travel through the porous implants to increase the grip of tissues over the implants but we require the strength similar to real bones .Hence to overcome the strength issue we have to sinter the sample tablets at high temperatures which decreases the porosity of the implants as porosity is inversely proportional to strength in case of powder metallurgy.

References

[1]. M.J. Olszta et al., Bone structure and formation: A new perspective, (2007)

[2]. Nelson H. A. Camargo*, Sarah A. de Lima, Enori Gemelli, Synthesis and Characterization of Hydroxyapatite/TiO2n Nanocomposites for Bone Tissue Regeneration, American Journal of Biomedical Engineering 2012, 2(2): 41-47

[3]. B D Ratner et al 2004, Bio Material science : An introduction to materials in medicine volume 2004, 37-73

[4]. Ozcan,Mullu and christoph Hammerle, "Titanium as a reconstructoion and implant material in Dentistry: Advantages and Pitfalls".Materials,2012.

[5]. F.N. Oktar Hydroxyapatite–TiO2 composites, Materials Letters 60 (2006) 2207–2210

[6]. Garrett Cavanaugh and Justin Perron: Nano-Materials for Bone Implants, P-17-18

[7]. M. Martina, G. Subramanyam, J.C.Weaver, D.W. Hutmacher, D.E. Morse, S. Valiyaveettil, Developing macro-porous bio-continuous materials as scaffolds for tissue engineering, Biomaterials 26 (2005) 5609

[8]. M.A. Meyers et al march 2008 : Biomedical Applications of Titanium and its Alloys, www.tms.org/jom.html

Performance Investigation of Solar Air Heater Duct having Square Protrusions as Roughness Geometry

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***Abstract*— An experimental investigation has been carried out on heat transfer and friction characteristics by using square type protrusions as roughness geometry in the solar air heater duct. Data have been generated for both the smooth as well as roughened absorber plate for fully turbulent flow in the range of system and operating parameters. Nusselt number and friction factor correlations have been developed by using the experimental data for predicting performance of the system having investigated type of roughness geometry.**

Keywords—Solar air heater; Artificial roughness; Nusselt number; Friction factor.

I. INTRODUCTION

Solar collectors (air heaters) are widely used in various equipments for utilization of solar thermal energy. But thermal efficiency of solar air heaters is generally considered poor because of low heat transfer capability between absorber plate and air flowing through the duct. It is due to the formation of laminar sub- layer on the heat transferring surface. So efficiency could be increase by enhancing the heat transfer coefficient between absorber plate and flowing air. One of the methods for enhancement of convective heat transfer is by creating turbulence at heat transfer surface with the help of artificial roughness on absorber plate. Artificial roughness breaks the laminar sub-layer on the heat transferring surface due to which thermal resistance between the heat transferring surface and flowing air decreases. However, use of artificial roughness results in higher friction and hence higher pumping power requirements. Therefore, it is desirable that the turbulence should be created in the vicinity of the wall i.e. only in the laminar sub-layer region, which is responsible for thermal resistance. Many investigators have attempted to design a roughness element, which can enhance convective heat transfer coefficient with minimum increase in friction loss. However, generating artificial roughness with a method other than performing protrusions is a very tedious task. Artificial roughness on the surface of absorber plate can be provided by fixing small diameter wires, ribs formed by machining process, wire mesh or expanded metal mesh and by forming dimple/protrusion shape geometry as has been reported by Bhushan and Singh (2010), Hans et al. (2009) and Varun et al. (2009).

Experimental investigations on heat transfer and friction in artificially roughened solar air heater duct have been reported by Gupta et al. (1993), Jaurker et al. (2006), Karwa (2003), Karmare and Tikekar (2007), Prasad and Saini (1998), Saini and Saini (1997). Nusselt number and friction factor correlations have been developed by these investigators by using experimental data. Considerable amount of experimentation has been reported in literature to study effect of different type of roughness geometries on heat transfer and friction in duct of solar air heaters. Formation of protrusions on the absorber plate is the latest and simple technique as protrusions are easy to fabricate and do not add extra weight to the absorber plate. In the present paper, an experimental investigation has been carried out on solar air heater duct having protrusions as roughness geometry. Nusselt number and friction factor correlations as a function of system and operating parameters have been developed by using experimental data.

II. EXPERIMENTAL PROGRAM

In order to carry out present experimental work, a test rig was used. The rig has been designed and fabricated as per the guidelines proposed in the literature for similar experimental investigations reported by Saini and Saini, (1997) and Saini and Verma, 2008. Schematic diagram and sectional view of experimental set-up is shown in Fig. 1. Aspect ratio of rectangular duct is 10; generally it is kept in the range of 9 to 11 for solar air heaters. Aspect ratio of rectangular duct channel is the ratio of its width (W) and height (H).

The length of test section was kept as 1000 mm, whereas lengths of entry and exit sections were kept as 900 mm and 500 mm respectively which were in accordance with the ASHRAE standard (1977). Therefore the total length of air duct was 2400 (900+1000+500) mm. An orifice plate of 40 mm internal diameter and 3 mm thickness was installed in the pipeline of 80 mm diameter with U-tube manometer, for measuring air flow rate .Micro-manometer was used to measure the pressure drop across test section of the duct. Calibrated copper-constantan thermocouples were used for measuring plate and air temperatures. Control valves were provided at inlet and outlet of centrifugal blower for control of air flow rate through the duct. Twelve thermocouples were installed in the air duct and twelve thermocouples were fixed on test section of the test section of the absorber plate for measuring plate temperature.

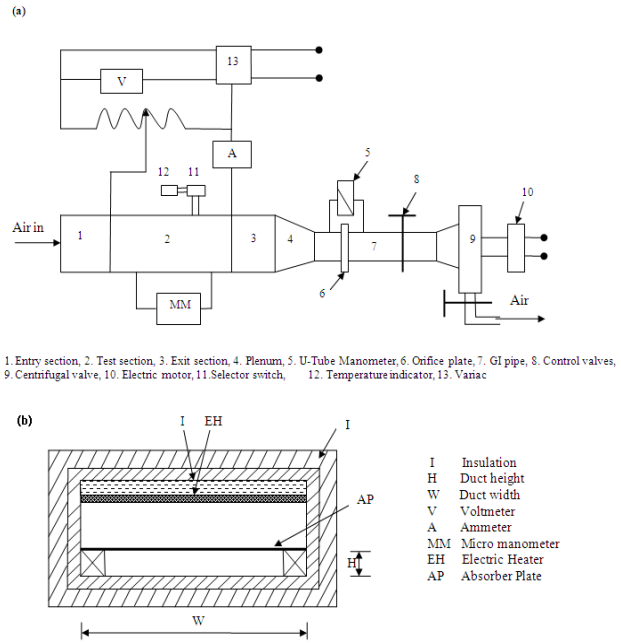

Fig. 1: a) Schematic of experimental set-up and b) Sectional view of duct from entry side.

III. ROUGHNESS GEOMETRY AND RANGE OF PARAMETERS

In the present investigation, the absorber plate was roughened by the formation of square type protrusions. Photographic view of absorber plate roughened by formation of square protrusions is shown in Fig. 2. Arrangement and shape of artificial roughness geometry used in the present experimental investigation is shown in Fig. 3. The range/value of system and operating parameters used in investigation is listed in Table 3.1

Fig. 2: Photographic view of absorber plate roughened by formation of square protrusions.

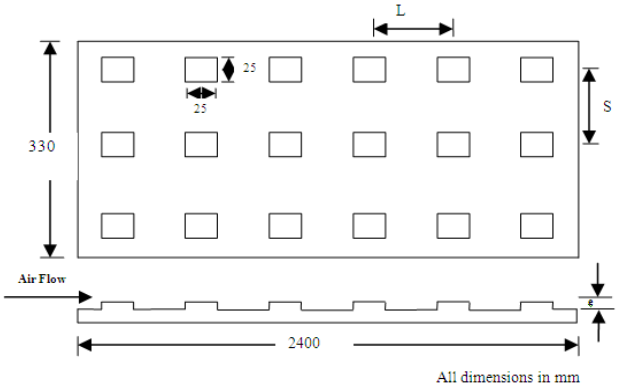

Fig. 3: Schematic of roughened absorber plate.

IV. DATA REDUCTION

Numerical values of heat transfer coefficient 'h', Nusselt number 'Nu', Reynolds number 'Re' and friction factor 'f' were obtained by reducing the experimental data as described in the following steps.

$$\Delta P_o = \rho_w g(\Delta h_1) \quad (1)$$

$$\dot{m} = C_d A_t \left[\frac{2\rho \Delta P_o \sin\theta}{1-\beta^4}\right]^{0.5} \quad (2)$$

$$\mathrm{Re} = \frac{\rho V D_h}{\mu} \quad (3)$$

$$h = \frac{Q_u}{A_c(T_{pm}-T_{am})} \quad (4)$$

$$Nu = \frac{hD_h}{k} \quad (5)$$

$$\Delta P = \rho_k g(\Delta h_2) \quad (6)$$

$$f = \frac{2(\Delta P)D_h}{4\rho L V^2} \quad (7)$$

Table 1: Range/value of system and operating parameters

S.No.	Parameter	Range/Value
1.	Reynolds number (Re)	4000-20000
2.	Relative long way length (L/e)	37.5
3.	Relative short way length (S/e)	25
4.	Relative roughness height (e/D)	0.03
5.	Duct aspect ratio	10

V. TEST OF EXPERIMENTAL SET-UP

A thorough check of experimental set-up was carried out by conducting experimentation on smooth duct. Accuracy of Nusselt number and friction factor data collected for smooth duct was verified by comparing it with the data obtained from following Nusselt number and friction factor correlations reported by Hans et al. (2010) for rectangular smooth duct.

$$Nu = 0.023\,\mathrm{Re}^{0.8}\,\mathrm{Pr}^{0.4}$$ (Dittus –Boelter Correlation)

$$f = 0.085\,\mathrm{Re}^{-0.25}$$ (Modified Blasius Correlation)

Comparison of experimental and predicted data of Nusselt number and friction factor is shown in Figs. 4 and 5 respectively. A reasonably good argument between experimental and predicted data ensures accuracy of the data being collected from the experimental set-up.

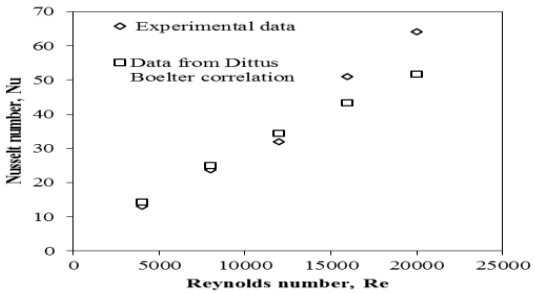

Fig. 4: Comparison of experimental and predicted data of Nusselt number for smooth plate.

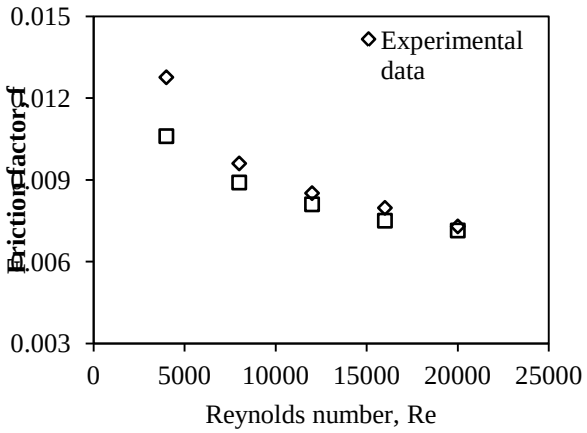

Fig. 5: Comparison of experimental and predicted data of friction factor for smooth plate.

VI. RESULTS AND DISCUSSION

Effect of system and operating parametres on heat transfer and friction characteristics of artificially roughened duct have been reported and discussed in the present section. Fig.6 shows variation of Nusselt number as a function of Reynolds number for smooth plate as well as for protruded absorber plate. The protruded absorber plate have relative longway length (L/e) of 37.5, relative shortway length (S/e) of 25, and relative roughness height of 0.03. It is observed that Nusselt number increases monotonously with increase in Reynolds number. Moreover value of Nusselt number for protruded absorber plate is much higher than that of the smooth plate due to the enhanced heat transfer coefficient. Enhanced heat transfer coefficient may be due to main flow impingement, vortex generation on both sides of the protrusion and flow separation. Because, decelerating motion is accompanied by adverse pressure gradient which promotes separation, instability, eddy formation and large energy dissipation as has been reported by Vennard and Street (1982) and Landau and Lifshitz (2000). Main flow impinges is on the front side of protrusion and vortices are generated due to hindrance created by protrusions. In addition, vortex originated at the former protrusion affects the downstream protrusions located in diagonal direction and augments heat transfer coefficients as has been reported by Sang et al. (2008). It can be observed that at low Reynolds number, Nusselt number for both the plates almost have same value, which might be due to less disturbance of laminar sub-layer. At higher Reynolds number, this layer is disturbed by the roughened surface; hence the boundary layer thickness decreases which increases the heat transfer coefficient and results into higher values of Nusselt number as has been reported by Karmare et al. (2007).

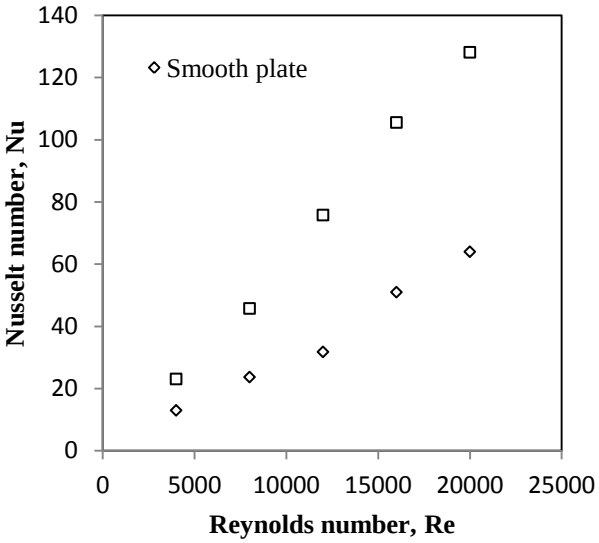

Fig. 6: Variation of Nusselt number with Reynolds number for smooth and protruded absorber plate.

Fig.7. shows the variation of friction factor with Reynolds number for the range of system and operating parameters. It can be observed that friction factor decreases monotonously with increase in Reynolds number. However in case of protruded absorber plate friction factor is more as compared to smooth absorber plate. It may happen due to change in the fluid flow characteristics as a result of roughness provided on the absorber plate. It implies that an augmentation of heat transfer coefficient is feasible to achieve by protrusions but at the cost of some additional friction loss.

VII. DEVELOPMENT OF NUSSELT NUMBER AND FRICTION FACTOR CORRELATIONS

Nusselt number and friction factor are strong functions of system and operating parameters. So, in order to predict performance of artificially roughened duct it is necessary to develop Nusselt number and friction factor correlations. In the present section Nusselt number and friction factor correlations have been developed using the experimental data reported in the previous section following the procedure described by

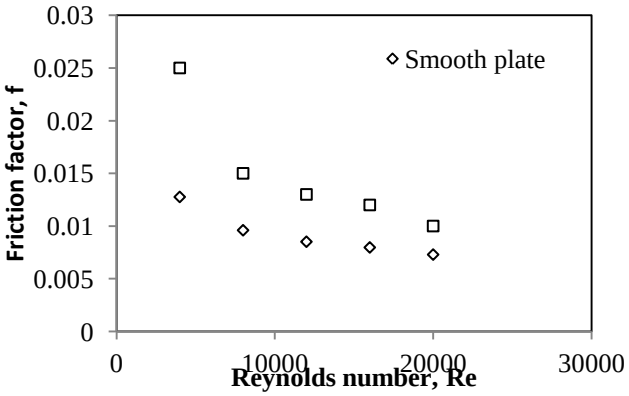

Fig.7: Variation of friction factor with Reynolds number for smooth and protruded absorber plate.

Singh et al. (2006) and using Sigma plot software as given in the below equations :

$$Nu = 0.00256 \times Re^{1.08} \quad (7.1)$$

$$f = 1.692 \times Re^{-0.499} \quad (7.2)$$

Figs. 8 and 9 show comparison of experimental data and that predicted from the developed Nusselt number and friction factor correlations for absorber plate roughened with investigated type of roughness geometry. An average absolute percentage deviation of -10% for Nusselt number and +10% for friction factor have shown good agreement between experimental data and that predicted from the Nusselt number and friction factor correlations.

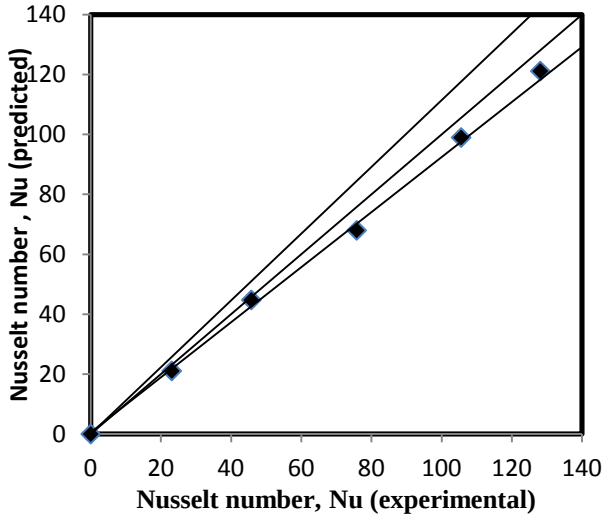

Fig. 8: Comparison of experimental and predicted data of Nusselt number.

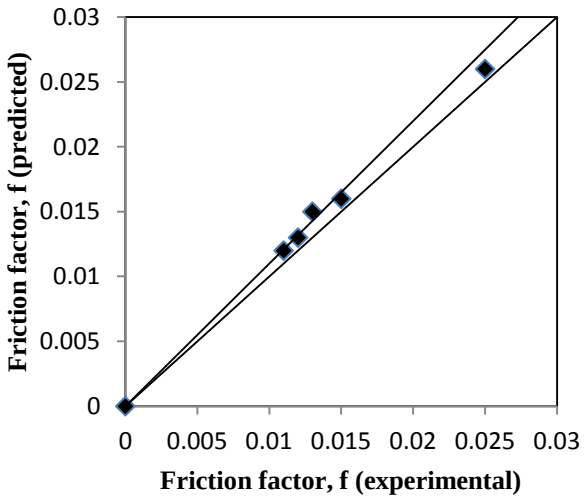

Fig. 9: Comparison of Experimental data and predicted data of friction factor.

VIII. CONCLUSIONS

Application of artificial roughness in the form of protrusion on absorber plate may be considered as an innovative technique for improving thermal performance of solar air heaters as it does not require complicated manufacturing process. Effect of artificial roughness (created by formation of square type protrusions on absorber plate) on heat transfer and friction has been investigated. In order to investigate heat transfer and flow characteristics of duct having smooth and roughened absorber plate, experimental data have been generated for fully developed turbulent flow in the range of system and operating parameters. It has been found that Nusselt number increases monotonously with increase in Reynolds number for smooth as well as protruded absorber plate whereas friction factor decreases with in increase in Reynolds number for both the plates. By using experimental data, correlations have been developed for Nusselt number and friction factor for predicting performance of such type of a system.

REFERENCES

[1] Bhushan, B. and Singh, R. (2010), "A Review on Methodology of Artificial Roughness Used in Duct of Solar Air Heaters", Solar Energy, vol. 35, 202-212.

[2] Hans, V.S., Saini, R.P. and Saini, J.S. (2009),"Performance of Artificially Roughened Solar Air heaters-A Review", Renewable and Sustainable Energy Reviews, vol. 13, 1854-1869.

[3] Varun, Saini, R.P. and Singal, S.k. (2007),"A Review On Roughness Geometry Used In Solar Air Heaters ", Solar Energy, vol.81, 1340-1350.

[4] Gupta, D., Solanki, S.C. and Saini, J.S. (1993), "Heat And Fluid Flow In Rectangular Solar Air Heater Ducts Having Transverse Rib Roughness On Absorber Plate", Solar Energy, vol.51, 31-37.

[5] Jaurker, A.R., Saini, J.S. and Gandhi, B.K. (2006), "Heat Transfer And Friction Characteristics Of Rectangular Solar Air Heater Duct Using Rib-Grooved Artificial Roughness" Solar Energy, vol.80, 895-907.

[6] Karwa, R., Solanki, S.C. and Saini, J.S. (1999), "Heat Transfer Coefficient and Friction Factor Correlations for the Transitional Flow Regime in Rib Roughened Rectangular Ducts", International Journal of Heat and Mass Transfer, vol. 42, 1597-1615.

[7] Karmare, S.V. andTikekar, A.N., (2007), "Heat transfer and friction factor correlation for artificially roughened duct with metal grit ribs", International Journal of Heat and Mass Transfer, vol. 50, 4342–4351.

[8] Prasad, B.N. and Saini, J.S. (1988), "Effect of Artificial Roughness on Heat Transfer and Friction Factor in a Solar Air Heater", Solar Energy, vol.41, 555-560.

[9] Singh, R., Saini, R.P. and Saini, J.S. (2006), "Nusselt Number and Friction Factor Correlations for Packed Bed Solar Energy Storage System having Large Sized Elements of Different Shapes", Solar Energy, vol.80, 760-771.

Effect of Cryogenic Treatment on Machining Performance of Tungsten Carbide: A Bibliographic Review

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***Abstract*— Cryogenic treatment (CT) of materials has bared momentous enhancement in their properties and endow with numerous advantages like boost in wear resistance, reduced residual stresses, enhancement in hardness, diminution in tool wear. Moreover, this technology is a biodegradable, non-hazardous, and non-explosive. Diverse approaches have been applied for CT to study the effect on tungsten carbides while machining different grades of steels. This paper brings out the most noteworthy works of the last few years, focusing on results & mechanisms of cutting tool performance, sequentially to provide the reader a preliminary point to tactic the Cryogenic Treatment area.**

Keywords—Carbide; Cryogenic; Flank Wear; Machining; Turning)

I. INTRODUCTION

Tungsten carbide tool materials habitually comprise a cobalt binder. Tungsten carbide tools can machine metals at speeds that trigger the cutting edge to become red hot, devoid of losing its hardness or sharpness. It exhibits about 2–3 times the productivity and 10 times the life of high-speed steel tools on machining non-ferrous materials [1]. Cobalt is adjacent to iron in the periodic table as part of the VIII B group, has the equal valences, and forms alike phases in crystalline structures, besides it is a fairly stable and constant crystal structure under many conditions. Therefore, a cryogenic treatment of tungsten carbide tool material may have some effect upon the cobalt binder to augment tool life. Since the cryogenic treatment hardens as well as toughens HSS (high speed steel), the material is in all probability more chemically inert at high temperatures. [12, 26]

Over the preceding century, many manufacturing methods have been endeavored to progress mechanical performance of carbides. In recent times, cryogenic treatment (CT) has been reported improving the properties of the materials shown in Figure 1. It is the process of treatment of materials at very low temperatures, by and large around −183°C. The temperature is much lower than that of cold treatment, where temperatures are only around −96°C. The notable effects of cryogenic treatment embrace changes in the mechanical properties and in the crystal structures of materials.

In the last few years or so, there has been an increasing curiosity in the effects of cryogenic treatment on the properties of metals.

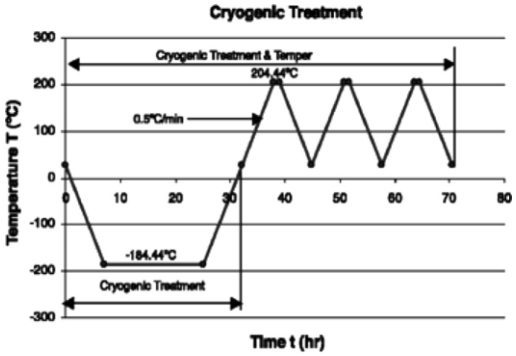

Fig1. Example of DCT temperature

II. EFFECT OF CRYO TREATMENT ON TOOL LIFE

Bryson [2] attributed the wear resistance, and consequently enhancement in tool life, of the carbide tools to the improvement in holding strength of the binder after cryogenic treatment. He believed that cryogenic treatment also acts to relieve the stresses introduced during the sintering process under which carbide tools are produced. Though, Bryson also warned that under particular conditions, cryogenic treatment would have little or no effect on carbide tools, for example when reprocessed carbides are used. Gallagher et al. [3] studied the effect of cryogenic treatments on tungsten carbide tool life and revealed it has the potential of extending tooling life. As the number and size of the η-phase increases, as a result the tool life get reduced and vice-versa. The treatments also cause the gamma phase to turn into more evenly dispersed through reductions in vein and pocket size. The capability of the gamma phase to inhibit the alpha grain growth influences the tool hardness during cutting, thereby affecting the tool life. Reddy et al. [4] found improvement in life of normal and deep cryogenically treated carbide inserts by an amount of 9.58% and 21.8% respectively. They examined the improvement in tool life of P-30 cryogenically treated tungsten carbide inserts and figured that precipitation and distributions of the η phase after cryogenic treatment have enhanced the flank wear resistance. Also they observed a slight increase in grain size

which increases the toughness. Dogra et al [5] observed that on machining AISI H11 steel the surface roughness produced by cryogenically treated and untreated coated-carbide inserts was much comparable with that produced by CBN inserts. Gill et al. [6] concluded that the deep cryogenic treatment has a destructive result on the performance of TiAlN coated tungsten carbide inserts chiefly at lower cutting speeds. Though, at higher cutting speeds, marginal gain in tool life can be attain. Also, deep cryogenic treatment weakens coating substrate interfacial adhesion bonding. So overall, deep cryogenic treatment is not suggested for TiAlN coated tungsten carbide inserts as the assistance gained is not significant. Ramji et al. [7] evaluated the cryogenic treated and tempered carbide inserts in turning white cast iron and revealed that lower values of surface roughness, tool tip temperature and tool forces cryogenically treated and double tempered tungsten carbide coated inserts. An increase in tool life of 8.43 % was attained when the tool insert was cryogenically treated and double tempered compared with that of non-treated condition. Yong et al. [8] a studied the effects of cryogenically treated and untreated tungsten carbide tool inserts and found cryogenically treated inserts performed well, by increasing 28.9% to 38.6% tool life also tools exhibit better tool wear resistance than untreated ones. Priyadarshini Amrita **[9]** aimed to study the effect of cryogenic treatment on HSS as well as Carbide inserts on flank wear tests, sliding wear tests and hardness tests. The author revealed that in flank wear tests cryogenically treated tool showed an increase in tool life. Yet in sliding wear test, weight loss in case of cryogenically treated tools was found to be more indicating the truth that the tool becomes more brittle after cryogenic treatment due to transformation of retained austenite to martensite also due to carbide refinement. Arner et al., [10] demonstrated that in a full production environment, the cryogenic treatment of tungsten carbide cutting inserts can have either a beneficial or harmful effect on the tool life. Bonilla et al [11] evaluated the performance of untreated and cryogenically treated TiCN-coated carbide inserts on machining gray cast iron clutch drum and concluded that cryogenically treated TiCN-coated carbide inserts improve the tool life due to less average residual weight of the inserts when related with untreated.

III. Effect of Cryo treatment on cutting forces & tool wear

Stewart, [12] applied cryogenic treatment to tungsten carbide and compared with untreated carbide to conclude if tool wear could be reduced during turning tests using medium **density fiber**board, along with it both the tool force data and observation of the cutting edges point toward that tool wear was reduced with cryogenic treatment. High-temperature oxidation was declared as the major contributor to the wear of tungsten carbide when machining medium density fiberboard. Singh et al. [13] examined the effect of cryogenic treatment of TiN and AlCrN coated tungsten carbide inserts resulted better performance than uncoated when treated cryogenically. TiN coated inserts gave better performance followed by AlCrN coated as compared to uncoated of cryogenic treatment in terms of lower wear and cutting forces. Poomari et. al. [14] presented an investigation on wear study of cryogenically treated cermet inserts, cryogenically treated and Ti-Al-N coated cermet inserts, Ti-Al-N coated cermet inserts and plain cermet inserts while machining AISI 4340 steel (45 HRc) and revealed cryogenically treated and Ti-Al-N coated cermet inserts performs better than other cermet inserts. Reddy et al. [15] observed that the flank wear and cutting forces during machining with deep cryogenic treated P-40 carbide tool was lower than that of untreated carbide cutting tools. Cryogenic treated inserts had better resistance and also surface finish produced on machined AISI 1040 steel workpieces was superior with the deep cryogenic treated carbide tools as compared to the untreated carbide tools. Sahoo [16] studied performance of untreated and cryo treated P 30 cemented carbide inserts while machining AISI 316 grade austenitic stainless steels and illustrated that cryogenic treatment had significantly improved the average flank wear and superior resistance to tool wear compared to its untreated inserts was demonstrated. Also the chip thickness along with chip reduction coefficient was found to decrease for cryogenic treated inserts compared to those for untreated inserts.

IV. Effect of Cryogenic treatment on Flank wear

Ramji et. al. [17] examined the performance of cryogenic treated inserts with untreated inserts and showed that cryogenic treated inserts have proved better to the non-treated in all the test conditions in terms of lesser flank wear of the inserts and reduced surface roughness of the specimens. Kadam et. al. [18] compared the performance of TiAlN coated cemented carbide and HSS tool on drilling of T105CR1 EN31 steel under dry condition and found that machining time and torque in TiAlN less as compared to HSS where as chip load remains same. Ramji et al [19] performed an experiment using untreated, cryogenically treated and tempered carbide tipped drills at various levels of feed, cutting speed, as well as tool conditions on thrust, surface roughness, torque of drilled holes. Results showed that cryogenically treated and cryogenically treated and double tempered inserts showed superior results in terms of reduced tool wear forces, and surface roughness of the drilled holes and revealed that cryogenic treatment can enable significant improvement in both productivity and product quality and hence overall machining economy offsetting the cost of cryogenic cooling. Kalinga [20] applied cryogenic treatment to PVD coated carbides and compared it with untreated inserts under different cutting parameters. The findings showed that, cryogenic treatment significantly improved the average flank wear and also the surface finish produced while machining the work-piece was better with the deep cryogenic treated carbide tools. Cutting force for cryogenic treated inserts appeared to be less than non-cryogenic treated inserts. He et. al. [21] compared the performance of uncoated, untreated inserts and deep cryogenically treated inserts while machining 40Cr steel and revealed that cutting forces and cutting temperature was less in deep cryogenically treated inserts in comparison with uncoated, untreated inserts. Moreover flank wear of deep cryogenically treated inserts was less than untreated inserts; also cryogenically treated inserts produced a better surface finish. They verified that, converse to steels, there is no martensite phase in tungsten carbide.

V. Effect of Cryo treatment on Coolant

Vadivel et al. [22] studied the effects of cryogenically treated carbide inserts for the machining operations on nodular cast iron for predicting the various parameters, i.e. power consumption, surface roughness of work specimen and wear of

the cutting tool inserts. In this coolant was also used in entire machining operation in order to emphasize that the life span of the cutting tool inserts and surface finish of the work specimen can be enhanced. The surface roughness of work specimen consumption of power, , and wear of the cutting tool inserts were found to be favoring cryogenically treated coated carbide inserts also the wear resistance of cryogenically treated coated carbide inserts is higher than that of the untreated one observed from SEM analysis. Gill et al. [23] performed comparative investigation of the wear behavior of cryogenically treated tungsten carbide inserts in dry and wet orthogonal turning conditions to reveal the affect of coolants on the performance of cryogenically treated tungsten carbide inserts. They also claimed that the use of coolant together with cryogenic treatment of tungsten carbide inserts further improved tool life. They too concluded that considerable increase in life of cryogenically treated tools can be attained for interrupted machining mode as compared with continuous machining mode.

VI. Effect of Cryo treatment on Hardness

Thornton et. al. [24] studied the effect of cryogenic treatment on development of surface and sub-surface wear of H13 a material while machining with tungsten carbide inserts and found that cryogenic treatment has resulted in 9.2% increase in hardness and abrasive wear resistance. Thakur et al. [25] scrutinized that there is a slight increase in the microhardness due to the controlled cryogenic treatment compared to untreated tungsten carbide–cobalt (WC–Co) sample. But the other two post treatments presented a considerable improvement in the hardness. The formation of the complex compounds like Co6W6C or Co3W3C may have increased the hardness in the case of the samples due to forced air cooling and oil quenching.

Kalsi et. al. [26] investigated the effect of number of post tempering cycles after cryogenic treatment on tungsten carbide inserts and observed that there was a significant improvement in tungsten carbide inserts with three tempering cycles after cryogenic treatment and with marginal difference for two tempering cycles after cryogenic treatment inserts.

Singh et. al [27] accomplished a study on crank shaft machining applying deep cryogenic treated HSS and carbide tools; it highlights 20% - 22% increase in tool life. Moreover cost per component is decreased up to 14.75%. Cryogenic treatment on HSS improves mechanical properties like toughness, wear resistance as well as resistance to fatigue cracking. This is straight to the, transformation of retained austenite into stable martensite which leads to the increase in density of dislocations and vacancies, in turns enhance the diffusion coefficient of carbon. This microstructure evolution produces precipitation of very tiny carbides during the cryogenic treatment.

Gill et al [28] made comparative investigation of the wear behavior and machining effectiveness of cryogenically treated tungsten carbide inserts (P25) in turning has been carried out in this study. The results unveiled that cryogenically treated tungsten carbide inserts has performed better as compared with untreated insets. Also, a convincing increase in tool life was recorded in deep cryogenically treated inserts as compared to shallow cryogenically treated inserts. Gill et. al. [29] presented the metallurgical and mechanical characterization of shallow and deep cryogenically treated tungsten carbide (WC–Co), plus illustrated that hard phase particles of tungsten carbide are refined into their most stable form via the phenomenon of spheroidization after shallow and deep cryogenic treatment. There exists an optimum cryogenic treatment temperature for tungsten carbide material which may ensure the maximum possible enhancement in hardness. However, the improvement in wear rate by deep cryogenic treatment is significantly higher than that achieved by shallow cryogenic treatment and also the improvement in wear resistance of shallow and deep cryogenically treated tungsten carbide material is attributed to the refinement and crystallographic alignment of hard α-phase particles, decreased amount of cobalt binder β phase, along with precipitation of fine eta (η)-carbides.

Thamizhmaniia et. al. [30] applied cryogenic treatment to worn CBN inserts disposed off or no longer used for finish machining can be used for rough machining and compared it with high speed steel inserts in machining difficult to cut materials. The authors presented the findings that cryogenically processed CBN inserts performed very close to new cutting inserts.

VII. Effect of Cryo treatment on Holding Duration

Yan et. al. [31] studied the effect of Deep cryogenic treatment on YT15 carbide inserts and concluded increase in hardness and enhance wear resistance of the carbide insert was due to soaking temperature, cooling rate and the tempering temperature. Also Deep cryogenic treatment improves the multi-type martensite transformation of Co. Farhani et al [32] concluded success of the cryogenic treatment depends on the rate of cooling, the soaking time and warming up of the treated metal. To make sure maximum effectiveness, the cryogenic process must be carried out in a devoted programmable cryogenic processor. Jiang et. al. [33] analyzed that after the cryogenic treatment improved hardness, compression strength, fatigue resistance and wear resistance, while no effect of toughness and bending strength of cemented carbides. The change in the mechanical properties is highly dependent on the soaking time. Ozbek et. al. [34] studied the effects of different holding times of deep cryogenic treatment on tool wear in turning with cemented carbide inserts at different cutting parameters and concluded that flank wear and crater wear were seen in all combinations of the cutting parameters. Though, notch wear appeared merely at lower cutting speeds. In general, cryogenically treated for 24 hours cutting inserts gave best wear resistance.

VIII. Effect of Cryo treatment on Surface roughness

Derani [35] revealed that at lower cutting speed and lower feed rate non-cryogenic PVD cutting tool performances better compare to cryogenic PVD cutting tool in term of surface roughness and tool wear. However at high cutting speed, cryogenic PVD engender low surface roughness and fewer tools wear during milling Inconel 718. Thamizhmanii et. al. [36] analyzed the tool performance between cryogenic treated and untreated PVD inserts by milling process on Inconel 718 material and the results were encouraging and performance of cryogenic treated inserts less flank wear than untreated inserts, also treated PVD inserts produced low surface roughness at high cutting speed with low feed rate.

IX. Effect of Cryo treatment on tool during Hard Turning

Thamizhmanii et al [37] studied the effect of cryogenic treated CBN inserts subjected to 30 hours of treatment in controlled atmosphere. and found that cryogenically treated CBN inserts produced less tool wear on titanium than AISI 440 C Martensitic stainless steel. The roughness produced was low at high cutting speed with low feed rate. Flank wear was not progressive and varied. In turning AISI 440 C stainless steel, built up edge formed in all cutting speed which was a common phenomenon which lead to crater wear formation. The chips produced were saw tooth chips by both materials. Thamizhmanii et al [38] conducted a study of the effect of cryogenic treatment on CBN inserts which was used for machining difficult to machine materials Titanium, Inconel 718 under different cutting parameters and found flank wear, surface roughnesss was less for Titanium than Inconel 718 alloy steel formed built up edge which deteriorated its surface and crater wear was more for Inconel 718 than Titanium also more depth of cut did not affect the quality of machine surface, besides it produced smooth surface

X. Summary

1. The work carried out by various researchers' shows that cryogenic treatment is quite effective for tool performance.
2. Benefit of tempering cycle after Cryogenic treatment has been justified by various researchers.
3. Cryogenic treatment is an economical one-time eternal treatment affecting the intact section.
4. Cryogenic treatment if appropriately engaged, can impart noteworthy improvement in productivity as well as product quality

References

[1] Krar S, Gill A and Smid P 2008 Technology of Machine Tools, 6th edition (New Delhi: McGraw-hill Education (I) Pvt Ltd.) 223 Lavergne O, Robaut F, Hodaj F and Allibert C H 2002 Acta Materialia 50 1683

[2] Bryson, W.E. (1999) Cryogenics, Hanser Gardner Publications, Cincinnati, OH, pp. 81–107.

[3] A.H. Gallagher, C.D. Agosti, J.T. Roth (2005) Effect of cryogenic treatments on tungsten carbide tool life: Micro-structural analysis, Transactions of the North American Manufacturing Research Institute of the Society of Manufacturing Engineers, NAMRI/SME, 33: pp.153–160

[4] Reddy, T.V.S., Sornakumar, T., Reddy, M.V., Venkatram, R. (2009) Machinability of C45 steel with deep cryogenic treated tungsten carbide cutting tool inserts. Int. J. Refract. Met. Hard Mat. 27, pp.181–185.

[5] Manu Dogra, Sharma Vishal, S., Anish Sachdeva, Narinder Mohan Suri, and Dureja Jasminder, S. (2011) Performance evaluation of CBN, coated carbide, cryogenically treated uncoated/coated carbide inserts in finishturning of hardened steel. Int. J. Adv. Manuf. Technol., Vol. 57, pp. 541-553

[6] Simranpreet Singh Gill, Jagdev Singh, Harpreet Singh, and Rupinder Singh (2011) Investigation on wear behaviour of cryogenically treated TiAlN coated tungsten carbide inserts in turning. Int. J. Mach. Tools Manuf., Vol. 51, pp. 25-33

[7] Ramji B.R., Narasimha Murthy H N (2012) Performance evaluation of cryo treated and tempered carbide inserts in turning white cast iron. British Journal of Engineering and Technology, Vol. 1, No. 1, pp 97 – 117

[8] Yong, A.Y.L.; Seah, K.H.W.; Rahman, M. (2006) Performance evaluation of cryogenically treated tungsten carbide tools in turning. Int. J. Mach. Tools Manuf., 46, 2051–2056.

[9] Priyadarshini Amrita (2007) A study of the effect of cryogenic treatment on the performance of high speed steel tools and carbide inserts. Master's Thesis, Department of Mechanical Engineering, National Institute of Technology, Rourkela

[10] Arner KA, Agosti CD, Roth JT (2004) Effectiveness of the cryogenic treatment of tungsten carbide inserts on tool wear when in full production operations. American Society of Mechanical Engineers, Mechanical Engineering Division, pp 31–40

[11] Bonilla, C., Meara, R.O. and Perry, L. (2007) Evaluation of the comparative performance of cryogenically treated cutting inserts as a capstone design project", Proceedings ASEE Annual Conference and Exposition, 9.

[12] Stewart, H.A. (2004) Cryogenic treatment of tungsten carbide reduces tool wear when machining medium density fiber board. For. Prod. J., Vol. 54, No. 2, pp. 53-56.

[13] Shivdev Singh, Dilbag Singh, and Kalsi Nirmal, S. (2012) Experimental analysis of cryogenic treatment on coated tungsten carbide inserts in turning. International Journal of Advanced Engineering Technology, Vol. 3, No. 1, pp. 290-294.

[14] A.Poomari, Dr. B. Mohan, Dr. A. Rajadurai, and Dr. A. Senthil kumar (2013) Wear performance of Ti-Al-N coated and crogenicllay treated cermet tools while machining AISI 4340 steel. Advanced materials Research vols. 622-623 pp 404-408

[15] Sreerama Reddy, T. V., Sornakumar, T. Venkatarama Reddy, M., Venkatram, R. and Senthilkumar, A. (2009) "Turning studies of deep cryogenic treated P-40 tungsten carbide cutting tool inserts- technical communication. Machining Science and Technology, Vol. 13, pp. 269-281

[16] Biranchi Narayan Sahoo (2011) Effect of cryogenic treatment of cemented carbide inserts on properties & performance evaluation in machining of stainless steel" Master's Thesis, Department of Mechanical Engineering, National Institute of Technology, Rourkela

[17] Ramji B.R., Narasimha Murthy, H.N. and Krishna, M. (2010) Analysis of forces, roughness, wear and temperature in turning cast iron using cryotreated carbide inserts. International Journal of Engineering Science and Technology, Vol. 2, No. 7, pp. 2521-2529

[18] Kadam, M.S. and Pathak, S.S. (2011) Experimental Analysis and Comparative Performance of Coated and Uncoated Twist Drill Bit Dry Machining. International Journal of Research in Mechanical Engineering and Technology, Vol. 1, No. 1, pp. 33-37

[19] Ramji.B.R, Narasimha Murthy.H.N, Krishna.M (2010) Performance analysis of cryogenically treated carbide drills in drilling white cast iron. International Journal Of Applied Engineering Research, Dindigul Volume 1, No 3, pp. 553-560

[20] Kalinga Simant Bal (2012) Performance appraisal of cryo-treated tool by turning operation. Master's Thesis, Department of Mechanical Engineering, National Institute of Technology, Rourkela

[21] Hui-Bo He, Wen-Qiang Han, Hua-Ying Li, Dong-Yang Li, Jun Yang, Tao Gu, and Tao Deng (2014) Effect of Deep Cryogenic Treatment on Machinability and Wear Mechanism of TiAlN Coated Tools during Dry Turning", International Journal Of Precision Engineering And Manufacturing Vol. 15, No. 4, pp. 655-660

[22] Vadivel, K.and Rudramoorthy, R. (2009) "Performance analysis of cryogenically treated coated carbide inserts", Int. J. Adv. Manuf. Technol.,pp.222-232

[23] Gill, S.S., Singh, R., Singh, H., Singh, J. (2009) Wear behavior of cryogenically treated tungsten carbide inserts under dry and wet turning conditions. Int. J. Mach. Tools Manuf., Vol. 49, pp. 256–260.

[24] R. Thornton, T. Slatter, R. Lewis (2014) Effects of deep cryogenic treatment on the wear development of H13A tungsten carbide inserts when machining AISI 1045 steel.

[25] Dinesh Thakur, Vijayaraghavan, L. and Ramamoorthy, B.(2008) Influence of different post treatments on Tungsten Carbide- Cobalt inserts. Intl. journal of Materials Letters, Vol. 62, pp. 4403-4406

[26] Nirmal s kalsi, rakesh sehgal and vishal s Sharma (2014) Effect of tempering after cryogenic treatment of tungsten carbide–cobalt bounded inserts", Indian Academy of Sciences, Bull. Mater. Sci., Vol. 37, No. 2, pp. 327–335

[27] Rupinder Singh, and Kamaljit Singh, (2010) Enhancement of Tool Material Machining Characteristics with Cryogenic Treatment: A Review. In Proceedings of International Conference on Industrial Engineering and Operations Management, Dhaka, Bangladesh, pp. 225-230

[28] Gill Simranpreet Singh, Singh Harpreet, Singh Rupinder and Singh Jagdev. (2011). Flank Wear and Machining Performance of Cryogenically Treated Tungsten Carbide Inserts. Materials and Manufacturing Processes, 26,1430–1441.

[29] Simranpreet Singh Gill & Jagdev Singh & Harpreet Singh & Rupinder Singh (2012) Metallurgical and mechanical characteristics of cryogenically treated tungsten carbide (WC–Co). Int J Adv Manuf Technol (2012) 58: pp.119–131

[30] S.Thamizhmaniia, Rajendran, Rasool Mohideen and Sulaimana (2012) Performance Evaluation of Cryogenically Treated Worn CBN Insert by Turning Process. Key Engineering Materials Vols. 504-506 pp. 1323-1328

[31] Hongjuan Yan, Honghai Xu, and Xueke Luo (2010) The Research on Process of Deep Cryogenic Treatment for YT15 Carbide Insert. International Conference on Machine Vision and Human-machine Interface (MVHI), pp. 725-728

[32] F. Farhani, K.S. Niaki (2008) Cryogenic treatment of metals–a review of experimental studies, underlying mechanism and process equipment. Proceedings of the 4th BSME-ASME International Conference on Thermal Engineering, Dhaka, Bangladesh pp.832-840

[33] Jiang Y, Chen D (2011) Effect of cryogenic treatment on WC–Co cemented carbides. Material Science Engineering, Volume 528, pp. 1735-1739.

[34] Özbek Nursel Altan, Çiçek Adem,, Gülesin Mahmut, Özbek Onur .(2014). Investigation of the effects of cryogenic treatment applied at different holding times to cemented carbide inserts on tool wear. International Journal of Machine Tools and Manufacture, Vol.86, 34-43.

[35] Mohd naqib bin derani, (2012) The effect of cryogenic cutting tools on machining difficult to cut material. Master's Thesis, Faculty of Mechanical and Manufacturing Engineering Universiti Tun Hussein Onn Malaysia

[36] S. Thamizhmanii, Mohd Nagib, H. Sulaiman (2011) Performance of deep cryogenically treated and non-treated PVD inserts in milling", Journal of achievements in material and manufacturing engineering, volume 49,pp.460-466

[37] S.Thamizhmaniia, Rajendran, Rasool Mohideen and Sulaimana (2012) Performance Evaluation of Cryogenically Treated Worn CBN Insert by Turning Process. Key Engineering Materials Vols. 504-506 pp. 1323-1328

[38] Sivaprakasam Thamizhmanii and Sulaiman Hasan (2013) Surface Roughness and Tool Wear on Cryogenic Treated CBN Insert on Titanium and Inconel 718 Alloy Steel. World Academy of Science, Engineering and Technology 77,pp. 1570-1575

Characterization and Joining of metal pieces by Microwave Energy

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***Abstract*—Processing of metallic materials through microwave hearting has been technically challenging. This paper illustrates a novel method for joining of bulk metallic materials through microwave heating. Joining of aluminum alloy in bulk form has been carried out using microwave energy in a multimode applicator at 2.45 GHz and 900 W. SiC was used at both top and bottom of the workpiece as susceptor material to facilitate microwave hybrid heating (MHH). Aluminum in plate forms have been successfully joined through microwave heating within 480s of exposure time. A sandwich layer of aluminum powder with approximately 0.5 mm thickness was introduced between the two candidate surfaces. Near complete melting of the powder particles in the sandwich layer does take place during the microwave exposure leading to metallurgical bonding of the bulk surfaces. Characterisation of the joints has been carried out through microstructure study, elemental analysis, phase analysis, microhardness survey, X-ray diffraction (XRD) pattern indicates that some aluminum powder particles got transformed into aluminum oxides. A dense uniform microstructure with good metallurgical bonds between the sandwich layer and the interface was obtained. The hardness of the joint area was observed to be 60.4 ± 10 Hv.**

Keywords— Microwave Joining; Aluminum Metal; Sem; XRD.)

I. INTRODUCTION

The Microwave heating is fundamentally different from conventional heating processes because there is energy conversion rather than energy transfer which is generally taking place in conventional mode of heat transfer [1-3]. Microwave heating thus receives considerable attention due to its specific advantages such as volumetric heating, reduced processing time, low power consumption and less environmental hazards [4]. Joining of metal parts is the second most important process in manufacturing of any product or structure. Assembly by joining simpler and / or smaller components to build up complex shaped or large sized items usually reduced production cost. But joining of metallic materials through microwave energy is a challenging area of research. Microwaves are electromagnetic waves. Their frequencies (wavelengths) are in the range from 300 MHz (λ = 1 m) up to 300 GHz (λ = 1 mm).When microwaves absorbed they are converted directly into atomic motion and motion is converted in to heat.

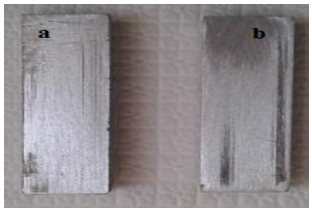
Microwave processing of materials is mainly used for ceramics, ceramic composites, polymers and semiconductors because they are good absorbers of microwave [5,6]. Bulk materials reflect microwave at room temperature because of low skin depth. The skin depth is a measure of depth of microwave in which the field is attenuated by 1/eth of its value at surface [7]. However in 1999, Roy et al. [8] reported that in a powdered form all metals, alloys, and intermetallics will couple/heat in a microwave both very efficiently and effectively to produce high sintered bodies with improved mechanical properties. The metallic materials can be processed using microwave in powder form by making powder particle size equal to skin depth of microwave. Later, many authors reported sintering of metallic materials by using microwave irradiation [9, 10]. The results show microwave induced sintering product yielded fast heating rates, better density, uniform microstructure and shape retention, higher flexural strength and uniform distribution of pores [11]. The microwave joining of thin metallic sheet having a thickness of 0.1 to 0.3 mm was successfully reported by Siores and Rego [12] 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. Srinath et al reported joining of similar and dissimilar bulk metals at atmospheric conditions with fusion of parent metals with the help of MHH [13-15].This paper discusses the joining of aluminum plates using 2.45 GHz microwave frequency in a multimode microwave applicator having a power of 900W. The joints were characterized through XRD, SEM, and Vicker's micro-hardness tester

II. EXPERIMENTAL PROCEDURE

Heating of a material using electromagnetic energy is based on a materials capacity to efficiently absorb set energy. Conductive sample can be much more effectively heated up in magnetic field component of microwave field. The following section describes the procedure adopted for joining of aluminum plates by the fusion of aluminum powder through microwave energy.

A. Material Selection

Aluminum plates having dimensions of 25x12x5 (mm) were used in this work as shown in fig.1 (a). Joints were made in both butt and lap form. The aluminum powder having an average particle size of ~ 45 μm were used as an interface layer. Patrice size plays an important role in heating of metals through microwave energy.



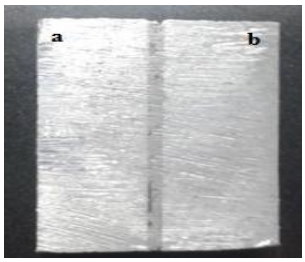


Fig.1.Sample images (a) before joining, (b) after joining and cleaning.

The heating rate of the particulate compacts increase as the particle size and green density decrease [16].The skin depth of aluminum plate was calculated using the following relationship by Eq. (1) [17].

$$\delta = \sqrt{\frac{\rho}{\pi f \mu_r \mu_o}} \delta = \sqrt{\frac{\rho}{\pi f \mu_r \mu_o}} \qquad (1)$$

Where, δ = skin depth (μm), ρ = resistivity (μΩ-m), f = frequency of microwave (GHz), μ = magnetic permeability = $\mu_r\mu_o$ (H/m), μ_r = relative permeability, and μ_o = absolute permeability (H/m). The skin depth of aluminum plates considering $\rho = 2.65$ μΩ-m, f = 2.45 GHz, $\mu_o = 4\pi \times 10^{-7}$ H/m and $\mu_r = 1$ is approximately 1.6 μm, which is less than the size of particle to be used in the present work. Table 1 show the chemical composition of the aluminum powder and aluminum plates used in the joining process.

Table 1 Chemical composition (wt.%) of material

Element	Al	Si	Fe	Ti
Aluminum Powder (wt %)	99.5	0.25	0.15	0.25
Aluminum Plate	98.6	0.8	0.7	0.15

B. Joining method

Before joining the metal plates used were cleaned with emery paper of different grads starting from 600, 800, 1000 respectively, after that the metal plates were cleaned with acetone to remove oxide layer formed on the surface of the metal. Aluminum powder of approximately 45 μm in size is used as sandwich layer in the joint. The powder was mixed with epoxy resin (Bisphenol-A, Blumer 1450XX) to make slurry so that a thin layer of the slurry can be easily placed between the two interfacing surfaces. All experiments were carried out under atmospheric conditions in a one kW multimode microwave system. Metal pieces were exposed for 600 sec in the multimode microwave applicator at a frequency of 2.45GHz without rotating disk and a power level of 900w is used for this experiment. Table 2 describes the process parameters used in this joining process. At room temperature aluminum metal reflect microwave because of very sallow skin depth is in the order of 1.6 μm. However the skin depth of a material increase with rise in temperature due to increase in resistivity and decrease in permeability with continue heating as obtained from Eq. (1). But here, in order to avoid the problem of skin depth metallic plates were placed in insulator masks of refractory brick so that they are not directly exposed to microwaves. SiC powder was used for two purposes first initial coupling of microwaves with metallic materials, as a susceptor medium and second it creates a boundary for the melted interlayer as it does not allow the diffused metal to flow out from the joint area. Principles of microwave hybrid heating (MHH) were effectively used. Fig. 2 illustrates the schematic view of the experimental process of the microwave hybrid heating used for joining of metallic materials.

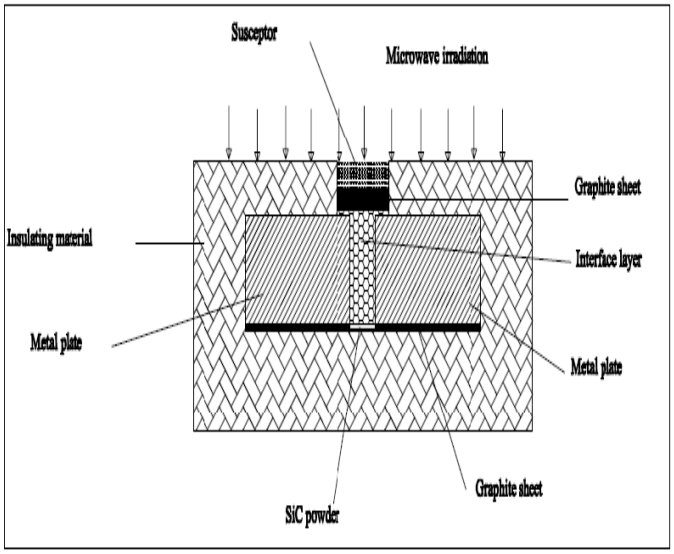


Fig.2. Schematic view of the experimental process for joining

Table 2 Microwave processing parameters used in the joining process

Parameters	Description
Microwave applicator	Multimode (Make: Whirpool)
Base material	Aluminum 6061
Microwave frequency	2.45 GHz
Interfacing powder layer	Aluminum powder in slurry form
Susceptor material	SiC Substrate(220 mesh)
Exposure power	900 W
Exposure time	480s (8 minutes)

C. Joining Characterization

Joints were characterized through XRD, FESEM, Microhardness. The XRD patterns were obtained at room temperature in a Anchor Scan Parameters (at IIT Ropar) with Cu–Kα X-ray. The scan rate was maintained at 1° min^{-1} and the scan range was from 30° to 130° having specimen length 10 mm. Analysis of the metallic joint microstructure was carried out in a field emission scanning electron microscope at NIPER, Mohali using HITACHI model number S-3400 and optical microscopy was carried out using Neophot 2, CARL ZEISS. The microwave joined aluminum specimens were cut into sections across the joint, followed by mechanical polishing and etching. The microhardness on different surfaces of the joints was evaluated by Vickers' microhardness tester (Huayin, China) at the load of 100 gm applied for duration of 15s.

III. RESULT AND DISCUSSION

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A. XRD Observation

Typical XRD spectra of aluminum joint are presented in Fig.3. The XRD spectrum of the aluminum based powder used as the interfacing layer is shown in Fig. 3(a). The high intensity peaks indicate the dominance of aluminum in the powder and presence of other elements is indicated through suppressed peaks. Fig. 3(b) shows the XRD spectrum of the aluminum joint produced through microwave hybrid heating. It is observed from the XRD spectrum that few intermetallics and aluminum oxides are present in the joint zone.

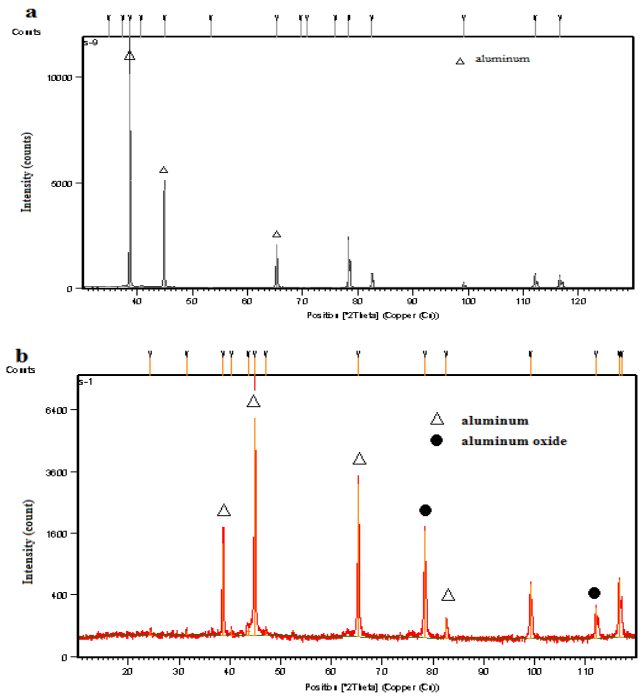


Fig. 3 Typical XRD spectra of (a) as received powder (b) developed joint zone.

The highest peak corresponding to 2θ ≈45.9028° indicates maximum quantity of aluminium at the joint area and the peak corresponding to 2θ ≈76.3533° indicates the formation of aluminum oxide, which could be due to slow cooling rate and the entire process was carried out in the atmospheric conditions. These phases are attributed to rapid heating of the aluminum based sandwich layer and sudden removal of the heat source associated with the end of irradiation cycle. The volumetric heating of the bulk interfaces in microwave irradiation is the result of frictional losses at the molecular level owing to the formation of dipolar configuration. The dipolar movement at the molecular level increases immediately with the withdrawal of microwave field leading to an ambient temperature condition. Formation of various carbide, oxide and intermetallics influences the dielectric properties of the sandwich layer appreciably and further enhances the coupling of microwaves in the sandwich layer. This causes rise in temperature in the joint zone leading to localized melting and bonding of the interface layers.

B. SEM observation

Fig.4 illustrates the SEM micrograph of aluminum joint developed through microwave hybrid heating. The microstructures shown in Fig.4 (a) and (b) indicates good metallurgical bonding with substrate and complete melting of aluminum based powder particles. Initially susceptor material, SiC couples with microwave which induces rapid heating. This heat is transferred to the metallic powder particles in the sandwich layer within a short duration. At elevated temperature, the metal powder starts coupling with microwave. This result in volumetric uniform heating in the metallic material, which melts the powder particles and wetting of the bulk interface takes place and the SiC powder at the bottom of the interlayer creates a boundary for this melted powder as it does not allow the melted material to flow out from the joint area. On cooling, a uniform joint is obtained. Homogeneous and dense joint surface of fused aluminum metal with fewer pores and voids without visible cracks has been clearly observed. The observed homogeneity of the joint is due to the uniform microwave heating as illustrated in Fig.4. A fully fused weld interface can be clearly seen. A well-bonded microstructure on the sandwich powder layer and powder-bulk interface is an indication of good joint efficiency. Fig 5 (a) Shows the optical micrograph of the work piece from where the fusion of interface layer is clearly seen. Fig 5(b) Shows enlarge view of joined metal plates.

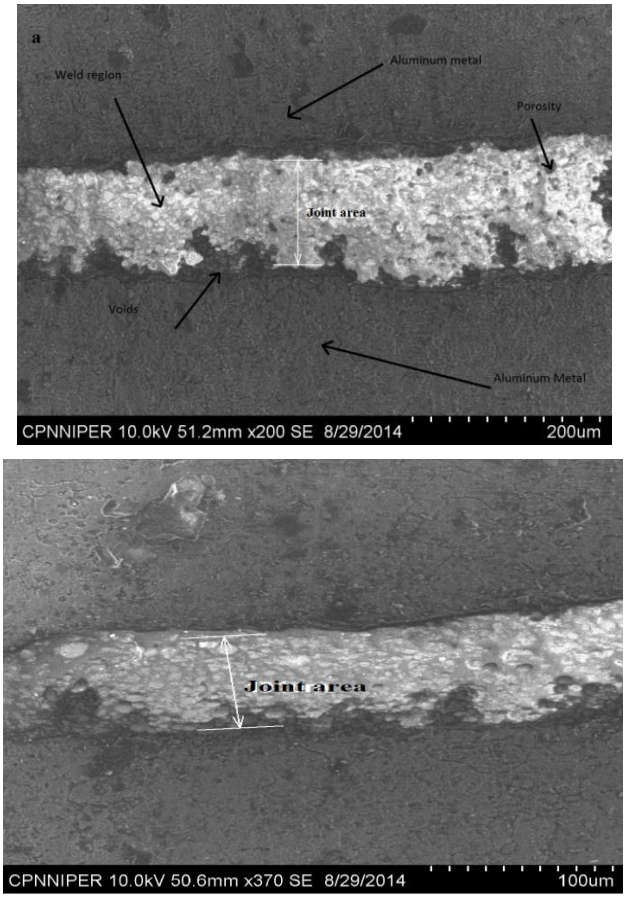


Fig.4(a) SEM image of the typical joint (b) Joint zone at higher magnification.\

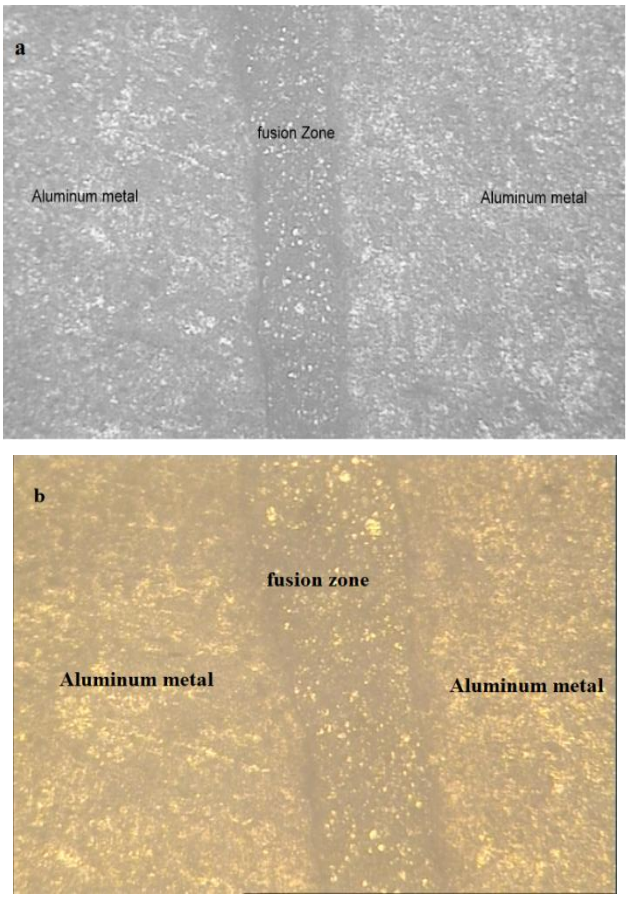
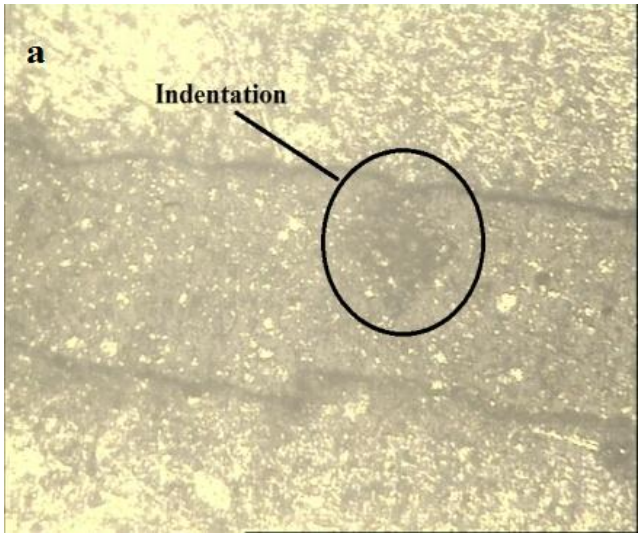


Fig. 5 Optical micrograph of joint zone at (a) 5x60X, enlarged view at (b) 8x60X

C. Hardness measurement

Micro hardness of the aluminum joint was measured using vicker's micro hardness tester on the joint, on the interface and substrate of the base metal by using a load of 100 gm for 15s. The indentation made on the joint, base metal and interface are shown in fig 6(a,b,c). The joint micro hardness at the substrate and on the interface was measured 44.2 Hv and 47.3 Hv respectively whereas, it was measured to be maximum at the joint about 60.4 Hv.



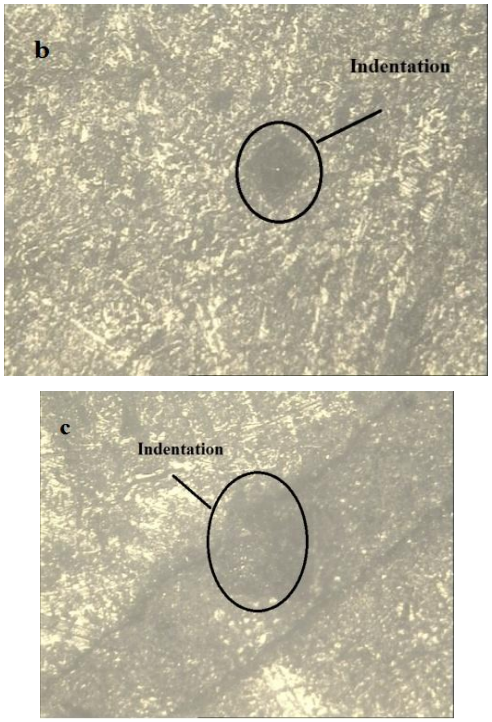


Fig.6. Micrograph showing typical vicker's indentation (100 mg load) (a) on the joint, (b) base metal and (c) interface.

IV. CONCLUSION

It is concluded from the above experiment that the joining of the aluminum plates was successfully carried out using MHH. Microstructural analysis of the developed joint was carried out using different characterization techniques. Microwave hybrid heating can be effectively applied for joining of aluminum alloy plates. The joints could be achieved by placing slurry of aluminum powder in the interface. The powder particles get melted and form a homogenous and dense joint through metallurgical bonding with the substrate, while the epoxy material gets evaporated at high temperature. Al-α-Al_2O_3 composite was formed by the microwave heating of aluminium powder. It is also concluded that the SiC powder used creates a boundary for the melted interlayer material, as it does not allow the diffused metal to flow out from the joint area.

REFERENCES

[1]. D.E. Clark, D.C. Folz, J.K. West, Processing materials with microwave energy, Mater. Sci. Eng, A 287 (2000) 153–158.

[2]. E.T. Thostenson, T.W. Chou, Microwave processing: fundamentals and applications, Composites: Part A 30 (1999) 1055–1071.

[3]. H.S. Ku, E. Siores, A. Taube, Productivity improvement through the use of industrial microwave technologies, Computers & Industrial Engineering 42 (2002) 281-290.

[4]. D.A. Jones, T.P. Lelyveld, S.D. Mavrofidis, S.W. Kingman, N.J. Miles, Microwave heating applications in environmental engineering – a review. Resour. Conserv. Recycl. 34 (2002) 75- 90.

[5]. Sutton WH. Microwave processing of ceramic materials. Am Ceram Soc Bull 1989;168:376–86.

[6]. Rajkumar K, Aravindan S. Microwave sintering of copper–graphite composites. J Mater Process Technol 2009;209:5601–5.

[7]. A.C. Metaxas, R.J. Meredith, Industrial Microwave Heating. Peter Peregrinus Ltd., UK, (1983) 99-100.

[8]. R. Roy, D. Agrawal, J. Cheng, S. Gedevanishvili, Full sintering of powdered metals parts in microwaves, Nature 399 (1999) 664.

[9]. G. Sethi, A. Upadhyaya, D. Agrawal, Microwave and conventional sintering of pre-mixed and prealloyed cu-12sn bronze, Sci of Sintering, 35 (2003) 49.

[10]. C. Leonelli, P. Veronesi, L. Denti, A. Gatto, L. Iuliano, Microwave assisted sintering of green metal parts, journal of materials processing technology 205 (2008) 489–496.

[11]. R.M. Anklekar, D.K. Agrawal, R. Roy, Microwave sintering and mechanical properties of P/M steel," Powder Metall. 44 (2001), 355.

[12]. Siores E, Rego D. Microwave application on material joining. J Mater Process Technol 1995;48:619–25.

[13]. Sharma AK, Srinath MS, Pradeep K. Microwave joining of metallic materials. Indian Patent; 2009 [Application no. 1994/Del/2009].

[14]. Srinath MS, Sharma AK, Pradeep K. Investigation on microstructural and mechanical properties of microwave processed dissimilar joints. J Manuf Process 2011;13:141–6.

[15]. Srinath MS, Sharma AK, Pradeep K. A new approach to joining of bulk copper using microwave energy. Mater Des 2011;32:2685–94.

[16]. A.Mondal, A.Shukla,A.Upadhyaya, D.Agarwal Effect of porosity and particle size on microwave heating of copper. Science of Sintering,42(2010) 169-182.

Radiation and Injection/Suction Effect on Spanwise Sinusoidal Fluctuating MHD Mixed Convective Flow Through Porous Medium in a Vertical Porous Channel

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***Abstract*---An analysis of magnetohydrodynamic (MHD) mixed convection flow of a viscous, incompressible and electrically conducting fluid through a porous medium filled in a vertical channel is carried out. The walls of the vertical channel lying in the planes $y^* = \pm\frac{d}{2}$ are porous and the fluid is injected through one of the porous plates of the channel with constant velocity and simultaneously sucked through the other plate with the same velocity. The temperature of the plate at $y^* = +\frac{d}{2}$ is assumed to be varying in space and time as $T^*(y^*, z^*, t^*) = T_1 + (T_2 - T_1)\cos\left(\frac{\pi z^*}{d} - \omega^* t^*\right)$. The temperature difference of the walls of the channel is assumed high enough to induce heat transfer due to radiation. A magnetic field of uniform strength is applied perpendicular to the planes of the channel walls. The magnetic Reynolds number is assumed very small so that the induced magnetic field is neglected. The fluid is acted upon by spanwise sinusoidal fluctuating pressure gradient in the vertically upward direction. It is also assumed that the conducting fluid is optically-thin gray gas, absorbing/ emitting radiation and non-scattering. The non-linear partial differential equations governing the flow problem along with its boundary conditions are non-dimensionalized by non-similar transformation and an exact analytical solution of the problem is obtained. The velocity field, the temperature field, the amplitude and the phase angle of the skin friction are shown graphically and discussed in detail.**

In the modern era, there is increase in the demand of air cooling and refrigeration system which put a huge load on the present energy resources present on the earth. The energy resources available with us are not able to cope with the present need. This review paper focuses on the utilization of Solar Energy as an alternative to meet our demands for increasing refrigeration and cooling systems. A comparison is made between traditional method and modern solar cooling technologies which can fulfill our energy needs in future.

Keywords— Magnetohydrodynamic (MHD), spanwise sinusoidal, mixed convection, heat radiation, porous medium.

I. INTRODUCTION

Unsteady magneto hydrodynamic (MHD) mixed convection flows through porous medium always remained of considerable interest because of their occurrence in nature and varied applications in many branches of science and technology. Magnetohydrodynamic (MHD) free convection flow through porous media are very important particularly in the fields of petroleum technology for the flow of oil through porous rocks, in chemical engineering for the purification and filtration processes and in the cases like drug permeation through human skin. A detailed account of the applications of the convection flows through porous media has been reported by Nield and Bejan (2006). A number of studies have appeared in the literature in view of numerous important engineering and geophysical applications of the channel flows through porous medium, for example in the fields of agriculture engineering for channel irrigation and to study the underground water resources, in petroleum technology to study the movement of natural gas, oil and water through the oil channels/reservoirs. Raptis et al. (1982) analyzed free convection MHD flow through a porous medium between two parallel plates. An exact solution for the forced convection flow through porous medium filled in a channel is obtained by Vafai and Kim (1989). Sahin (2008) studied a free convective flow in a vertical channel through a porous medium with heat transfer. Hakiem (2000) analyzed MHD oscillatory flow on free convection radiation through porous medium with constant suction velocity. Singh et al. (2012) studied heat and mass transfer in an unsteady MHD free convective flow through a porous medium bounded by vertical porous channel. Hassanien and Mansour (1990) investigated unsteady magnetic flow through a porous medium between two infinite parallel plates.

Generally majority of authors have treated the permeability of the porous medium as constant. In fact a porous material containing the fluid is a non-homogeneous medium and there can be numerous in homogeneities present in a porous medium. In view of this Singh and Verma (1995) analyzed an oscillatory flow through porous medium with periodic permeability where the permeability varies periodically in a direction and because of which the problem becomes three dimensional. Singh et al. (2000) designed a mathematical model for the fluctuating flow and heat transfer in which the permeability of the porous medium is considered to be varying in space and time both. This three dimensional problem is solved adopting complex

variable notations and employing series expansion method. Singh (2011) studied injection/suction effect on convective oscillatory flow through porous medium bounded by two vertical porous plates.

Thermal radiation effects may play an important role in a number industrial and environmental heat transfer processes, for example, fossil fuel combustion, heating and cooling chambers, evaporation from larger open water reservoirs, astrophysical flows, solar power technology and space vehicle re-entry. High temperature plasmas, cooling of nuclear reactors, liquid metal fluids and power generation systems are some other important applications of heat radiation from a vertical wall to conductive fluids. Heat radiation has important applications in science and engineering, particularly in space technology and other high temperature processes. Actually, many processes in the areas of modern engineering occur at high temperatures and the knowledge of radiation heat transfer beside the convective heat transfer becomes very important for the design of the pertinent equipment such as nuclear power plants, gas turbines and various propulsion devices for jet aircrafts, missiles, satellites and space vehicles. During heat transfer due to high temperature the fluid involved can become electrically conducting. Raptis (1998) analyzed radiation and free convection through porous medium. Makinde and Mhone (2005) investigated heat transfer to MHD oscillatory flow in a channel filled with porous medium. Alagoa et al. (1999) studied radiative and free convective effects of a MHD flow through a porous medium between infinite parallel plates with time-dependent suction. Radiation effects on MHD free convection flow over a vertical plate with heat and mass flux has been investigated by Sivaiah, et al. (2010). Mebine (2007) studied the radiation effects on MHD Couette flow with heat transfer between two parallel plates. Singh and Garg (2010) analyzed radiative heat transfer in MHD oscillatory flow through porous medium bounded by two vertical porous plates.

There are many material processing industrial operations where due to high temperatures all the three modes of heat transportation such as conduction, convection and radiation accompany together. The important areas in which thermal radiation heat transfer must be considered along with thermal convection heat transfer are direct flame impingement (DFI) furnace for rapid heating of metals in materials processing (Malikov et al. 2001), heating of a continuously moving load in the industrial radiant oven (Fedorov et al. 1998) and glass melting simulation (Lentes and Siedow 1999). The high temperatures in these industrial processes may not be uniform everywhere in the processing plants. In other words these high temperatures may not necessarily be constant. It may vary over a period of time and at the same time may be different at different locations. In view of this a few studies have been conducted by considering spanwise cosinusoidal temperatures of the surfaces. Singh (1992) analyzed an unsteady free convection flow past a hot vertical porous plate with variable temperature. Singh and Khem Chand (2000) discussed an unsteady free convective MHD flow past a vertical porous plate with such a variation of the temperature. Sumathi et al. (2011) also attempted heat and mass transfer in an unsteady three dimensional mixed convection flow past an infinite vertical porous plate with cosinusoidally fluctuating temperature. Kumar and Singh (2011) studied an unsteady MHD flow of radiating and reacting fluid past a vertical porous plate with cosinusoidally fluctuating temperature.

Hence, in the present paper an unsteady MHD mixed convection flow of a viscous, incompressible and electrically conducting fluid through a porous medium filled in a vertical channel is studied in the presence of heat radiation when the temperature of one of the channel plates varies spanwise cosinusoidally as shown in figure 1b. The two porous plates of the channel are subjected to a constant injection and suction as shown in figure 1a. A magnetic field transverse to the flow is applied and the magnetic Reynolds number is assumed very small so that the induced magnetic field is neglected. It is also assumed that the conducting fluid is optically-thin gray gas, absorbing/ emitting radiation and non-scattering. An exact solution of the mathematical problem so formed is obtained and the final results for the velocity, temperature, shear stress and heat transfer coefficient in terms of their amplitudes and phase angles are discussed in the last section of the paper.

II. MATHEMATICAL ANALYSIS

Consider an oscillatory MHD convective flow of a viscous, incompressible and electrically conducting fluid through a porous medium in a vertical channel. The insulated plates of the channel are at distance 'd' apart. The porous walls of the vertical channel are lying in the $y^* = \pm\frac{d}{2}$ planes and the fluid is injected through the left porous plate with constant velocity (V) and simultaneously sucked through the other plate with the same velocity (V). The x^*- axis is oriented vertically upwards along the centreline of the channel. The y^*-axis taken perpendicular to the planes of the plates and a transverse magnetic field of uniform strength $\vec{B} = (0, B_0, 0)$ is applied along this axis. The non-uniform temperature of the plate at $y^* = +\frac{d}{2}$ is assumed to be varying spanwise cosinusoidally in space and time both as

$$T^* = T_1 + (T_2 - T_1)\cos\left(\frac{\pi z^*}{d} - \omega^* t^*\right). \qquad (1)$$

Since the plates of the channel are of infinite extent in the x*-direction, therefore, all the physical quantities except the pressure are independent of x*. All fluid properties are assumed to be constant except that the influence of density variation with temperature is considered only in the body force term. The equation of continuity $\nabla.\vec{V} = 0$ for the constant injection/suction at the channel plates integrates to v*= V where $\vec{V} = (u^*, v^*, w^*)$ represents the velocity components in the directions (x^*, y^*, z^*) respectively. The physical configuration of the problem is shown in Figure 1a & 1b.

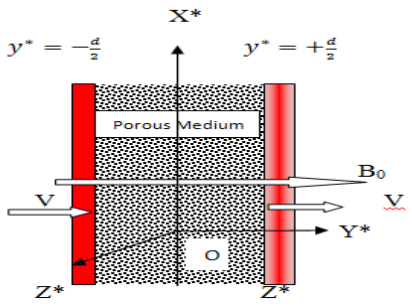

Fig.1a. Hot vertical channel

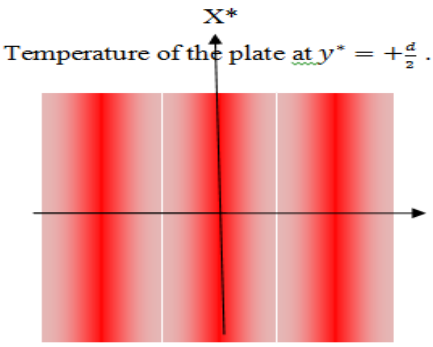

Fig.1b. Spanwise cosinusoidal plate temperature

Using the velocity and the magnetic field distributions as stated above and taking into account the usual Boussinsq's approximation the magnetohydrodynamic (MHD) forced and free convection flow in the vertical channel is governed by the following momentum and energy differential equations:

$$\frac{\partial u^*}{\partial t^*} + V\frac{\partial u^*}{\partial y^*} = -\frac{1}{\rho}\frac{\partial p^*}{\partial x^*} + \vartheta\left(\frac{\partial^2 u^*}{\partial y^{*2}} + \frac{\partial^2 u^*}{\partial z^{*2}}\right) - \frac{\sigma B_0^2}{\rho}u^* - \frac{\vartheta}{K^*}u^* + g\beta(T^* - T_1), \quad (2)$$

$$\rho c_p\left(\frac{\partial T^*}{\partial t^*} + V\frac{\partial T^*}{\partial y^*}\right) = k\left(\frac{\partial^2 T^*}{\partial y^{*2}} + \frac{\partial^2 T^*}{\partial z^{*2}}\right) - \frac{\partial q^*}{\partial y^*}, \quad (3)$$

where ρ is the density, ϑ is the kinematic viscosity, β is the coefficient of volume expansion, g is the acceleration due to gravity, k is the thermal conductivity, cp is the specific heat at constant pressure and p* is the pressure.

The last term in equation (3) stands for heat due to radiation in the y*-direction. Following Raptis et al. (2003) the local radiant for the case of an optically thin gray gas is expressed by

$$\frac{\partial q^*}{\partial y^*} = 4a'\sigma'(T^{*4} - T_1^4), \quad (4)$$

where a' is the mean absorption coefficient and σ' is Stefan- Boltzmann constant. We assume that the temperature differences within the flow are sufficiently small such that T*4 may be expressed as a linear function of the temperature. This is accomplished by expanding T*4 in a Taylor series about T1 and neglecting higher order terms, thus

$$T^{*4} \cong 4T_1^{*3}T^* - 3T_1^4. \quad (5)$$

Substituting (5) into (4) and simplifying, we obtain

$$\frac{\partial q^*}{\partial y^*} = 16a'\sigma'T_1^3(T^* - T_1). \quad (6)$$

The substitution of equation (6) into the energy equation (3) for the heat due to radiation, we get

$$\rho c_p\left(\frac{\partial T^*}{\partial t^*} + V\frac{\partial T^*}{\partial y^*}\right) = k\left(\frac{\partial^2 T^*}{\partial y^{*2}} + \frac{\partial^2 T^*}{\partial z^{*2}}\right) - 16a'\sigma'T_1^3(T^* - T_1) \quad (7)$$

The boundary conditions for the problem are

$$y^* = -\frac{d}{2}: \quad u^* = w^* = 0, \; v^* = V, \; T^* = T_1, \quad (8)$$

$$y^* = \frac{d}{2}: \quad u^* = w^* = 0, \; v^* = V, \; T^* = T_1 + (T_2 - T_1)\cos\left(\frac{\pi z^*}{d} - \omega^* t^*\right), \quad (9)$$

where ω^* is the frequency of oscillations.

Introducing the following non-dimensional quantities

$$x, y, z = \frac{x^*, y^*, z^*}{d}, \; t = \omega^* t^*, \; u = \frac{u^*}{V}, \; \theta = \frac{T^* - T_1}{T_2 - T_1}, \omega = \frac{\omega^* d^2}{\vartheta}, p = \frac{p^*}{\rho V^2}, \quad (10)$$

into equations (2) and (7) we get

$$\omega\frac{\partial u}{\partial t} + \lambda\frac{\partial u}{\partial y} = -\lambda\frac{\partial p}{\partial x} + \left(\frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}\right) - M^2 u - K^{-1}u + Gr, \quad (11)$$

$$\omega Pr\frac{\partial \theta}{\partial t} + \lambda Pr\frac{\partial \theta}{\partial y} = \left(\frac{\partial^2 \theta}{\partial y^2} + \frac{\partial^2 \theta}{\partial z^2}\right) - N^2 \quad (12)$$

where '*' represents the dimensional physical quantities,

$\lambda = \frac{Vd}{\vartheta}$ is the injection/suction parameter,

$M = B_0 d\sqrt{\frac{\sigma}{\mu}}$ is the Hartmann number,

$K = \frac{K^*}{d^2}$ is the permeability of the porous medium,

$Gr = \frac{g\beta d^2(T_2 - T_1)}{\vartheta V}$ is the Grashof number,

$Pr = \frac{\mu c_p}{k}$ is the Prandtl number,

$N = 4\sqrt{\frac{a'\sigma'T_1^3 d^2}{k}}$ is the radiation parameter.

The boundary conditions in the dimensionless form become

$$y = -\frac{1}{2}: u = w = 0, \; \theta = 0, \quad (13)$$

$$y = \frac{1}{2}: u = w = 0, \; \theta = \cos(\pi z - t). \quad (14)$$

III. SOLUTION OF THE PROBLEM

In order to obtain the solution of this flow in the porous channel when the fluid is acted upon by an unsteady periodic drop in pressure, we assume the solution in complex variable notations as

$$u(y,z,t) = u_0(y)e^{i(\pi z - t)},\quad T(y,z,t) = \theta_0(y)e^{i(\pi z - t)},\quad -\frac{\partial p}{\partial x} = Ae^{i(\pi z - t)}, \tag{15}$$

where A is a constant. The real part of the solution will have physical significance.

The boundary conditions (13) and (14) can also be written in complex notations as

$$y = -\frac{1}{2}: u = 0,\ \theta = 0, \tag{16}$$

$$y = \frac{1}{2}: u = 0,\ \theta = e^{i(\pi z - t)}. \tag{17}$$

Substituting expressions (15) into equations (11) and (12), we obtain following equations

$$u_0'' - \lambda u_0' - (\pi^2 + M^2 + K^{-1} - i\omega)u_0 = -\lambda A - G \tag{18}$$

$$\theta_0'' - \lambda Pr\theta_0' - (\pi^2 + N^2 - i\omega Pr)\theta_0 = 0, \tag{19}$$

where the primes in these ordinary differential equations denote differentiation with respect to y. The boundary conditions (16) and (17) reduce to

$$y = -\tfrac{1}{2}:\ u_0 = 0,\quad \theta_0 = 0, \tag{20}$$

$$y = \tfrac{1}{2}:\ u_0 = 0,\quad \theta_0 = 1. \tag{21}$$

The solution of equation (18) for the velocity field under the boundary conditions (20) and (21) is obtained as

$$u(y,z,t) = \left[\frac{1}{2\sinh\left(\frac{m-n}{2}\right)}\left[\frac{Gr}{2\sinh\left(\frac{r-s}{2}\right)}\left\{\left(\frac{e^{\frac{r-s}{2}}}{C_1} - \frac{e^{-\frac{r-s}{2}}}{C_2}\right)\left(e^{my-\frac{n}{2}} - e^{ny-\frac{m}{2}}\right) + \left(\frac{C_1 - C_2}{C_1C_2}\right)\left(e^{my+\frac{n}{2}} - e^{ny+\frac{m}{2}}\right)e^{-\frac{\lambda Pr}{2}}\right\} + \frac{2\lambda A}{C_3}\left(e^{my}\sinh\frac{n}{2} - e^{ny}\sinh\frac{m}{2}\right)\right] + \frac{\lambda A}{C_3} - \frac{Gr}{2\sinh\left(\frac{r-s}{2}\right)}\left(\frac{e^{ry-\frac{s}{2}}}{C_1} - \frac{e^{sy-\frac{r}{2}}}{C_2}\right)\right]e^{i(\pi z - t)}, \tag{22}$$

where $C_1 = r^2 - \lambda r - C_3$, $C_2 = s^2 - \lambda s - C_3$,

$C_3 = (\pi^2 + M^2 + K^{-1} - i\omega)$,

$$m = \frac{\lambda + \sqrt{\lambda^2 + 4(\pi^2 + M^2 + K^{-1} - i\omega)}}{2},$$

$$n = \frac{\lambda - \sqrt{\lambda^2 + 4(\pi^2 + M^2 + K^{-1} - i\omega)}}{2},$$

$$r = \frac{\lambda Pr + \sqrt{\lambda^2 Pr^2 + 4(\pi^2 + N^2 - i\omega Pr)}}{2},\qquad s = \frac{\lambda Pr - \sqrt{\lambda^2 Pr^2 + 4(\pi^2 + N^2 - i\omega Pr)}}{2}.$$

Similarly, the solution of equation (19) for the temperature field under the boundary conditions (20) and (21) is obtained as

$$\theta(y,z,t) = \left(\frac{e^{ry-\frac{s}{2}} - e^{sy-\frac{r}{2}}}{2\sinh\left(\frac{r-s}{2}\right)}\right)e^{i(\pi z - t)}. \tag{23}$$

From the velocity field obtained in equation (22) we can get the skin-friction τ_L at the left plate (y = -0.5) in terms of its amplitude |F| and phase angle φ as

$$\tau_L = |F|\cos(\pi z - t + \varphi), \text{ with} \tag{24}$$

$$F = F_r + i\,F_i = \frac{1}{2\sinh\left(\frac{m-n}{2}\right)}\left[\frac{Gr}{2\sinh\left(\frac{r-s}{2}\right)}\left\{\left(\frac{e^{\frac{r-s}{2}}}{C_1} - \frac{e^{-\frac{r-s}{2}}}{C_2}\right)(m-n)e^{-\frac{\lambda}{2}} + \left(\frac{C_1 - C_2}{C_1C_2}\right)\left(me^{-\frac{m-n}{2}} - ne^{\frac{m-n}{2}}\right)e^{-\frac{\lambda Pr}{2}}\right\} + \frac{2\lambda A}{C_3}\left(me^{-\frac{m}{2}}\sinh\frac{n}{2} - ne^{-\frac{n}{2}}\sinh\frac{m}{2}\right)\right] - \frac{Gr}{2\sinh\left(\frac{r-s}{2}\right)}\left(\frac{r}{C_1} - \frac{s}{C_2}\right)e^{-\frac{\lambda Pr}{2}}. \tag{25}$$

The amplitude is $|F| = \sqrt{F_r^2 + F_i^2}$ and the phase angle

$$\varphi = \tan^{-1}\frac{F_i}{F_r}. \tag{26}$$

Similarity, we can get the Nusselt number, Nu, the heat transfer coefficient in terms of its amplitude |H| and the phase angle □ from equation (23) for the temperature field as

$$Nu = |H|\cos(\pi z - t + \psi) \tag{27}$$

with

$$H = H_r + i\,H_i = \frac{(r-s)e^{-\frac{\lambda Pr}{2}}}{2\sinh\left(\frac{r-s}{2}\right)} \tag{28}$$

where the amplitude |H| and the phase angle ψ of the rate of heat transfer are given as

$$|H| = \sqrt{H_r^2 + H_i^2} \qquad \psi = \tan^{-1}\frac{H_i}{H_r}. \tag{29}$$

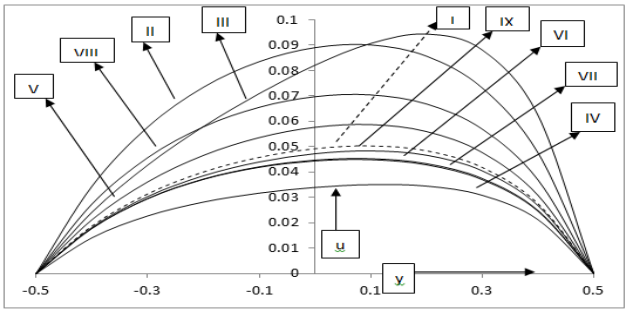

Fig. 2. Velocity profiles for z=0.5 and t=π/2.

Table 1. Sets of parameter values plotted in Figure 2.

λ	Gr	M	K	Pr	N	A	ω	Curve
0.5	1	2	0.2	0.7	1	2	1	I (---)
1.0	1	2	0.2	0.7	1	2	1	II
0.5	5	2	0.2	0.7	1	2	1	III
0.5	1	4	0.2	0.7	1	2	1	IV
0.5	1	2	1.0	0.7	1	2	1	V
0.5	1	2	0.2	7.0	1	2	1	VI
0.5	1	2	0.2	0.7	5	2	1	VII
0.5	1	2	0.2	0.7	1	3	1	VIII
0.5	1	2	0.2	0.7	1	2	5	IX

Table 2. Sets of parameter values plotted in Figs. 3 & 4.

λ	Gr	M	K	Pr	N	A	Curve
0.5	1	2	0.2	0.7	1	2	I (---)
1.0	1	2	0.2	0.7	1	2	II
0.5	5	2	0.2	0.7	1	2	III
0.5	1	4	0.2	0.7	1	2	IV
0.5	1	2	1.0	0.7	1	2	V
0.5	1	2	0.2	7.0	1	2	VI
0.5	1	2	0.2	0.7	5	2	VII
0.5	1	2	0.2	0.7	1	3	VIII

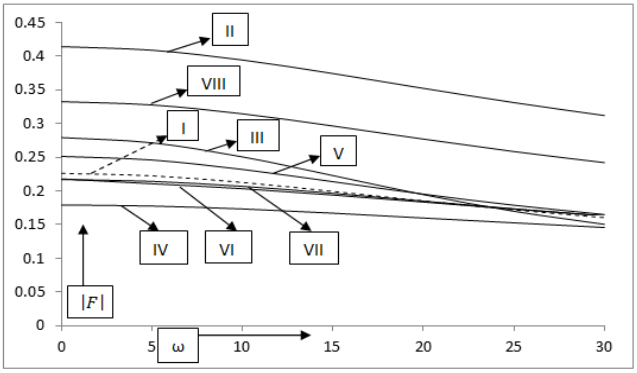

Fig. 3. Amplitude |F|of skin-friction.

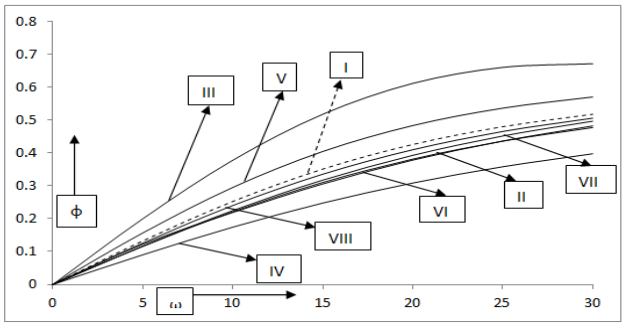

Fig. 4. Phase angle φ of the skin-friction.

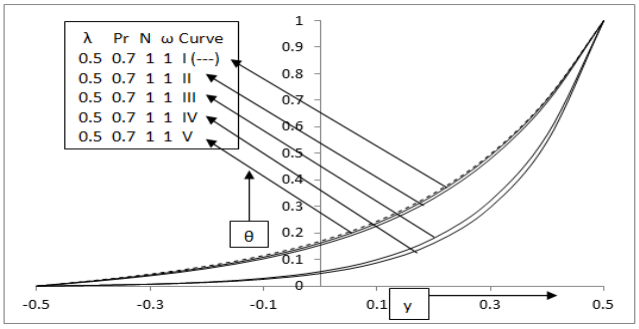

Fig. 5. The temperature field for z=0.5 and t=π/2

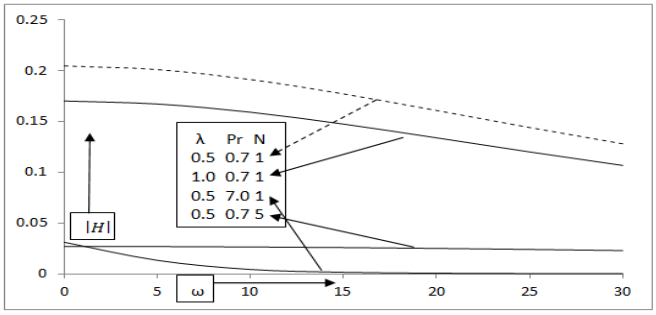

Fig. 6. Amplitude |H| of the rate of heat transfer.

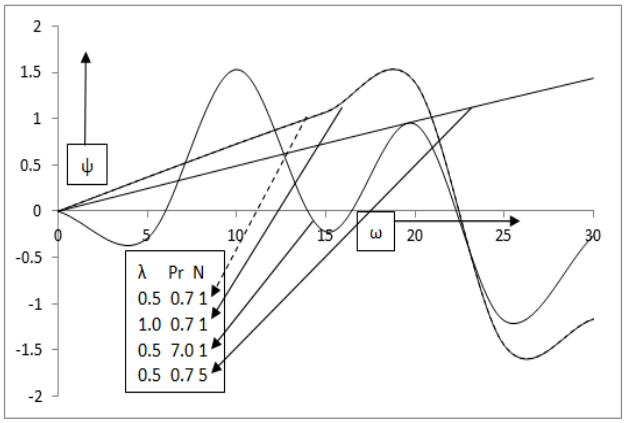

Fig. 7. Phase angle ψ of the rate of heat transfer.

IV. Results and Discussion

An exact analytical solution of the problem of MHD free convection flow through a porous medium bounded by two infinite vertical porous plates is obtained when the plate temperature of the channel varies spanwise cosinusoidally. The two porous plates are subjected to constant injection and suction. It is also assumed that the conducting fluid is optically-thin gray gas, absorbing/ emitting radiation and non-scattering. The analytical results obtained in the previous section are evaluated numerically for different sets of values of the parameters involved in the flow field. In order to have a better insight of the influence of the parameters on the velocity and temperature fields these numerical values are then illustrated through figures. The influence of each of the parameters on the physical quantities like the velocity, the temperature, the amplitude and the phase of the skin-friction are depicted through these figures.

The effect on the velocity field u(y, z, t) with the increase of different parameters over the width of the channel are shown in Figure 2. This figure clearly shows that the velocity is maximum in the middle of the channel which leads to parabolic velocity profiles in the channel as expected. To assess the influence of each of the parameter on the velocity every curve is compared with the dotted curve I (---). This figure clearly shows that curves II, III, V and VIII lie above the dotted curve I (---) which means that the velocity increases with the increase of injection/suction parameter λ, Grashof number Gr, permeability of the porous medium K and favorable pressure gradient A respectively. There is a sharp rise in the velocity with the increase of the injection/suction parameter λ. The increase of velocity with the increase of the Grashof number Gr physically means that the enhancement of the buoyancy force leads to increase of the velocity component u(y, z, t) of the velocity. The increase of velocity with the increase of permeability of the porous medium indicates that the resistance posed by the porous medium reduces as the permeability of the medium increases because of which the velocity increases. As expected the larger favorable pressure gradient in the channel leads to faster flow, hence, velocity increases.

The effects of other parameters like Hartmann number M, Prandtl number Pr, radiation parameter N and frequency of oscillations ω are represented by curves IV, VI, VII and IX respectively. These curves show smaller values than those of dotted curve I (---). This means that the flow velocity decreases with the increase of these parameters. Lorentz force which is introduced due to the application of the transverse magnetic field retards the velocity. This force gives a dragging effect on the flow. The two values of the Prandtl number chosen are Pr=0.7 and Pr=7 which represent air and water respectively, most commonly found fluids on the planet earth. It is evident that the velocity is less in water than in air. Since the Prandtl number gives the relative importance of viscous dissipation to the thermal dissipation so for larger Prandtl number viscous dissipation is predominant and due to this velocity decreases. The increase of radiation N and the frequency ω leads to a decrease in velocity.

The variation of the amplitude |F| of the skin-friction with the increase of different parameters like the injection/suction parameter λ, Grashof number Gr, Hartmann number M, permeability of the porous medium K, Prandtl number Pr, radiation parameter N, and the pressure gradient is presented in Fig.3. It is obvious from this figure that for any set of parameters the amplitude goes on decreasing with the increasing frequency of oscillationsω. The skin-friction amplitude increases with the increase of injection/suction parameter λ, Grashof number Gr, permeability of the porous medium K and the pressure gradient A. It is true physically also because the increase in these parameters results into velocity increase which consequently leads to the enhancement of shear stress. However, the increase in Hartmann number M, Prandtl number Pr or the radiation parameter N attribute towards the decrease in the amplitude of the skin-friction.

The behavior of the phase angle φ of the skin-friction τ_L is shown in Figure 4 for different values of various flow parameters. From this figure it is evident that there is always a phase lead because its values computed numerically remain positive throughout for any set of values of the flow parameters. We notice from this figure that the phase lead goes on increasing with increasing frequency of oscillations ω. The phase angle increases when the value of the Grashof number Gr is increased from 1 to 5 and that of the permeability of the porous medium K from 0.2 to 1 keeping the values of all other parameters fixed. However, the phase lead reduces when the values of other parameters increased i.e., the injection/suction parameter increased from λ=0.5 to λ=1, Hartmann number increased from M=2 to M=4, Prandtl number is increased from Pr = 0.7 to Pr = 7.0, the radiation parameter is increased from N = 1 to N = 5 or the pressure gradient A=2 to 3. This variation with the Prandtl number indicates that the phase lead is less in water (Pr = 7.0) than in air (Pr = 0.7).

The variation of the temperature with the injection/suction parameter , Prandtl number Pr, radiation parameter N and the frequency of oscillations are shown in Fig. 5. The comparison of different curves with the dotted curve reveals that the temperature decreases with the increase of all these parameters.

The amplitude |H| and the phase angle of the rate of heat transfer against the frequency of oscillations are illustrated in Figures 6 and 7 respectively. It is evident from Fig. 6 that the amplitude |H| decreases with the increase of injection/suction parameter , Prandtl number Pr and the radiation parameter N. The amplitude in the case of water (Pr =7) becomes negligible for larger values of oscillations ω. The increase of radiation parameter stabilizes the amplitude with increasing frequency of oscillations ω. Figure 7 shows that with increasing oscillations the phase angle of the rate of heat transfer oscillates between the phase lag and the phase lead as the injection/suction parameter or the Prandtl number are increased. For the values of injection/suction parameter the amplitude remains linear initially for smaller oscillations but oscillates thereafter for larger ω. It is interesting to note that the phase lead with increasing radiation becomes linear with the increasing frequency of oscillations ω.

REFERENCES

[1] Nield, D. A. and Bejan, A. (2006). Convection in porous media, Springer, New York.

[2] Raptis, A. Massalas, C. and Tzivanidis, G. (1982). Hydromagnetic free convection flow through a porous medium between two parallel plates, PhysicsLetters A, 90, 288-289

[3] Vafai, K. and Kim, S. (1989). Forced convection in a channel filled with porous medium-an exact solution, ASME Journal of Heat Transfer, 111, 1103-1106.

[4] Sahin, A. (2008). Free convective flow in a vertical channel through a porous medium with heat transfer, Int. J. Appl. Math., 21, 67.

[5] Hakiem, E.I.M.A. (2000). MHD oscillatory flow on free convection radiation through porous medium with constant suction velocity, J. Magnetism and Magnetic Materials, 220, 271-276.

[6] Singh, K. D., Chand, Khem. and Sharma, Shavnam. (2012). Heat and Mass transfer in an unsteady MHD free convective flow through a porous medium bounded by vertical porous channel, Int. J. Math. Sci. & Engng. Appl., 6, 317-336.

[7] Hassanien, I. A. and Mansour, M. A. (1990). Unsteady magnetic flow through a porous medium between two infinite parallel plates, Astrophysics and Space science, 163, 241-246.

[8] Singh, K. D. and Verma, G. N. (1995). Three dimensional oscillatory flow through a porous medium with periodic permeability, Z. Angew. Math. Mech. (ZAMM), 75, 599-604.

[9] Singh, K. D., Sharma, R. and Chand, Khem.(2000). Three dimensional fluctuating flow and heat transfer through a porous medium with variable permeability, Z. Angew. Math. Mech. (ZAMM), 80, 473-480.

[10] Singh, K. D. (2011). Effect of injection/suction on convective oscillatory flow through porous medium bounded by two vertical porous plates, Int. J. Physical and Mathematical Sciences, 2, 140-147.

[11] Raptis, A. (1998). Radiation and free convection flow through a porous medium, International Communications in Heat and Mass Transfer, 25, 289-295.

[12] Makinde, O. D. and Mhone, P. Y. (2005). Heat transfer to MHD oscillatory flow in a channel filled with porous medium, Rom. Journ. Phys., 50, 931-938.

[13] Alagoa, K. D., Tay, G. and Abbey, T.M. (1999). Radiative and free convective effects of a MHD flow through a porous medium between infinite parallel plates with time-dependent suction, Astrophysics and Space Science, 260, 455-468.

[14] Sivaiah, M., Nagarajan, A.S. and Reddy, P.S. (2010). Radiation effects on MHD free convection flow over a vertical plate with heat and mass flux, Emirates Journal for Engg. Research, 15 (1), 35-40.

[15] Mebine, P. (2007). Radiation effects on MHD Couette flow with heat transfer between two parallel plates, Global J Pure Appl Math, 3, 191-202.

[16] Singh, K. D. and Garg, B.P. (2010). Radiative heat transfer in MHD oscillatory flow through porous medium bounded by two vertical porous plates, Bull. Cal. Math. Soc. 102, 129-138.

[17] Malikov, G. K., Lovanov, D. L., Malikov, K. Y., Lisienko, G. V., Viskanta, R. and Fedorov, A. G. (2001). Direct flame impingementheating for rapid thermal materials processing, Int. J. Heat and mass Transfer, 44, 1751-1758.

[18] Fedorov, A. G., Lee, K. H. and Viskanta, R. (1998). Inverse optimal design of the radiant heating in materials processing and manufacturing, J. Materials Engineering and Performance, 7, 719-726.

[19] Lentes, F. T. and Siedow, N. (1999). Three-dimensional radiative heat transfer in glass cooling processes, Glass Sci. Technology Glastechnische Berichte, 72(6), 188-196.

[20] Singh, K. D. (1992). Unsteady free convection flow past a hot vertical porous plate with variable temperature, Proc. Indian Natn. Sci. Acad., 58, 537-544.

[21] Singh, K. D. and Chand, Khem. (2000). Unsteady free convective MHD flow past a vertical porous plate with variable temperature, Proc. Nat. Acad. Sci. India, 70, 49-58.

[22] Sumathi, K., Anuradha, S. and Arunachalam, T. (2011). Heat and mass transfer in an unsteady three dimensional mixed convection flow past an infinite vertical porous plate with cosinusoidally fluctuating temperature, International J. Engineering Science and Technology, 3, 8569-8578.

[23] Kumar, R. and Singh, K. D. (2011) Unsteady MHD flow of radiating and reacting fluid past a vertical porous plate with cosinusoidally fluctuating temperature. International J. Appl. Math. and Mech., 7, 19-35.

[24] Raptis, A. A., Perdikis, C. and Leontitsis, K. (2003). Effects of radiation in an optically thin gray gas flowing past a vertical infinite plate in the presence of a magnetic field, Heat and Mass Transfer, 39, 771-773. Doi: 10.1007/s00231-002-0317-8.

Testing of Tool Wear on CNC Turning Machine: A case study

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***Abstract*— In machining, the wear of tool also takes place as well as the work piece manufactured. To study and improve the life of tool we have done this work. In this study, commercial hot work tool steels were selected and their wear behavior under dry sliding condition was investigated after heat treatment applications. For experiment TT3500, CA5515 and CA5535 tool bits are used. These tools bits are extensively used for cutting of die steels. Due to this H11 and H13 die steel materials are used as work piece. The wear produced on these tool bits after machining of die steels are used to determine the compensations for the CNC machine. This compensation is used to guide the CNC machine to make the part slightly smaller than its dimensions according to the wear produced on the tools.**

Keywords— Tool steels; Wear calculations; Compensations.

I. INTRODUCTION

Hot work tool steels are mostly subjected to thermal stresses and mechanical failures. These stresses cause failures in tool steels and shorten their service life. The service life of tool steels is limited by the effect of repeated loading of single or multiple mechanisms of e.g. abrasive or adhesive wear, thermal or mechanical fatigue, and plastic deformation. Particularly, among other mechanisms, wear is the most encountered one and leads usually to economical loss. Mechanical properties, especially wear resistance of hot work tool steels can be enhanced by alloying and appropriate heat treatment applications.

A. Tool

Cutting tool is tool which is used to cut material from the work piece by means of shearing. Cutting tools may be single-point or multipoint tools. Single-point tools are used in turning, boring, plaining etc and cut material with the help of one cutting edge. Milling, Grinding and drilling tools are multi-point cutting tools. In Grinding abrasive action takes place to remove material.

B. Wearing of tool

Wearing of tool is the the gradual failure of cutting tools during operation. It is a term mostly associated with pointed tools, tool bits or drill bits which are used with machine tools. The effects of tool wear are:

- Increased cutting force on tool
- High temperature produces
- Rough surface finish
- Decreased dimensional accuracy
- Tool breakage

During cutting action tools cuts the surface of workpiece. Due to this cutting, tool is also worn out and the dimensions of the tool changed.

C. CNC Machining

CNC Machining is used in the manufacturing industries that uses the computers to control machine tools. Tools that can be controlled in this way includes lathes, milling, and grinding. The CNC means Computer Numerical Control.

In CNC Machining, machine tools takes programs in numeric code form through numerical control. A computer program includes CNC machining language called G-code that automatically controls all specifications like feed rate, co-ordinates and speeds. CNC machining is used in manufacturing for metal and plastic parts.

Firstly a CAD drawing is made on solidworks, creo etc, and then code is generated with the help of CAM softwares (like NX, Mastercam) that the CNC machine will understand. The program is loaded in CNC machine and an operator run a test that ensure there is no problems.

II. EXPERIMENTAL STUDY

TABLE I. RAW MATERIALS

Die Steel	Tool Inserts
H11 Steel	TT3500
H13 Steel	CA5515
	CA5535

A. Die Steels

TABLE II. PROPERTIES OF DIE STEEL MATERIALS

S.no.	1	2
Material	H11 Steel	H13 Steel
Properties	An air hardening, chromium and molybdenum hot work steel which have highest toughness of the 5% chromium.	The most versatile air hardening, 5% chromium hot work steel have good combination of high toughness, temper resistance and thermal fatigue

		resistance.
HRC	48	48
Toughness Wear Resistance Hot Hardness		

1) H11 Steel

H-11 is 5% chromium family hot work die steel. H-11 steel exhibits high hot tensile strength and toughness. It has good thermal conductivity and ability to reduce hot cracking.

Fig. 1. H11 Steel

2) H13 Steel

H-13 is 5% chromium hot work tool steel with high value of vanadium. H-13 is an air hardening tool steel which have a very good red-hardness with toughness and covers a wide variety of applications. H-13 hot work Tool Steel is water cooled in service and gives high temperature strength and wear resistance.

Fig. 2. H13 Steel

B. TOOL BIT MATERIAL

1) TT3500:

Taegu Tec has introduced a new coated carbide grade for machining steel as shown in figure 3. The flexibility of the TT3500 enables customers to conduct machining on over 50% of their steel turning applications. Providing customers with an insert grade that can cover a wide range of applications from low carbon steel to cold work die steel and applications from roughing to finishing is very important for general machine shops.

The new grade has a high combination of wear resistance and toughness, credit to its high strength substrate that provides exceptional tool life even in interrupted cuts. The Al2O3 coating has a smooth surface that provides the end user with longer tool life in continuous cuts in high speed machining. The TT3500 is capable of cutting anything from low carbon steels with a hardness of 150BHN at 250-600m/min to alloy steels with a hardness ranging from 180-220BHN at feeds ranging from 80-300 m/min.

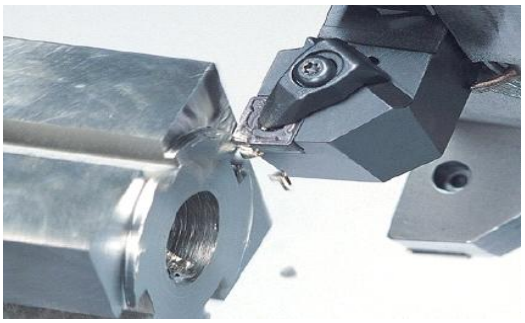

Fig. 3. Insert TT3500

2) CA5515

The extra smooth outer TiN coating reduces cutting forces, resists adhesion and prevents sudden fracture as shown in figure 4. The TiCN layer assists in increasing toughness and wear resistance. As a result, these new products provides stable processing of steel includes both continuous cutting and interrupted cutting processes are involved.

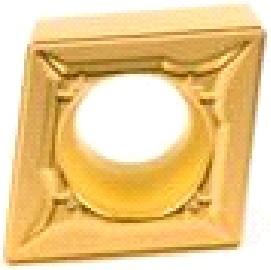

Fig. 4. Insert CA5515

3) CA5535

The properties of CA5535 are Sifter Gear velocity is 400 sfm and doc is 0.07 and feed is 0.008 ipr and it can machine 300 pcs/edge. Competitor D (coated) 200 pcs/edge .CA5535 machined 1.5 times as many work pieces as Competitor D.

Fig. 5. Insert CA 5535

III. EXPERIMENTAL PROCEDURE

Wear Calculation on CNC Turing Machine: - Wear calculation is examined by the observational procedure. In this way, we have taken three samples of H11 die steel and H13 die steel each. On the other hand the tool of CNC machine are taken which are TT3500, CA5515 and CA5535. Now the procedure starts and die steel set on the CNC machine and turning is done by different combinations of die steels and tools. From this data is collected and results are found out. The combinations are:-

H 11 – TT 3500

H 11 – CA 5515

H 11 – CA 5535

H 13 – TT 3500

H 13 – CA 5515

H 13 – CA 5535

From the above combinations, data is collected. This data is used to calculate the tool wear of CNC machine per mm or cm.

For example, as we say about H 11 and TT 3500. The results find out are:-

Total tool wear during turning = 0.25 in 10 depth of cuts of 3mm = 0.025

Length of turning = 30mm

Tool wear / mm = 0.025/30 = 8.33 * 10-4

IV. RESULTS

After heat treatment of H11 and H13, the machining of six samples was taken using different inserts. The results taken are as following in Table III and Table IV.

TABLE III. WEAR OF H11 MATERIAL

Raw Material	Insert	Total tool Wear	Tool wear / micron
H11	TT3500	0.25 mm	0.833333
H11	CA5515	0.21 mm	0.7
H11	CA5535	0.28 mm	0.933333

TABLE IV. WEAR OF H13 MATERIAL

Raw Material	Insert	Total tool Wear	Tool wear / micron
H13	TT3500	0.28 mm	0.933333
H13	CA5515	0.25 mm	0.833333
H13	CA5535	0.35 mm	1.166667

V. CONCLUSIONS

From the readings, it is concluded that insert CA5515 is best insert and it can be selected for coating on dies H11 and H13 for various operations of forming in industries. The composition of CA5515 can be taken and powders of this composition can be coated via various coating methods on dies of H11 and H13.

REFERENCES

[1] Kyocera Catalog Book

[2] http://pdfsb.com/readonline/5a56564b6577313156334e3441483568

[3] http://www.bsrdindia.com.

Case Study on Traffic Management for Rectification of Congestion on A Staggered Junction

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***ABSTRACT*-In this case study we try to rectify the congestion on a staggered intersection by using traffic management. A traffic signals are the most effective as well as an economical method and flexible active control of traffic and is widely used in many major cities worldwide to improve congestion for further improvement purposes and to make the perfect plan for the road stretch when coming from Chandigarh side towards landran. The increase in traffic volumes at staggered junction intersections is one of the important problems that makes difficulties in the traffic movement then leads to traffic congestion. The objective of the this case study is improvement the traffic operation of the selected intersection Chandigarh –Landran and Sirhind – Kharar landran city by analysis and evaluation this staggered junction intersection and using accepted solutions to improve the traffic operation of intersection under local exist conditions and present a best proposal to enhance the performance at the staggered junction intersection .To achieve these objectives, the traffic volumes data collection and layout plan for Landran – Banur and Sirhind –kharar staggered junction intersection that required for the traffic volume data and analysis were gathered and done by manual count method and designed by British method of design of traffic lights.**

Keywords: Rectification of Congestion; Lights Traffic data

I. INTRODUCTION

A recent study showed that congestion wasted 2.9 billion gallons of fuel in 2012The total financial cost of congestion is $121 billion, of which $27 billion is wasted time and diesel fuel from trucks moving goods .The best way to ease congestion is to drive less, bike and walk more, and to use public transportation when it's available. But beyond that, it makes sense to look at how our current driving behaviour contributes to congestion. New technologies that more evenly distribute traffic and alert drivers of problems down the road are redefining how we manage our highways. At the heart of all this new technology is the ability to adapt to constantly changing highway conditions and respond in the most efficient manner - we are working on making our highways smarter with new techniques and tools. The present paper includes some of the new tools and technologies that are being used or that can be used worldwide to fight against traffic jam. The paper also contains few ways to cut traffic jams out of his life. Traffic congestion is a condition on road networks that occurs as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queuing. The most common example is the physical use of roads by vehicles. When traffic demand is great enough that the interaction between vehicles slows the speed of the traffic stream, this results in some congestion. As demand approaches the capacity of a road (or of the intersections along the road), extreme traffic congestion sets in. When vehicles are fully stopped for periods of time, this is colloquially known as a traffic jam or traffic snarl-up.

Traffic volume study: this study is used to determine the number of movements, pedestrian on vehicular traffic flow & classification of roadway vehicles & it also helps to identify critical flow & time period. The traffic volume data should be collected during peak & non-peak hour with time interval 30 min. After analyzing the data we proposed the design of traffic lights to rectify the congestion. This study is done because traffic volume is useful in design of pavement, geometric design, computing road capacity, planning one way street, regulatory measures, sidewalks cross walks, subways, pedestrian signals, intersection and deciding on signal timing and channelization. It has seen that the future traffic projection based on previous or present day traffic volume studies in necessary for an estimate of the existing facilities. It also seen that the projection of traffic can lead to policy decision with respect to the requirement of bypasses to the city and increase the road capacity. The purpose of this study is to analysis the traffic pattern and trends for the planning of traffic operation and controls of signalling.

II. METHODOLOGY

There are different types of method is used for collecting the data like Manual count & Automatic count. In this case study we used method of counting traffic volume data as manual count method. The data is collected on road Chandigarh Landran – Banur and Sirhind –kharar. Two points in considered in every road A & B, the distance between each point is 1km. On those two points the two students' one stand at the start of the line and other will stand at the end of the line. If the different types of vehicle are used for collecting the data the number of students or person will increase. The number of vehicles has to be counted manually, the data collected for different types of vehicles like Bull Carts, Two Wheelers (TW), Four Wheelers (FW), Low Motor Vehicles (LMV) and High Motor Vehicles (HMV) The time interval is taken 30 min & it is a two lane road. Figure 1; show s the layout plan of the different types of road stretch. The design hour flow is taken from PWD and PIDB departments. The traffic volume data is collected for this study. The data which is collected is shows in the followings figures.

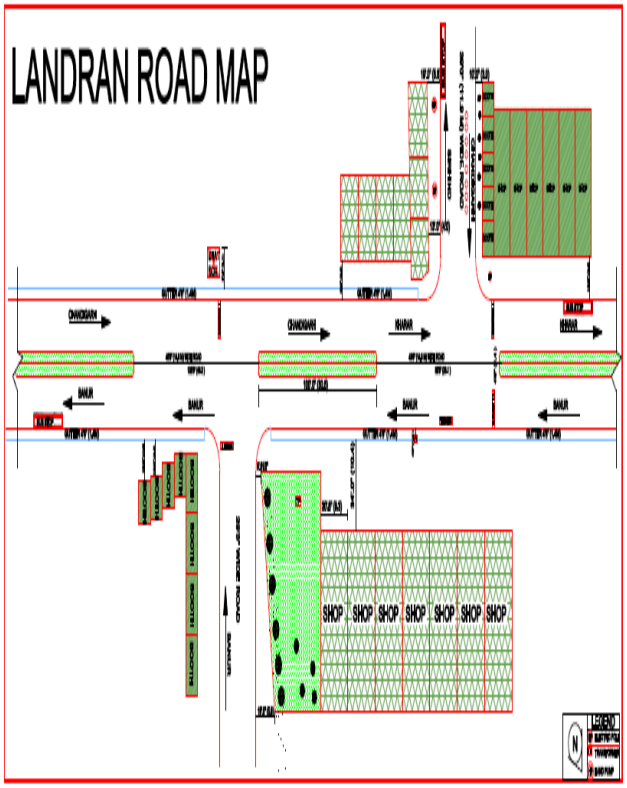


Fig 1: Layout Plan of Landran Road Map

TRAFFIC VOLUME DATA

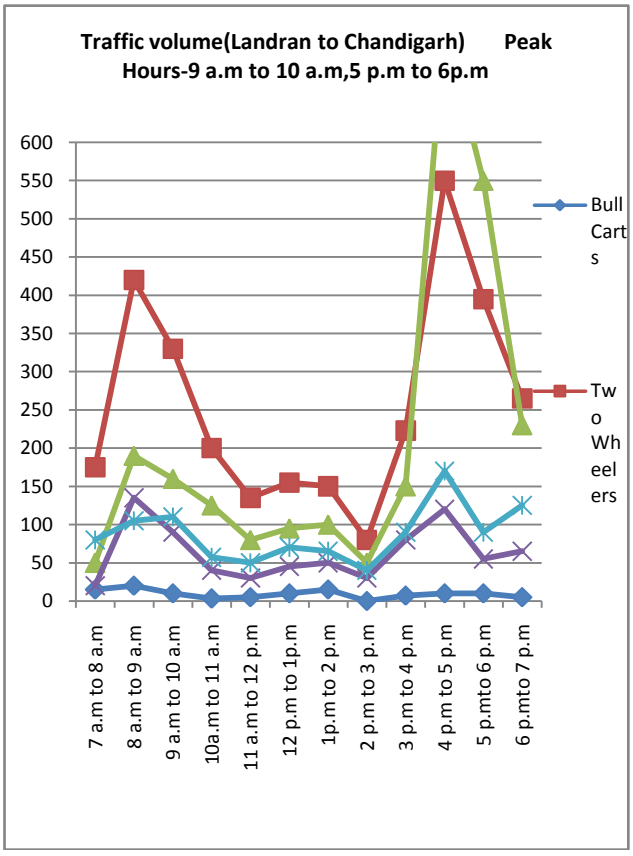


Figure 2: Traffic Volume Landran to Chandigarh (Peak Hour 9-10am, 5-6pm)

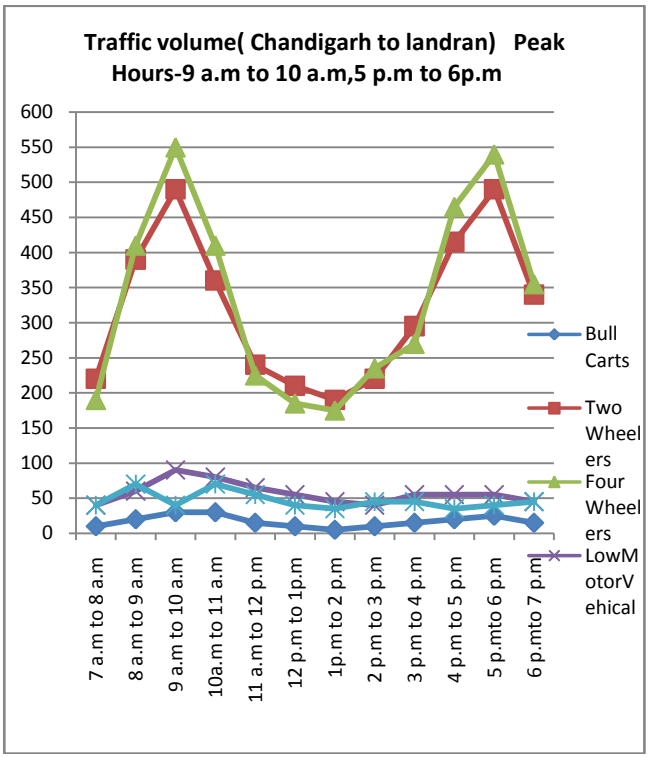


Fig 3: Traffic Volume Chandigarh to Landran (Peak Hour 9-10am, 5-6pm)

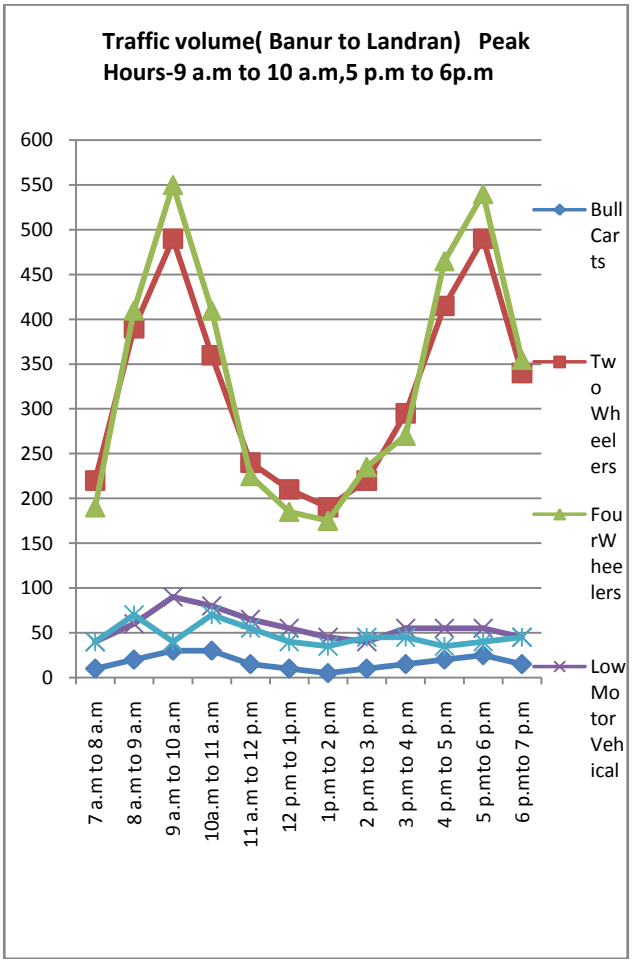


Figure 4: Traffic Volume Banur to Landran (Peak Hour 9-10am, 5-6pm

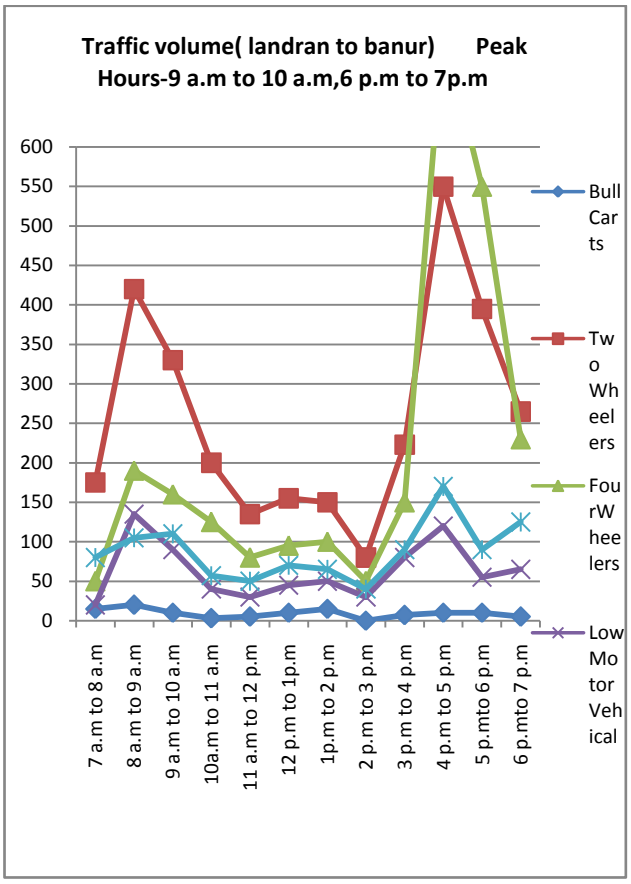


Figure 5: Traffic Volume Landran to Banur (Peak Hour 9-10am, 6-7pm)

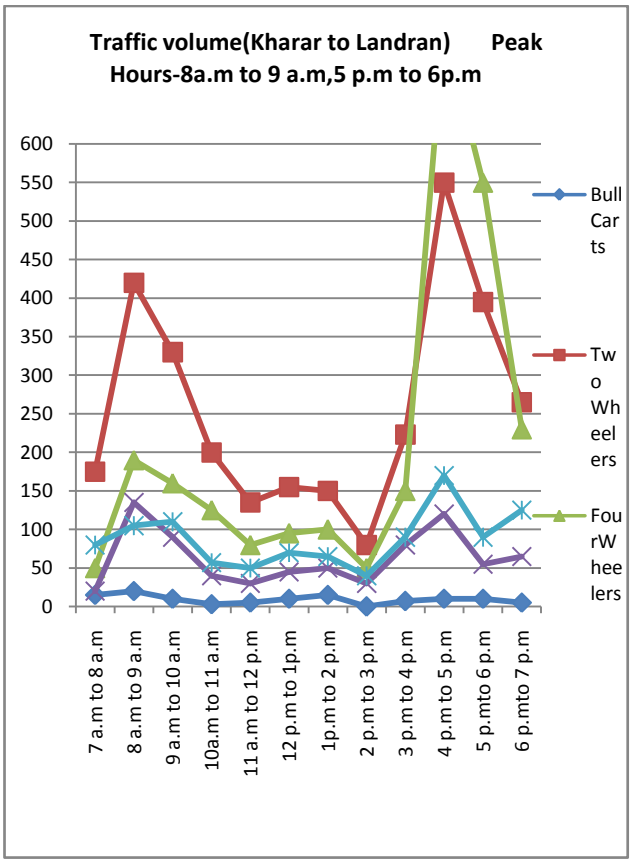


Figure 6: Traffic Volume Kharar to Landran (Peak Hour 9-10am, 5-6pm

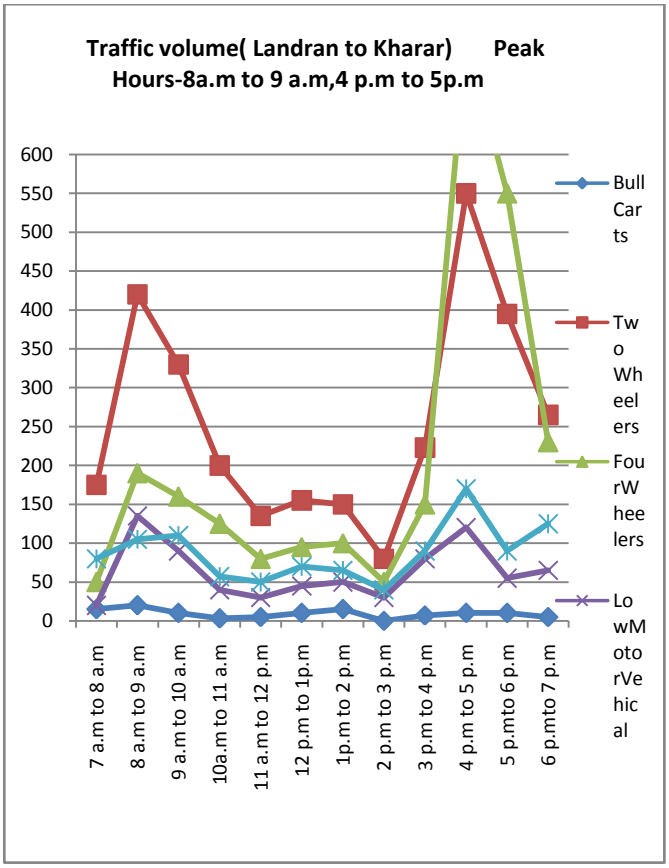


Figure 7: Traffic Volume Landran to Kharar (Peak Hour 9-10am, 5-6pm)

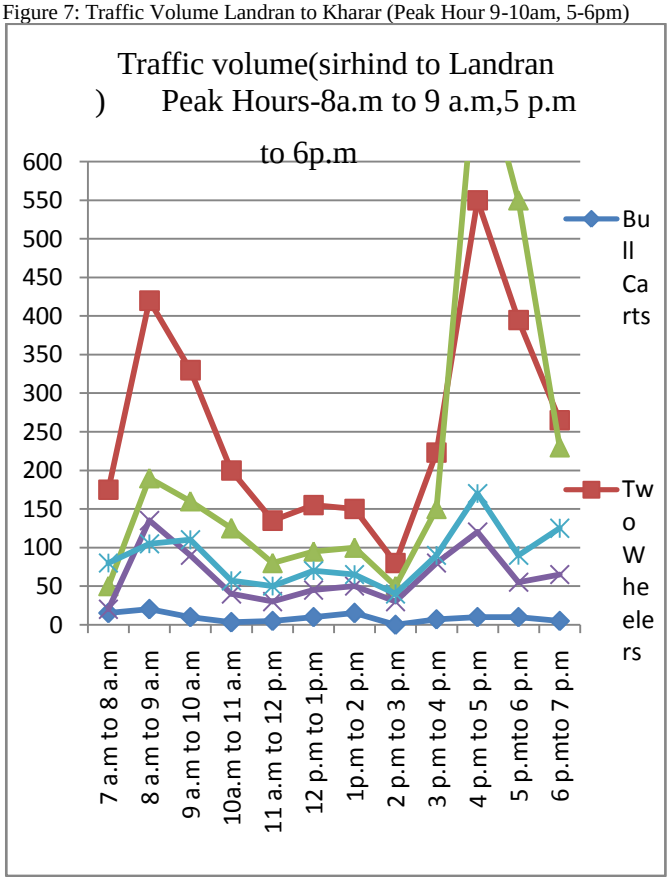


Figure 8: Traffic Volume Sirhind to Landran (Peak Hour 8-9am, 5-6pm)

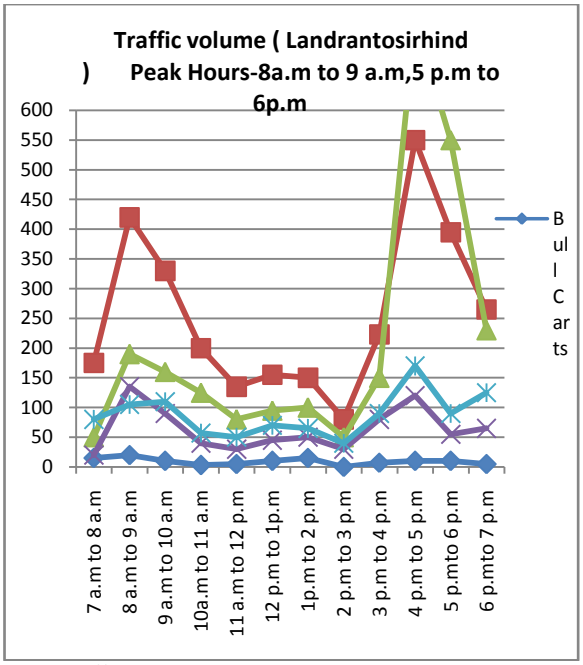


Figure 9: Traffic Volume Landran to Sirhind (Peak Hour 8-9am, 5-6pm)

Figure 10: Traffic at Landran Staggered Intersection (a: Chandigarh-banur road, b: Sirhind –Chandigarh road, c: Sirhind –kharar road, b: Sirhind Banur road)

Above data shows the traffic volume on different roads stretches. The traffic signal design is given below according to above data

DEGISN OF TRAFFIC LIGHTS

TABLE 1: Design of Traffic Lights

Direct on	Chandigarh(C)	Sirhind(S)	Banur(B)	Kharar(K)
Design hour flow	2300	1500	2700	990
Saturation on flow	4672	6247	7770	7770
Y	.49	.19	.37	.14
Y(max)	.49		.37	

Minimum intergreen period (I) =4 seconds (as per British practice)
Amber period (a) =3 seconds
Red/amber period=2 seconds
Time lost due to starting delays =2 seconds per phase

Total time lost (L) =8 seconds
Optimum cycle me= c_o=1.5L+5

1-Y

Co=121 seconds
Effective green time per cycle= c_o-L=121-8=113 seconds
The effective green time for the phases can be calculated as follows:

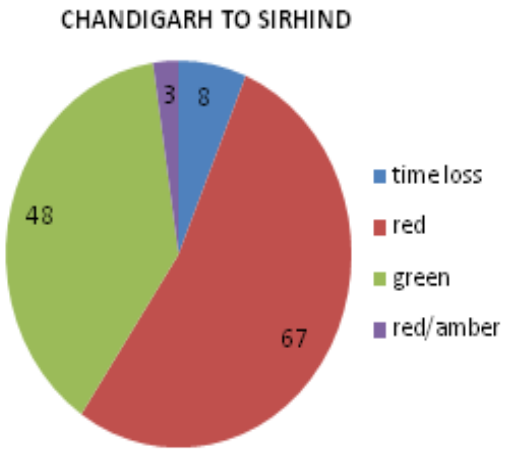
g(C)(S) =65 seconds g(B)(K) =48 seconds

TABLE 2: Signal Time

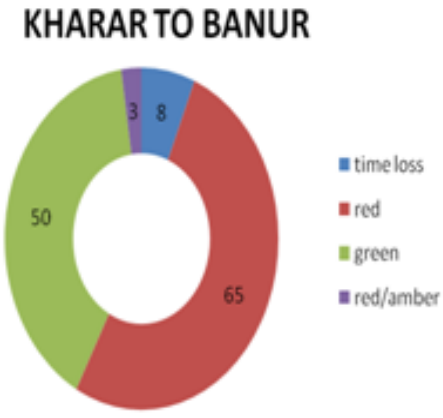
SIGNAL	TIME IN SECONDS
time loss	8
Red	67
Green	48
red/amber	3

TABLE 3: Signal Time

SIGNAL	TIME IN SECONDS
time loss	8
red	65
green	50
red/amber	3



(a)



(b)

Figure 11(a), 11(b):With Traffic Lights at different places

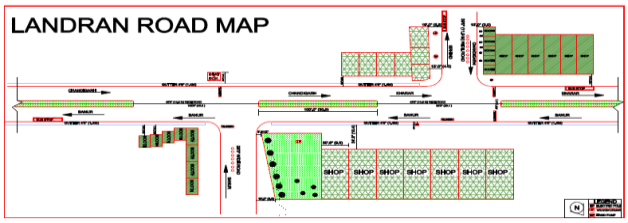
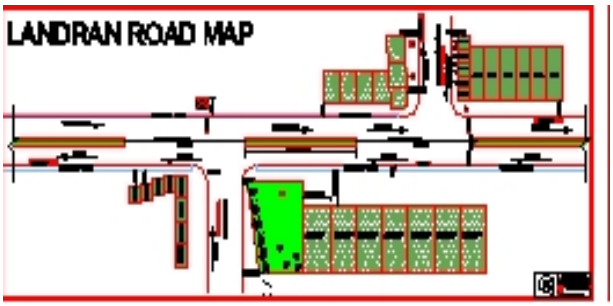


Figure 12: With Traffic Lights at centre not done yet

Fig.13: with traffic lights with minimum space



Above figure shows the traffic time interval at junction. The amber time, green & red time for CHANDIGARH to SIRHIND road is 3 sec, 65 sec, 50 sec & for the BANUR to KHARAR road 3, 48, 67 sec is designed. The figure 11, show the layout plan With Traffic Lights at different places or signal is designed & the figure12, shows the layout plan With Traffic Lights at centre not done yet, Figure 13 shows layout plan with traffic lights with minimum space.

III. CONCLUSIONS

Reasons for traffic jam on landran road:

1. Unpaved roads-the main reason behind the traffic jams on landran road is that roads are damaged i.e. broken and presence of patches which makes the traffic slow to move and further results in jams. Landran to Chandigarh road is damaged badly it slows the traffic and results in traffic jams

2. Bus stops-the point where the buses stop is not right. It stops the traffic for a short amount of time which results in traffic jams.

3. Illegal parking-people park their cars on road side which gets in the way of people passing by

4. Violation of traffic rules-there is a total violation of rules on landran road, which makes a ruckus on the road further results in traffic jams.

5. Auto ricksaw stops-the points where auto ricksaw stop is not right

6. College timings-all the colleges get over at 4:30 p.m which results in a sudden traffic and further leads to traffic jams

7. Checking of H.M.V andL.M.V-checking of trucks and buses is done the roads which results in a standstill of traffic leading to traffic jams

IV. RECOMMENDATIONS

Methods of reducing traffic jam on landran road

- By reconstruction of pavements (roads) which are damaged.
- By introduction of traffic signs and sign boards. Sign boards should be placed on kharar to landran road i.e., sign boards should be placed near chapar -chiri village for the traffic going to Mohali via kharar. It will further reduced the traffic on landran road and hence traffic jamms
- Bus stop should be moved forward to an extent by which the traffic can continues without a glitch.
- Designing landran road there are three possible designs of landran road (wider roads, flyovers, bypasses and expressways) which can reduce traffic jams to solve this problem but for developing countries like India, money and space are serious concerns**.**
- Second approach is to manage existing traffic with same infrastructure, with the use of technology and by involving commuters in the process know as Intelligent Transportation System (ITS) techniques aim to provide information like current road congestion level, predicting travel time, predicting traffic congestion.
- Designing of traffic lights
- Map out and Try some alternative routes, also Plan with your timing. Check traffic reports before you leave and Use a GPS device with live traffic updates during your commute**.**

V. CONCLUDING REMARKS

Traffic signal is an aid to control traffic at intersections where other control measures fail. The signals operate by providing right of way to a certain set of movements in a cyclic order. The Design procedure discussed in this paper include phase design, interval design, determination

Of cycle time, computation of saturation flow and green splitting. The concept and the need of Innovative Transportation Techniques have been reported. The application areas of Innovative Transportation Techniques have also been described. The case studies of landran city where the Innovative Transportation Techniques system are being implemented have been reported. In all the cases the significant benefits to the road users in terms of time saving, reduction in fuel consumption and improvement in air quality have been reported. It has seen that the main reason behind the traffic jams on landran road is that roads are damaged i.e. broken and presence of patches & the point where the buses stop is not right which makes the traffic slow to move and further results in jams. Landran to Sirhind, people park their cars on road side which gets in the

way of people passing by the State Highway which violation of traffic rules-there is a total violation of rules on landran road, which makes a ruckus on the road further results in traffic jams. Auto ricksaw stops-the points where auto ricksaw stop is not right. College timings-all the colleges get over at 4:30 p.m which results in a sudden traffic and further leads to traffic jams Checking of H.M.V andL.M.V-checking of trucks and buses is done the roads which results in a standstill of traffic leading to traffic jams. So we have design the signal which helps to move the traffic is proper flow by introduction of traffic signs and sign boards. Sign boards should be placed on kharar to landran road i.e., sign boards should be placed near chapar -chiri village for the traffic going to Mohali via kharar. It will further reduced the traffic on landran road and hence traffic jamms. Bus stop should be moved forward to an extent by which the traffic can continues without a glitch.

REFERENCES

[1]. Indian Road Congress "IRC: 93-1985 Code GUIDELINES ON. DESIGN AND INSTALLATION. OF. ROAD TRAFFIC" IRC New Delhi

[2]. Indian Road Congress "IRC: 65-1976 Code recommended practice for traffic rotatry" IRC New Delhi Books:

[3]. Khanna S.K. Justo C.E.G. "Highway Engineering" Nem Chand and Bros. Roorkee, 2001.

[4]. Khanna S.K. Justo C.E.G. "Highway Material Testing" Nem Chand and Bros. Roorkee, 2001.

[5]. Kadiyali L.R and N.B Lal"Principal of Highway Engineering"4th edition Khana Publishers, Delhi 2006

Green Architecture

Sustainable Living Environment in Auroville

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***Abstract*—Sustainable architecture has arisen as an effort in architectural design since last decades. It can be interpreted as an approach to architectural design that minimizes resource consumption, utilizes natural energy, mitigates damages to the environment, and helps in improving human health. More decisively, it can also be considered as a tool to raising people's awareness of environmental protection or in other words a reaction to mother nature, which always cohabits and value manhood. The most important characteristic of sustainability is identification of different areas which escalate its power in architecture world, namely i) site selection, ii) environmental quality of indoor, iii) energy consumption, iv) water consumption, v) disposal through waste etc. This paper will review the methods and technologies in few of these areas that should be retained to create the sustainability of the built environment of Auroville. This paper will tend to explain the various dimensions of sustainable living, practices and planning processes in Auroville. It will highlight the innovations and sustainable processes of the experimental community and highlight the day-to-day operations from the individual level, to the organizational and how they are centered on green practices**

Keywords— sustainable architecture, sustainable technology, material, consumption, waste, green practices.

I. INTRODUCTION

Sustainable development is development, which fulfill the needs of the present without compromising the ability of future generation to meet their own needs. The truly formulated definition by World Commission on Environment and Development

It relies on two important concepts: the concept of necessities, and the concept of limits of the competence of the ecosystem to fulfill the potential of the present and future. Due toweakening of natural limitations like finite resources, and also of declining productivity caused by over exploitation of resources, declining quality of water and diluting of biodiversity steps should be taken. For the prosperity of nation, it is required to needs should be fulfilled and limits not to be increased but preferably decreased. Making of Auroville has to look at and incorporate a number of key aspects of a sustainable development. Such key aspects in Auroville are: environmental restoration, rain water harvesting, solar passive architecture, building materials and technology, renewable energy , decentralized waste water treatment, solid waste management etc

A. Essential Aims for Sustainable buildings

Sustainable buildings essential aim is to minimizing environmental impact, responsible utilization of non-renewable resources, create places, products and services and connecting people to their natural surroundings by following certain dimensions.

1) *Design efficiency* This is the concept stage of sustainable building and has the largest impact on cost and performance. It goals to minimize the environmental impact associated with all life-cycle stages of the creating procedure.

2) *Energy efficiency* Examples of approaches to reduce energy use incorporate insulating walls, ceilings, and floors, and constructing high efficiency windows. The layout of a constructing, such as window placement, can be strategized so that natural light comes in for additional heat. Similarly, shading the roof with trees offers an eco-friendly alternative to air conditioning.

3) *Water efficiency* To minimize water consumption and safeguard water good quality, facilities really should aim to boost their water use, which has been collected, used, purified and recycled. We should also make it a goal to waste less water by using items such as ultra-low flush toilets and low-flow showerheads.

4) *Materials efficiency* To lessens the impact of the environment, facilities should appreciate materials that have been recycled and can generate a excess amount of energy. A great example of this is solar power panels. Not only do they provide lighting but they are also a useful energy source. Low-power LED lighting technology minimizes energy consumption and energy bills.

5) *Indoor Air Top quality* Less dangerous organic compounds and providing adequate ventilation and interior finish goods with low-zero emissions will vastly boost a building's indoor air high quality

II. REVIEW OF METHODS AND TECHNOLOGIES

A. Energy Consumption

One of the issues mentioned most in sustainable architectural design is Energy consumption. It has to be kept in mind that the main contributor to the "greenhouse effect" is carbon dioxide, energy and how it is used is the key environmental issue and should be at the forefront of priorities for all those in the construction industry. Promoting energy efficiency, utilizing natural energy, and using renewable energy have been the three main ways to reduce energy use in buildings. It is necessary to have good energy management, effective energy design, and well control of mechanical systems in sustainable design.

1) *Promoting energy efficiency* The first factor that contributes to increasing energy efficiency in buildings is the way that buildings are designed. Few scholars have proved that several basic rules employed before the concept of sustainability helped in reducing energy consumption like: providing maximum areas of shade or reducing the external surface area; well sealing to reduce the infiltration of air from outside; providing insulated masonry such as using thick brick wall and reinforced concrete and expanded polystyrene insulation for external cladding; using reflective or suspended ceilings; and minimizing the height of storeys to save energy consumption for air conditioning. The basic component in green buildings is the good management and control of mechanical and electrical systems. Appropriate and efficient design systems help in achieving energy efficiency in a building. Energy efficient methods are not a difficult goal with today's technology, few of them listed are integrating systems, commissioning the building, using intelligent controls for electric systems, designing systems for appropriate use patterns and locating in areas accessible for maintenance of noise pollution and frequency band discomfort.

2) *Utilizing natural energy* Natural energy is considered as a concept that refers to natural ventilation, lighting, heating, and cooling or in other words the direct uses of passive solar energy and renewable energy is used to describe indirect uses of natural energy converted by artificial technologies. Natural ventilation is enabled based on a basic rule that warm air is lighter than cold air and therefore will tend to rise in relation to cold air. Following are a number of methods used to encourage natural ventilation: opening windows on opposite walls rather than on adjacent walls in order to allow better cross-ventilation; providing enough opening areas to provide sufficient flow; providing windows that are able to control air flow; and incorporating vertical towers into the design to allow the stack effect to draw air through the building. However, one disadvantage of natural ventilation is that it may draw polluted air into building. In order to overcome this, two methods are employed. First, drawing fresh air into the building at only high level. Second, terminal design should be used, which rotates according to the direction of the wind, thereby it is ensured that fresh air is always drawn in from the windward side and exhaust air is expelled on the leeward side. Although natural daylight always exists as a present of Mother Nature, it did not receive significant attention in building design until recently.

B. Water Consumption

Water consumption is one of the important issues in sustainable architecture. Technologies and equipment make it another form of energy. Flat-plate collectors are typically used to collect energy for hot water and space heating. The plates transfer heat to a fluid-usually air or water circulating. This system is associated with the use of advanced glazing such as heat reflecting, heat absorbing glazing and photochromic, thermo chromic, electrochoromic glass as prove by the intellectuals. One of the most promising technologies in using renewable energy is photovoltaic technology. The technology is operated based on the rule that photovoltaic materials can generate direct electrical current when exposed to light.

C. Site Selection and Building Orientation

Site selection and building orientation is the first and important stage in any green design. It directly and strongly affects the environment. Some specific methods used are the followings:

- Protecting features existing on site including native landscape, natural vegetation, historical and cultural elements, and hydrogeology characteristics.
- Restoring damaged sites: this method refers to the concept of restoring sites that have been damaged by previous building or industrial activities. It includes cleaning up site contamination and restoring original landscape features.
- Fostering community sense and culture: this is also known as planning and designing for a good social and cultural environment. Several specific ways of this method is designing more pedestrian walkways, trails, common spaces, bikeways, and green spaces for community activities.

III. SUSTAINABLE TECHNOLOGY AND DESIGN IN AUROVILLE

In designing of Auroville, technology has played an important role to have sustainable living environment. New technologies are being adopted and research is still ongoing to reduce energy and modification methods are adopted for water management to make it more sustainable to the habitats.

Fig 1:- Master plan of Auroville

A. Solar Technology

Renewable source of energy plays an important role in Auroville's establishment. Solar technology has moved to the resource management. The most common application of solar technology is solar electricity in the form of street lighting and also the generation of electricity. Other important use of solar technology is through water pumping and heating which has done tremendous change in its sustainable planning. [Fig2]

Fig 2:- Solar technology

1) *Solar Electricity, Solar Water Pumping and Heaters* Photovoltaic panels (PV) are used for production of electricity. Few of houses are completely driven by such generation. More than 80% Auroville has adopted the technique of solar technology in the form of water heating and pumping. Well/boreholes has dependence on this form of energy to move the water for operations like waste water management systems. The scholars have also formulated Pumping and water heating systems. [Fig 3&4]

Fig 3:- Solar photovoltaic

Fig 4: - Solar energy

IV. WASTEWATER TECHNOLOGY

Auroville take advantage of wastewater technology to fulfill its needs. The Center for Scientific Research (CSR) has used minimal energy input for designing wastewater systems which are grounded around principles of simplicity and affordability. Various techniques of Integrated Decentralized Waste Water Systems have also been adopted to avoid the inefficiency and high cost of municipal wastewater management. For this task underground containment and overhead oxygenating and polishing ponds, pre-filtration tanks, are used in the system. As urban spaces have less space for producing ponds so CSR has initiated a cylindrical vortex system which helps to filter and oxygenate the water by the process of centrifugal and centripetal forces. This resultant 'gray' water from the system is either reinserted into the water table, or is used for local irrigation purposes. Effective Micro-organisms (EM) is another technology used for wastewater treatment. EM, an organic liquid composed of microbes, quicken the decomposition of waste and compose it. It lessens the sludge amount in black and grey water when added effectively to waste water; it reduces the amount of sludge in the black and grey water. [Fig5]

Fig 5:- Wastewater Technology

V. WIND TECHNOLOGY

Wind is one of the major sources of renewable form of energy. For energy production wind is a viable source used by CSR in Auroville. Architects, planners and product designers within Auroville have centralized the core of their innovations around sustainable design. [Fig6]

Fig 6: - Wind Technology

VI. CONCLUSION

This paper has been able to supply information about the different aspects to be taken as tool of sustainable development through architecture. The multidisciplinary nature of

sustainable development and the role of architecture in this regard should be given a thoughtfulness. The paper revealed that if certain issues are to be taken care before hand and energy efficient design ideas should be incorporated then architecture can also help in minimizing this through the use of innovative construction materials, water conservation, site selection and building orientation, renewable energy and other sustainable design means and it has been achieved in Auroville. Indisputably, it is evident from the study that sustainable architecture is a veritable practice through which the goals of sustainable development can be realized. Looking at design from a sustainable angle involves incorporating and utilizing the natural environment into planning and design of Auroville.

REFERENCES

[1] Doerr Architecture, Definition of Sustainability and the Impacts of Buildings

[2] United Nations. World urbanization prospects: the 2003 revision Data tables and highlights. New York: United Nations; 2004.

[3] Thaddeus C Trzyna): A Sustainable World. Defining and Meausring Sustainable Development.

[4] Ronnie Harding: Sustainability: principles to practice. Outcomes

Track-3

Technical Session 1

PHARMACEUTICS & PHARMACEUTICAL CHEMISTRY

Enhancement of Solubility of Antihelminthic Drug Through Solid Dispersion Technique

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Abstract: **Poorly water solubility is a basic problem during formulation development and evaluation of efficacious drug. Albendazole (ABZ) is an antihelminthic drug derived from benzimidazole that has a broad spectrum of activity, good tolerance, and low cost. It has been used against human and animal helminthe parasites, such as nematodes, metacestodes, and hydatoses, for more than two decades. The basic difficulty for oral administration of tablet to children is difficulty in swallowing. So it is better to formulate the drug as mouth dissolving tablet. The albendazole is poorly water soluble so the object of the research is to enhance the solubility of drug by solid dispersion technique using solvent evaporation method.**

Keywords: Solid dispersion, Albendazole

I. INTRODUCTION

Albendazole (ABZ) is an antihelminthic drug derived from benzimidazole that has a broad spectrum of activity, good tolerance, and low cost. It has been used against human and animal helminthe parasites, such as nematodes, metacestodes, and hydatoses, for more than two decades (Gyurik et al., 1981; Evrard et al., 2002). When used in lengthy therapies such as for hydatoses and neurocysticercosis, ABZ can produce gastrointestinal pain, severe headaches, fever, fatigue, hair loss, leukopenia, thrombocytopenia, and liver degeneration. Hence, it is not recommended for patients with hepatic problems. ABZ is teratogenic and embryotoxic and consequently cannot be administered to pregnant women. In some of the less developed regions of the world, helminthic intestinal infections are more common and they may impair ocular, muscle or blood systemic circulation (Evrard et al., 2002). The low cost and broad spectrum of activity of ABZ make it typically the drug of choice for these cases. However, it's very low solubility results in low absorbance through the gastrointestinal tract and in some applications, such as for the systemic diseases, high oral doses that cause adverse gastrointestinal disturbances and several detrimental side effects are required. Therefore, achieving greaterABZ solubility

solid dispersion technique can be used to enhance the sol ubility,dissolution rate and absorption of several insoluble dr ugs.Now a days, theimportance is given to enhance thedisso lution rate of the poorly soluble drugs, so, it increases thebioa vailability of drug.

Solid dispersion is one of the techniques used to increas e thedissolution rate of the lipophilic drugs. Solid dispers ions are prepared by solvent or co-precipitation method where both guestsolute and solid carri er solvent are dissolved in a common volatile solvent such as methanol. The liquid solvent is removed by evaporation under reduced pressure or by freeze drying whichresults in amorphous precipitation of guest in a c rystalline carrier. Solid dispersions are two

component systems which consist of ahydrophilic carrier in which the drug is incorporated. The drug is incorporated in the hydrophilic carrier which may be mole cularly dispersed or may occur as Nano crystals or amor phous nanoparticles.[3]

II. MATERIALS & METHOD

A. Materials

A gift sample of Albendazole (ABZ) pure drug was received from Unicure pharmaceutical, Noida, β cyclodextrin and methanol were obtained from S D Fine chemicals, India, sodium lauryl sulphate was obtained from CDH, India.

B. Method

- Estimation of Albendazole

An UV-VIS Spectrophotometric method based on the measurement of absorbance at 229 nm in a 0.1 N HCL containing 0.05% w/v of sodium lauryl sulphate was used for the estimation of albendazole. The method was validated for linearity, accuracy, precision and interference. The method obeyed Beers law in the concentration range of 4-20µg/ml (r^2=0.9993). When a standard drug solution was repeatedly assayed (n=6), the standard deviation and %RSD were found to be 0.000144 and 1.02 respectively. No interference by the excipients used in the studies was found. The data was not published.

- Phase solubility study

Solubility determinations were performed in triplicate according to the method of Higuchi and Connors (4). In brief, an excess amount of ABZ was taken into a screw-capped glass vial to which 20 mL of aqueous solution containing various amount of β cyclodextrin was added. Then the samples were shaken at 37±0.5 °C for 72 h in a water bath (Remi Pvt Ltd, Mumbai). After 72 h, samples were filtered through a 0.45 µm membrane filter. The filtrate was suitably diluted and analyzed spectrophotometrically at the wavelength of 229 nm using a UV–VIS spectrophotometer (Lab India 3200, India).

- Preparation of solid dispersion by solvent evaporation

The required amount of ABZ and carrier at three different mass
ratio(1:1, 1:2and1:5) were dissolved in sufficient volume of methanol with continuous stirring. The solvent from the solution was removed at 45° withcontinuous stirring to obtai n dry mass. The dried mass was pulverizedpassed through 44 mesh sieve and stored in dessiccator until used for further studies.

- Characterization of solid dispersions
- Saturation solubility studies 5

Saturation solubility was determined by adding excess amounts of drug and solid dispersion to water and 0.1N HCL containing 0.05% (w/v) sodium lauryl sulphate at 37 ± 0.5°C respectively. The solutions were equilibrated under continuous agitation for 24 h and filtered through Whatman filter paper to obtain a clear solution. The absorbance of the samples was measured by UV-VIS spectrophotometer at 229 nm and the concentrations in µg/mL were determined.

- % Practical Yield6,7

Percentage practical yield is calculated to know about percent yield or efficiency of any method, thus its help in selection of appropriate method of production. Solid dispersions were collected and weighed to determine practical yield (PY) from the following equation.

$$PY(\%) = \frac{\text{Practical Mass (Solid dispersion)}}{\text{Theoretical Mass (Drug + carrier)}} \times 100$$

- Drug Content 6, 7, 8

10 mg of solid dispersions were weighed accurately and dissolved in 10 ml of methanol. The solution was filtered, diluted suitably and drug content was analyzed at 295 nm by UV spectrophotometer. Each sample analyzed in triplicate. Actual drug content was calculated for all batches using the equation as follows:

$$\text{Drug content \%} = \frac{\text{Actual content in weight quantity of solid dispersion}}{\text{Theoretical amount in solid dispersion}} \times 100$$

- *In-vitro* disolution rate studies 9, 10, 11

Pure drug, and solid dispersion equivalent to 200 mg albendazole were subjected to in vitro dissolution studies using USP dissolution test apparatus II (paddle type) at 37±0.5ºC using 900 ml each water, 0.1N HCl and 0.05M sodium lauryl sulfate as dissolution media. The rotation speed of the paddle was adjusted to 50 rpm. Samples were collected at 5, 10, 15, 20, 30, 45 and 60 minutes upto 2 h and passed through a 0.45 µm filter and analyzed by UV spectrophotometer at 229 nm .The cumulative percent drug release was calculated and plotted versus time.

- Stability study12

The stability of solid dispersion was checked by storing in tightly sealed vials at 40ºC and 75%RH.Periodically samples were removed and analyzed for their stability.

III. RESULT AND DISCUSSION

The plot of drug solubility against β cyclodextrin concentrations indicated a linear relationship between drug and beta cyclodextrin solution i.e. the solubility of albendazole increased with increasing carrier concentration.

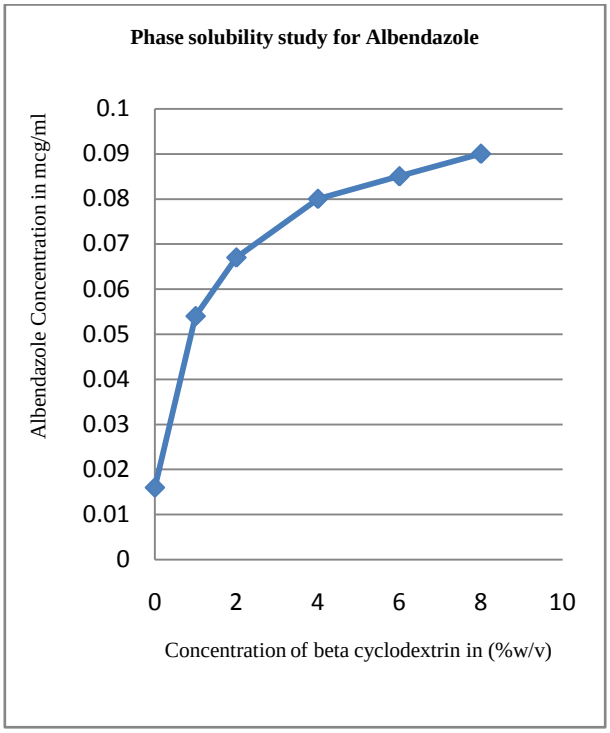


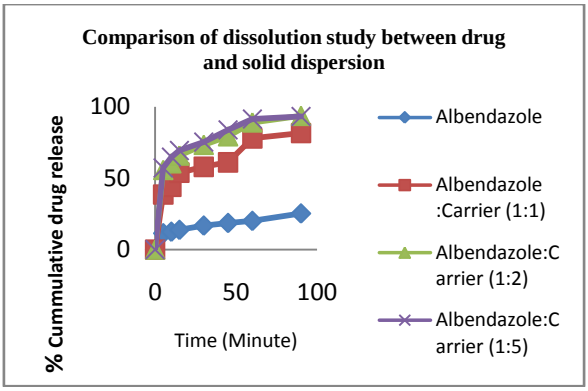
Fig:1 Phase solubility study of ABZ in β cyclodextrin

The solid dispersion of albendazole was prepared by solvent evaporation method and saturation solubility, percentage yield and drug content are as given in table.

Composition	Ratio	Saturated solubility in distilled water (mcg/ml)	Saturated solubility in 0.1N HCL with SLS (mcg/ml)	% Practical Yield	% Drug content
Albendazole Pure	-	0.18±.05	0.21±.02	-	-
Drug: beta cyclodextrin	1:1	55±0.24	64±0.05	88	98.02±1.2
Drug: beta cyclodextrin	1:2	75±0.08	85±0.15	92	102±.07
Drug: beta cyclodextrin	1:5	84±0.06	92±0.06	90	99.78±0.24

Dissolution study

Time (Minute)	Cummulative drug release (%)			
	Albendazole Pure	Solid Dispersion		
		F1	F2	F3
0	0	0	0	0
5	11.38	38.46	55.8	57.2
10	12.45	44.01	60.48	64.74
15	13.76	53.82	65.9	69.41
30	16.76	57.92	73.39	75.3
45	18.59	61.07	79.39	83.81
60	20.05	77.84	89.09	91.5
90	25.25	81.5	93.69	93.24



IV. CONCLUSION

Solid dispersions of Albendazole was prepared by solvent evaporation by using beta cyclodextrin as carrier. In Saturation solubility and phase-solubility studies, it was found that the solubility was increased with increasing the proportion of betacyclodextrin in the formulation. The highest solubility was shown when the ratio of drug & urea was 1:5 prepared by solvent evaporation method. It was found thatdissolution rate of poorly soluble drug Albendazole can be increased by forming into solid dispersions; solid dispersions demonstrated a higher dissolution rate than pure drug. The dissolution study was carried out in 0.1 M Hcl containing 0.05% sodium lauryl sulphate (%w/v) at 37+ 0.5°C up 90 minute and it was found that the rate ofdissolution was increased in solid dispersion as compare to pure drug. The dissolution rate is increased about the fivefold to the pure drug when solid dispersion in the ratio of 1:5 (Drug: carrier).

REFERENCE

[1]. Gyurik, R. J., Chow, A.W., Zaber, B., Brumer, E. L., Miller, J. A., Petka, L. A. and Parish, R. C., Metabolism of albendazole in cattle, sheep, rats, and mice. Drug Metabolism and Disposition, 9, 503-508 (1981).

[2]. Evrard, B., Chiap, P., DeTullio, P., Ghalmi, F., Van Hees, T., Crommen, J., Losson, B. and Delattre, L., Oral bioavailability in sheep of albendazole from a suspension and from a solution containing hydroxypropyl-beta-cyclodextrin. Journal of Controlled Release, 85, 45-50 (2002).

[3]. M.M.Gupta*,1 Patel Mitul G1 , Patel Nimesh S1, Madhulika Kedawat,Enhancement Of Dissolution Rate Of Ibuprofen By Preparing Solid Dispersion Using Different Methods, International Journal of Pharmacy and Pharmaceutical Sciences, Vol 3 Suppl 3, 2011, 204-206.

[4]. T. Higuchi, and K. Connors. Phase solubility techniques. Adv. Anal. Chem. Instrum. 4:17–123 (1965)

[5]. Kim, E.J.,Chun, M.K.,Jang, J.S. Preparation of solid dispersion of felodipine using a solvent wetting method.Eur.J.Pharm.Biopharm., 64,200-205 (2006)

[6]. Kothawade S. N. Kadam N. R. Aragade P. D. and Baheti D. G. (2010). Formulation and characterization of telmisatan solid dispersions. Int J of PharmTech Research, 2(1):341-347.

[7]. Ghebremeskel A.N., Vemavarapu C. and Lodaya M. (2006). Use of surfactants as plasticizers in preparing solid dispersions of poorly soluble API: stability testing of selected solid dispersions. Pharm. Res., 23: 1928–1936.

[8]. Adamo F., Jose R.M., Juan M.G., Jose I.P. and Antonio M.R. (2005). Diclofenac salts, II. Solid dispersions in PEG6000 and Gelucire 50/13. Eur. J. Pharm. And Biopharm., (60): 99–111.

[9]. M. J. Arias, J. M. Gines, J. R. Moyano, and A. M. Rabasco.Dissolution properties and in vivo behavior of triamterene in solid dispersions with polyethylene glycols. Pharm. Acta Helv. 71:229–235 (1996).

[10]. F. Damian, N. Blaton, L. Naesens, J. Balzarini, R. Kinget, P. Augustinjns, and G. V. Mooter. Physicochemical characterization of solid dispersions of the antiviral agent UC-781 with polyethylene glycol 6000 and Gelucire 44/14. Eur. J. Pharm. Sci. 10:311–322 (2000).

[11]. S. Okonogi, T. Oguchi, E. Yonemochi, S. Puttipipatkhachorn, and K. Yamamoto. Improved dissolution of ofloxacin via solid dispersion. Int. J. Pharm. 156:175–180 (1997a).

[12]. Pathak, D., Dahiya, S., Pathak, K. Solid dispersion of meloxicam: Factorially designed dosage form for geriatric population.Acta Pharm., 58, 99-110 (2008)

Pharmacovigilance: Clinical Perspectives Towards Patient Safety

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***Abstract*: Pharmacovigilance is an important and integral part of clinical research relating to the detection, assessment, understanding and prevention of adverse effects, particularly long term and short term adverse effects of medicines. Adverse drug reaction means all the noxious and unintended responses that occur after the administration of the drug at any dose in patients which may be related to the drug. The science and systems used for systematically identifying and correlating drugs and side-effects and taking corrective actions fall under the discipline of Pharmacovigilance. Its main aim is to minimize the risk related to drugs used and to maximize their benefits. According to the regulations of worldwide health agencies, pharmacovigilance units collect adverse events from all over the world that were caused or might have been caused by the use of a specific drug. The aim of this review is to provide a summary of methods used in pharmacovigilance to guarantee the safety, drug development and future need of pharmacovigilance in clinical practice.**

Keywords: Pharmacovigilance, adverse effects, drug safety, Drug regulation.

I. INTRODUCTION

The awareness about the adverse drug reactions in emergence of the practice of Pharmacovigilance, which can be defined as the science of detection, assessment, understanding, and prevention of adverse effects or any other possible drug-related problems.[1-2] It is widely accepted that a drug has to go through phases of clinical trial to establish its safety and efficacy before it is marketed. However, the clinical trials offer various limitations, like; strict criteria of inclusion and exclusion make it to be used in a very selective group of patients; special population groups like children, pregnant woman, and old age population are not studied during the trials; and other factors causing drug reactions such as genetic factors, environmental factors, and drug-drug interactions may not have been studied during the clinical trials. [3]

Medicines have changed the life in which diseases are managed and controlled. Besides all their benefits, evidence continues to mount that adverse reactions to medicines are many or all of those who take them for illness, cause of illness, disability and even death. Adverse drug reactions (ADRs) rank top 10 leading causes of mortality. Aside from the intrinsic dangers associated with the products themselves, individual. Patients may exhibit particular and unpredictable sensitivities to certain medicines. The selection and use of the best and safest medicines for a given individual out of the many choices available thus requires considerable skills on behalf of the prescribing practitioner.[4]

II. ORIGINS OF PHARMACOVIGILANCE

The history of pharmacovigilance goes back more than 40 years. In 1965 the eighteenth World Health Assembly, WHA 18.42, drew attention to the problem of adverse drug reaction monitoring and following further resolutions (see Annex 3) in 1966, 1967 and 1970 the International Drug Monitoring Programme came into being. In 2005, 78 member countries are participating in this Programme and the last decade has seen the participation of numerous developing countries. The programme function on the basis of national Pharmacovigilance centre coordinated by the WHO Programme for International Drug Monitoring, which consists of the WHO Collaborating Centre for International Drug Monitoring, Uppsala and the Pharmacovigilance Department of WHO, Geneva. Recently, the concerns of pharmacovigilance have been widened to include herbal, traditional and complementary medicines, blood products, biological, medical devices and vaccines. Many other issues are also of relevance to the science of pharmacovigilance. These include substandard medicines, medication errors, lack of efficacy, use of medicines for indications that are not approved and for which there is inadequate scientific basis, case reports of acute and chronic poisoning, assessment of medicine-related mortality, abuse and misuse of medicines, and adverse interactions of medicines with chemicals, other medicines and foods and drinks.

III. Concept of Pharmacovigilance Practices

Concept of pharmacovigilance enlists following points that are

- Improvisations in patient care, safety and health in terms of any uses related to drug, therapeutic

agents, medical devices and any paramedical services.

- To find out any problems and adverse responses either fatal or non fatal related to use or application of medicinally active agents.
- To communicate the course and scope of effects of any medicine on human body in a better manner of social well being.
- Part and parcel of assessment of degree of effectiveness and risk benefit ratio so this can help in decrement of harmful effects and increase the benefits.
- Participate as a useful hand in field of cost cutting of medicines provides rational behind careful and safe use of medicines.
- Also encourage the common people understanding towards the life saving and health giving drugs in terms of educational or training programmes.

IV. NEED OF PHAMRACOVIGILANCE

The purpose of this document is to prove it as an essential component that has to integrate public health programmes (PHPs). It is important that active pharmacovigilance is undertaken by all PHPs that use medicines. Every medicine has adverse effect for sure with vary in severity. This document fills the gap and smoothen the communication between Pharmacovigilance systems and PHPs. Fully functioning and optimized Pharmacovigilance system informs or advise the medicine regulatory authority about and ADR.

V. OBJECTIVES OF PHARMACOVIGILANCE

- Detection of severe and unexpected adverse drug reactions to the established drugs and even the minor ones to newer drugs.[5]
- Identification of the risk factors associated with the development of adverse drug reactions and mechanisms of their causation like Type A, Type B, Type C, etc.[6]
- Quantitative estimation of the risk factors, incidence, and prevalence of adverse drug reactions. Estimation of the pharmacoeconomic data related to ADRs.[7]
- Improvement of patient care and safety in relation to the use of medicines with medical and Paramedical interventions remains to be an important parameter, clinical training in Pharmacovigilance and effective communication to the generic public. [8]

VI. FOUNDATION TO SETUP GOOD PHARMACOVIGILANCE PRACTICES

The major objective of the concept is to diminish the arousal of adverse effects and decrease the incidents of severe fatal adverse reaction due to wrong treatment. Drug must not lie in harmful side whether is beneficial or not. Following points should be taken into account for good practices of Pharmacovigilance.

- Maintain the quality of medicine or raw material used in manufacturing.
- Full technical and professional competence in use of medicines and patient care.
- Immediate respond by company or approving agency on need of any withdrawal of assistance related to their use.
- Medical practioner has not only right to write the prescription but also the duty to inform the adverse effects of the drugs.
- The person who dispenses or compounds or sells the drugs must go thoroughly with the prescription to find any chances of drug interactions as well as prescription errors.
- Diagnosis means find out the ail but if this goes in wrong or blurred direction the respected treatment itself cause a disease. It should also include any organ failure or genetic disorder so good treatment became best treatment and no dose related adverse effects come out. An example of that is thalidomide disaster in pregnancy. In case of this disaster ingestion of thalidomide and diethylstilbestrol is little toxic to adults but when ignorantly given to pregnant women can produce fatal and life taking disorders in neonates called teratogenicity.
- The processes involved in the clinical development of medicines will only have been tested for short-term safety and efficacy on a limited numbered intentionally selected and particular group of population but is in sake of safety of public test of medicines should widespread and involve real-life conditions. Effects after release of marketed on infant, lactating mother, pregnant women and aged person. Clinical study should be tried on possible combinations or rational merging of other drugs and food.

VII. RISK MANAGEMENT PLANS

Risk assessment and risk minimization form what FDA calls risk management. It is an iterative process of

- Assessing a product's benefit-risk balance.
- Developing and implementing tools to minimize its risks
- Evaluating tool effectiveness and reassessing the benefit-risk balance
- Making adjustments as appropriate to the risk minimization tools to further improve the benefit-risk balance.

This four part process should be continuous throughout a product's lifecycle with the results of risk assessment informing the sponsor's decisions regarding risk minimization.

The Federal Food Drug and Cosmetic Act (FDCA) and FDA implementing regulations establish requirements for routine risk assessment and risk

minimization (e.g., FDA requirements for professional labeling and adverse event monitoring and reporting).[9] Risk Management Plan (RMP) is an integral part of pharmacovigilance. It is a Risk a documented framework that consist the description of adverse drug reactions (ADR) adhered with the drug. This also defines how to withstand and face them. The information is in form of warning or a precautionary statement on label or leaflets that if seen during the treatments immediately inform these effects to the physician, pharmacist or the manufacturer or any approving agency. Aim of RMP this segment is to provide or prepare a risk-benefit profile of any marketed drug. There are three level of risks; Identified Risks, Potential Risks, and Unknown Risks. The risk profile is the upcoming part of the post-marketing surveillance and labeling amd a major tool. Also described within an RMP are the measures that the Market Authorization Holder, usually a pharmaceutical company, will undertake to minimize the risks associated with the use of the drug. Risk Evaluation and Mitigation Strategies are the essential part of post marketing strategies that can assure that. Positive risk-benefit profile has maintained for the marketed molecule.

Pharmacovigilance and Pharmacoepidemiology In Risk Management

Risk assessment during product development should be conducted in a thorough and rigorous manner; however, it is impossible to identify all safety concerns during clinical trials. Pharmacovigilance involves the identification and evaluation of safety signals. Signals can arise from post marketing data and other sources, such as preclinical data and events associated with other products in the same pharmacological categories. It is possible that even a single well documented case report can be viewed as a signal, particularly if the report describes a positive re challenge or if the event is extremely rare in the absence of drug use. Signals generally indicate the need for further investigation, which may or may not lead to the conclusion that the product caused the event. After a signal is identified, it should be further assessed to determine whether it represents a potential safety risk and whether other action should be taken [10]

VIII. PHARMACOVIGILANCE IN MEDICAL DEVICES

A medical device is an instrument, apparatus, implant, *in vitro* reagent, or similar or related article that is used to diagnose, prevent, or treat disease or other conditions, and does not achieve its purposes through chemical action within or on the unlike medicinal drugs. Risk associated with the insertion medical devices can be evaluated ion the risk scale like class 1 to 3 or say it class 1 to 4 somewhere , class 1 is adhered to least significant harm like optical lens whereas class 3 and 4 high significant harm like pacemaker. A report regarding medical device adhered adverse reactions is essential to be attached with the product.

IX. ROLE IN CLINICAL PERSPECTIVE

Continuous and daily reporting abloy the arised or produced any adverse effect or fatal side effects during clinical, preclinical and marketing plays important role in Pharmacovigilance it is crucial bridge between medicines and patient. National drug policy and schemes have introduced including experts in this field to generate large amount adverse drug reaction (ADR) databases, in this, Post marketing surveillance which is theoretically important but practically in current the weakest link in this segment. Active surveillance systems with a prospective, comprehensive and systematic approach to monitoring, collecting, analyzing and reporting data on ADRs are in the queue of advancement. This laid a huge amount of pressure on pharmaceutical companies to do post marketing studies and report any ADR or come with safety aspects during drug's life in market. This should be communicated to clinicians and patients in the name of a public safety.[14]

X. Beyond Routine Pharmacovigilance: Developing A Pharmacovigilance Plan

For most products, routine pharmacovigilance (i.e., compliance with applicable postmarket requirements under the FDCA and FDA implementing regulations) is sufficient for postmarketing risk assessment. However, in certain limited instances, unusual safety risks may become evident before approval or after a product is marketed that could suggest that consideration by the sponsor of a pharmacovigilance plan may be appropriate. A risks and/or evaluating already identified safety risks. Specifically, a pharmacovigilance plan describes pharmacovigilance efforts above and beyond routine postmarketing spontaneous reporting, and is designed to enhance and expedite the sponsor's acquisition of safety information. [32] The development of pharmacovigilance plans may be useful at the time of product launch or when a safety risk is identified during product marketing. FDA recommends that a sponsor's decision to develop a pharmacovigilance plan be based on scientific and logistical factors, including the following:

1) The likelihood that the adverse event represents a potential safety risk;

2) The frequency with which the event occurs (e.g., incidence rate, reporting rate, or other measures available);

3) The severity of the event;

4) The nature of the population(s) at risk;

5) The range of patients for which the product is indicated (broad range or selected populations only); and

6) The method by which the product is dispensed (through pharmacies or performance linked systems only).

A pharmacovigilance plan may be developed by itself or as part of a Risk Minimization Action Plan (RiskMAP), as described in the *RiskMAP Guidance*. Sponsors may meet with representatives from the appropriate Office of New Drugs review division and the Office of Drug Safety in CDER, or the appropriate Product Office and the Division of Epidemiology, Office of Biostatistics and Epidemiology in CBER \ regarding the specifics of a given product's Pharmacovigilance plan.

FDA believes that for a product without safety risks identified pre- or post-approval and for which at-risk populations are thought to have been adequately studied, routine spontaneous reporting will be sufficient for postmarketing surveillance. On the other hand, pharmacovigilance plans may be appropriate for products for which: (1) serious safety risks have been identified pre- or post-approval, or (2) at-risk populations have not been adequately studied.

A pharmacovigilance plan could include one or more of the following elements:

- Submission of specific serious adverse event reports in an expedited manner beyond routine required reporting (i.e., as 15-day reports);
- Submission of adverse event report summaries at more frequent, prespecified intervals (e.g., quarterly rather than annually);
- Active surveillance to identify adverse events that may or may not be reported through passive surveillance. Active surveillance can be (1) drug based: identifying adverse events in patients taking certain products, (2) setting based: identifying adverse events in certain health care settings where they are likely to present for treatment (e.g., emergency departments, etc.), or (3) event based: identifying adverse events that are likely to be associated with medical products (e.g., acute liver failure);
- Additional pharmacoepidemiologic studies (for example, in automated claims databases or other databases) using cohort, case-control, or other appropriate study designs (see section V);
- Creation of registries or implementation of patient or health care provider surveys (see section V); and
- Additional controlled clinical trials.

As data emerges, FDA recommends that a sponsor re-evaluate the safety risk and the effectiveness of its pharmacovigilance plan. Such re-evaluation may result in revisions to the pharmacovigilance plan for a product. In some circumstances, FDA may decide to bring questions on potential safety risks and pharmacovigilance plans before its Drug Safety and Risk Management Advisory Committee or the FDA Advisory Committee dealing with the specific product in question. Such committees may be convened when FDA seeks: (1) general advice on the design of pharmacoepidemiologic studies, (2) comment on specific pharmacoepidemiologic studies developed by sponsors or FDA for a specific product and safety question, or (3) advice on the interpretation of early signals from a case series and on the need for further investigation in pharmacoepidemiologic studies. While additional information is being developed, sponsors working with FDA can take interim actions to communicate information about potential safety risks (e.g., through labeling) to minimize the risk to users of the product.

REFERENCE

[1] Klepper MJ. The periodic safety update report as a pharmacovigilance tool. Drug Saf 2004;27:569-78.

[2] Livio F, Renard D, Buclin T. Pharmacovigilance. Rev Med Suisse 2012;8:116-9

[3] Pharmacovigilance. Mann RD, Andrews EB, eds. John Wiley & Sons Ltd, Chichester, 2002.

[4] World Health Organisation : safety monitoring of medicinal drugs : Guidelines for setting up and running up of pharmacovigilance centre WHO. Available from ww.who.int/medicinedocs/en/d/Jh2934e.

[5] Bates DW. Spell N, Cullen DJ et al. The costs of adverse drug reactions in hospitalised patients. JAMA 1997; 277: 301-07.

[6] 14. Leape LL. Errors in medicine. JAMA 1994; 272: 1851-7.

[7] 15. Bates DW, Collen DJ, laird N et al. Incidence of adverse drug events and potential adverse drug events in hospitalized patients. JAMA 1997; 277: 307-11.

[8] WHO, Pharmacovigilance: ensuring the safe use of medicines, Geneva: WHO 2004.

[9] WHO, Safety monitoring of medicinal products. : Guidelines for good Clinical Practice (GCP) for trials on pharmaceutical products, Geneva, WHO 1995.

[10] Edwards A, Elwyn G. How effectiveness of risk communication to aid patient's decision should be judged: A review literature. Medical Decision Making 19(4), 1999, 128-434.

[11] *J:\!GUIDANC\6359OCC.doc*

[12] xpert Rev Clin Pharmacol. 2008 Sep;1(5):695-705. doi: 10.1586/17512433.1.5.695.

Global Overview of Groundwater Arsenic Contamination

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***Abstract*: Groundwater with increasing concentrations of Arsenics has been found as a problem of global concern with more than 70 countries experiencing arsenic groundwater contamination. Arsenic is a naturally occurring element found in the earth's crust and within numerous ores. It is classified as a metalloid because it complexes with metals. Arsenic can enter into the body either through drinking water (including water used for cooking); consumption of food containing arsenic or by breathing of arsenic brought into the air through burning of fuel contaminated with arsenic.**

Keywords: Arsenic, contamination, metals

I. INTRODUCTION

Arsenic is a naturally occurring element found in the earth's crust and within numerous ores. It is classified as a metalloid because it complexes with metals. It also reacts with other elements such as oxygen, hydrogen, chlorine, carbon, and sulphur. Elemental arsenic is rare, and the element exists more commonly as organic or inorganic. Arsenical compounds can be grouped as inorganic, organic, and arsine gas (AsH3), and they are further classified according to their valence states: elemental (0), arsenite (trivalent, +3), and arsenate (pentavalent, +5). Trivalent Arsenic or arsenite compounds, both inorganic and organic, are considered the most toxic as compared to the pentavalent and elemental states (6).

Arsenic (As) poisoning via groundwater has become a worldwide problem with more than 70 countries experiencing arsenic groundwater contamination. Some of the best-documented and most severe cases of arsenic contaminated groundwater have been found in aquifers in Asia (Fig. 1). (a) Bangladesh: most districts including Chandpur, Munshiganj,

Noakhali, Satkhira; (b) India: West Bengal, Bihar; (c) China: Inner Mongolia Xinjiang and Shanxi Province; (d) Nepal: Terai region) and South America (Argentina: Salta province, Mexico: Legunea) (3).

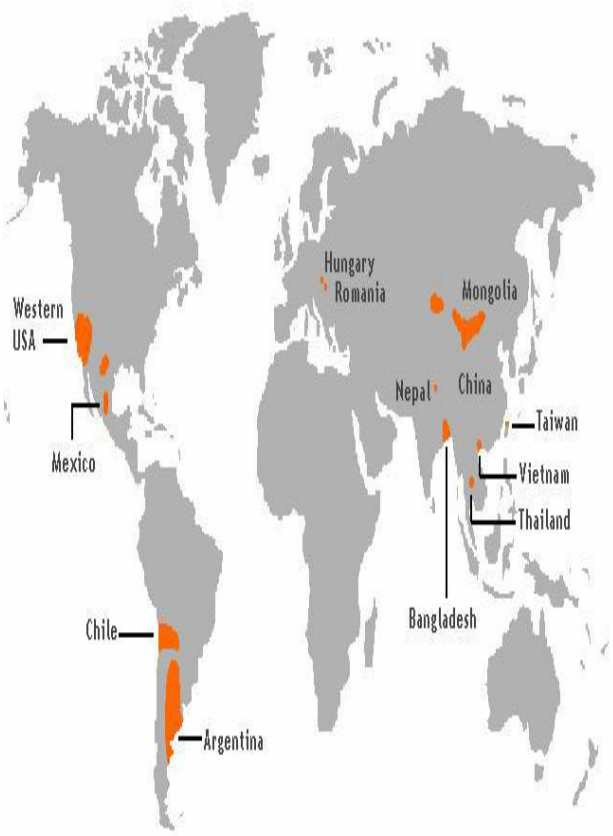

Fig.1: Groundwater arsenic contamination areas in the world (Kibria, 2013)

II. INDIA

The first case of arsenic in India was reported in 1976 from Chandigarh. Since then widespread arsenic contamination has been reported in groundwater from many parts of India including West Bengal , Bihar, Chhattisgarh, Jharkhand, Uttar Pradesh, Bihar, and Assam and other regions of Punjab, Haryana, and Himachal Pradesh, surroundings of New Delhi, the union

territory of Chandigarh, and the state of Rajasthan (Fig. 2). Among them, the most severely contaminated state is West Bengal, where 12 districts and 2,60,00,00 people are affected (3).

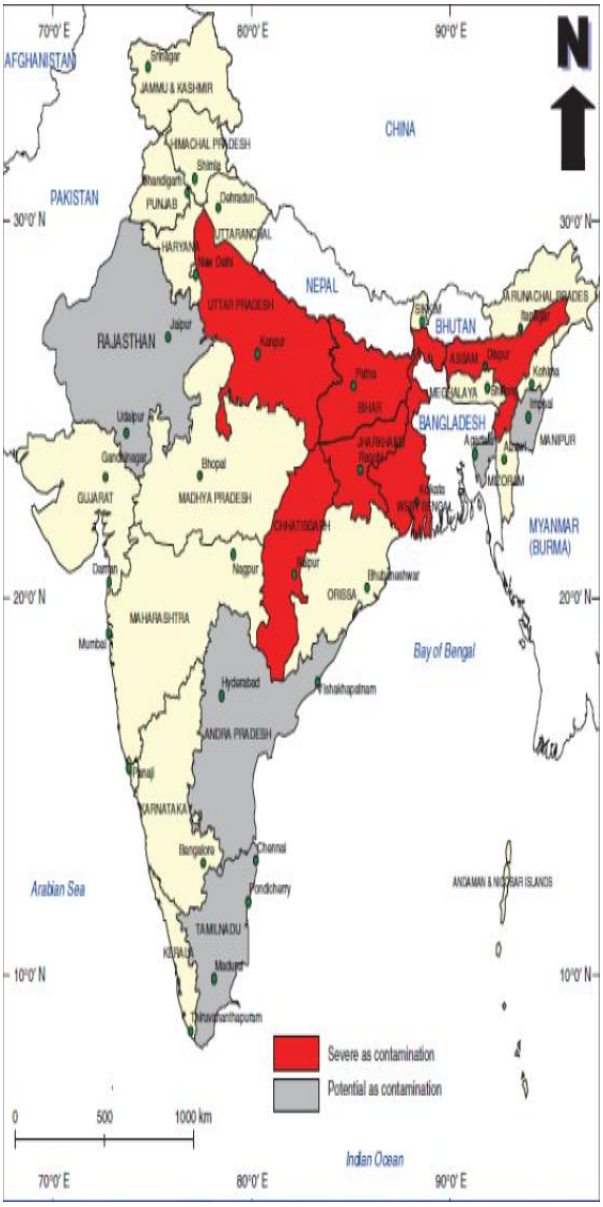

Fig.2: The scenario of the extent and severity of elevated concentration of arsenic in groundwater's of India (Kibria, 2013)

The concentration of Arsenic in the groundwater of the Ganges river basin was reported to be around 50 ppb, which denotes its toxicity. Groundwater and surface water are the main sources of drinking water of this region with groundwater being the prominent source for As exposure. Use of Arsenic contaminated water in northern India is alarming. Deep examination of the effects of Arsenic contamination from a toxicological and epidemiological perspective is imperative. The district of Patna was marked as one of the Arsenic hotspot regions in Bihar. The primary source of Arsenic contamination in the populace is ground and surface water. The secondary source of Arsenic is consumption of food cultivated in Arsenic rich soil irrigated with As contaminated water (1).

III. PUNJAB

Groundwater is the main source of drinking water for more than 95% of the population in Punjab (4).The main source of irrigation in Punjab is ground water. The quality of irrigation water is poor due to presence of heavy metal. One of the most dangerous trace metals in drinking waters is arsenic (As) being both toxic and cancer causing (8). In Punjab, news reported about cancer deaths first emerged in late 1990s when the media reported high cancer mortality in a few select villages. Gyana and Jajjal in Bathinda district came in limelight for being "cancer stricken" villages. The government was at first rejected this type of news in reply to a parliamentary question .Cancer death data was collected from randomly villages in Malwa region of Punjab. 15 villages were selected from cancer prone "high risk" districts of Muktsar, Faridkot, Bathinda and Mansa, and the other 15 from "low risk" districts of Sangrur, Barnala, Moga and Firozpur (2).

IV. PATHWAY OF ARSENIC EXPOSURE

Groundwater with increasing concentrations of Arsenics has been found as a problem of global concern. Arsenics contamination of groundwater is one of the principal pathways of human exposure to inorganic Arsenic. Elevated concentrations of Arsenic have been reported from several regions of the world resulting primarily from natural sources, such as erosion and leaching from geological formations, although sometimes from anthropogenic sources, such as uses of Arsenic for industrial purposes, mining activities and metal processing, and application of pesticides and fertilizers containing Arsenic. The risk of Arsenic contamination is generally much higher in groundwater compared to surface water (7).The main route of arsenic exposure for the general population is via drinking water. Arsenite and arsenate are the most common forms of arsenic in groundwater, as well as the most toxic of the four

compounds. The pathway they follow through the human body is important to understanding arsenicosis, the disease caused by chronic arsenic poisoning. There are three main pathways in which arsenic poses a health threat to humans (Fig. 3): ingestion through drinking water (including water used for cooking); (2) consumption of food containing arsenic; and (3) breathing of arsenic brought into the air through burning of fuel contaminated with arsenic (e.g. straw or cow dung). Arsenic is not readily absorbed through skin, so physical contact with contaminated water, for bathing and washing, is not toxic. When arsenite and arsenate enter the human body, they bind to tissues, inhibit enzyme activity, and interfere with cell respiration (5).

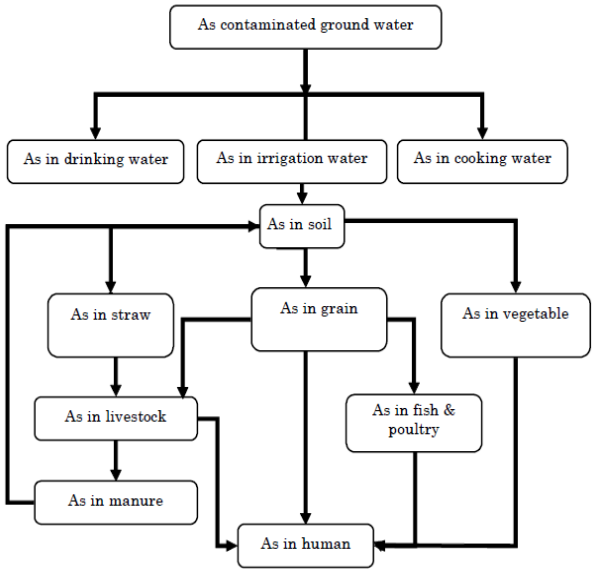

Fig.3: Pathway of the arsenic exposure to human (Sarkar, 2011)

V. CONCLUSION

Thus, looking into the current scenario, it is very clear that most parts of the world are contaminated by arsenic. People should be educated about pesticide storage, use, and proper disposal of the empty containers. Steps should be taken so that pesticides are used carefully and safely.

REFERENCES

[1] A. Nath, P.S.Vendan, S. Kumar, A. Kumar and J. K. Singh, " Toxicity Due to Arsenic in Gangetic Zone of Patna, India and Its Linkage with Cancer". J Environ Anal Toxicol, vol 3, pp 6, 2013.

[2] B.P. Singh, " Cancer Deaths in Agricultural Heartland, A Study in Malwa Region of Indian Punjab, Geo-Information Science and Earth Observation for Environmental Modelling and Management" .M.Sc. (Thesis) 2008.

[3] G. Kibria, "Global Groundwater Arsenic Contamination: Impacts on Agriculture, *Human Health and Social Life"* .Hydrogeology Journal, vol 12, pp103–114, 2013.

[4] H. S. Hundal, K. Singh, D.Singh, "Arsenic content in ground and canal waters of Punjab, North-West India". Environ Monit Assess, vol 154, pp 393–400, 2009.

[5] 5.M. Sarker, "Assessment of Arsenic Exposure to Human, Concentrations in Tube Well Water and Urine and Body Mass Index" .International Journal of Environmental Science and Development, vol 2, 2011.

[6] P. Ravenscroft, " Predicting the global distribution of arsenic pollution in groundwater" .Royal Geographical Society Annual International Conference Department of Geography. Cambridge University.2007.

[7] S. Kapaj, H.Peterson, K. Liber , P. Bhattacharya, "Human Health Effects FromChronic Arsenic Poisoning–A Review". Journal of Environmental Science and Health Part A, vol 41, pp 2399–2428, 2006.

[8] V.Singh, M.S. Brar, P.Sharma and B. S. Brar, " Distribution of Arsenic and its Relation with Chemical Characteristics of Soil and Water in South Western Districts of Punjab, India" .Journal of the Indian Society of Soil Science, vol 59, pp 376 – 380, 2011.

Transgenic Animals

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***Abstract*: Before the development of molecular genetics, the only way of studying the regulation and function of mammalian genes was through the observation of inherited characteristics or spontaneous mutations. Selective breeding was a common practice among farmers for the enhancement of chosen traits, e.g., increased milk production.**

I. INTRODUCTION

The mutual contributions of developmental biology and genetic engineering permitted rapid development of the techniques for the creation of transgenic animals. J.W. Gordon and F.H. Ruddle (1981) was the first to use the term transgenic. It is important application of animal cell to transfer desired isolated foreign genes into livestock. Gene transfer is called transgenesis. So this method involves transfer of desired isolated genes using recombinant technology. Transfection has greatly improved animals like that show higher growth rate; give more milk, wool, etc.

DNA microinjection is the first technique in mammals, was first applied to mice (Gordon and Ruddle, 1981) and then to various other species such as rats, rabbits, sheep, pigs, birds, and fishes. Two other main techniques were then developed: those of retrovirus-mediated transgenesis (Jaenisch, 1976) and embryonic stem (ES) cell-mediated gene transfer (Gossler et al., 1986).

During the 1970s, the first transgenic mice were produced (Brinster, 1974). The cells of two different embryos of different strains were combined together at an early stage of development (eight cells) to form a single embryo that subsequently developed into an adult, exhibiting characteristics of each strain.

Methods:- A no. of methods are available to produce transgenic animals a few of them are:-

A. Transfer of whole nucleus:

In this fertilized egg or embryo can develop into whole individual. In this transfer of whole nucleus from a somatic cell of superior of doner to enucleated egg of another organism. Unfertilized egg are treated with cytochelasin B and centrifuged so that enucleated egg remain in supernatant are collected and nuclear of eggs are settle down at bottom are discarded, nucleai with only residual plasma membrane are obtained in similar way from blastula of donor is called karyoplast. karyoplast is fused with enucleated eggs in the presence of polethylglycol (PEG) and this egg is transferred to uterus of surrogate mother for development.

B. Transfer of embryo:

The first successful transfer of embryo is achieved by Walter Heape in Angora Rabbit in 1891. The developing embryo is bisected by surgical blade and a part of bisected embryo is transferred to uterus surrogate mother and it developed with superior traits.

C. Transfer of chromosome:

In this desired chromosome is taken and isolated at metaphase stage. Then receipient cell and isolated chromosome treated with calcium phosphate and this chromosome is taken by recipient cell.

D. Transfer of DNA:

This method involves the direct microinjection of DNA or segment of DNA from another member of same species or from a different species into pronucleus of a fertilized ovum and inserted genes become the part of host genome by recombination during cell division this DNA may load to expression of genes entirely new to the animal species.

E. Transfer of gene transfer methods:

It was possible only in bacteria and yeast but Oliver Smithies (1985) was first to use this technique by transferring B- globin gene from one person to another person. This technique is convenient because use of marker gene, involvement of vector.

II. TRANSGENIC ANIMAL CLASSIFICATION AND EXAMPLES

Transgenic animals can be divided into five major categories: **disease models, transpharmers, xenoplanters, food sources, and scientific models.**

A. Disease Model:

Disease models are animals that have been modified to show symptoms of particular disease so treatment for that disease can be tested on them. The first Alzhimer's mouse was produced in 1995 by Worester Polytechnic Institute and Transgenic sciences. In the brain of Alzhimer's patients has been linked to beta amyloid plaque. Mouse made by introducing amyloid precusser gene into fertilized egg of mice. the mice overproduce a protein that forms these amyloid plaques and mice display symptoms. A vaccine was tested on mice that entirely prevented the formation of amyloid plaque.This was first Alzhimer's vaccine send to human clinical trails and was cancelled in 2001 due to brain in flammation in majority of paitents but a second generation

vaccine by same company with no deteriorous effect but not proved by FDA.

Oncomouse was made by Stewart et.al (1984) by inserting activated onco genes.

IDS mouse was created in 2001 at University of Maryland.

The Drosophila fly contains a Synuclein gene linked to inheritable parkinson's disease, fly shows loss of motion control and loss of dopamine neuren as in human disease.

Many more disease models have been made but most popular is mouse due to short generation time.

B. Transpharmers:

It was first done in animals blood but it has shifted to milk. Transpharmers are engineered to express a particular gene in the mammary gland (so that the milk contains the desired protein). Mice are commonly used to test the transpharming transgene first (to make sure it encodes a functional protein) before it is built into larger animals like goats and cows, which are significantly more difficult for performing in vitro fertilization and surrogate motherhood. The first transpharmer, was a mouse engineered in 1987 to express the clot dissolver drug tissue plasminogen activator (tPA) (Gordon et al, 1987). Transgenic cows are made to produce protein lacto ferrin and interferans in milk. Transgenic sheeps are produce for good quality wool production.

C. Xenotransplanters:

Xenotransplanters are engineered animals so they do not express those antigens. To solve this organ shortage, xenotransplanters are being engineered to provide animal organs that are histocompatible with humans. Normally, the host rejects organs that come from other tissue types. This is because of antigens on the organ's surface that tell the host that the organ is not itself. The host's own immune system attacks the transplanted organ, causing a whole range of problems, most notably blood clotting, particularly dangerous to an already weakened patient. The organs from pigs designed not to trigger the immune systems of baboons were transplanted into baboon and no rejection was observed (Logon and Sharma, 1999). The biggest setback is the fear that the pig organs will allow the crossover of viruses from animals to humans (zoonotic infection), especially to weakened humans like those waiting for a transplant. Influenza, which is often transmitted from pigs to humans even without organ transplantation (Carnell 2000).

D. Transgenic Food Sources:

Food animals grow bigger and faster producing more food sources and called super animals like super fish, super pig etc. This animal was not transgenic, but it was genetically engineered.Fish transgeniesis is comparatively difficult as tough chorion is present which impedes micro injection. Gene transfer is achieved but gene integration is difficult.For microinjection puncture of local trypsin digestion should be done. Devlinet.al.(2001) grows superfish salmon about 10-11 times faster than normal fish.

E. Transgenic Biological Models:

Biological models are transgenic animals made with the aim of increasing knowledge of genetics and expression, or some natural process. ANDi was first transgenic monkey, born in 2000. "ANDi" stands for "|inserted DNA" spelled backwards. An engineered virus was used to insert the hatrmless gene for green fluosecence protein (GFP) into ANDi's rehesus genome. There are many different kinds of transgenic animals, made with many different purposes in mind.

III. IMPORTANCE:

- **Medical Importance:**
  Many products such as GH(Growth Harmons), blood anti clotting factors may have been obtained from milk of transgenic mammals.

- **Agricultural importance:**
  Selective breading procedures have been adopted to produce disease resistant animals for improving quality and quantity of milk, meat, eggs and wool production etc.

- **Industrial importance:**
  Toxicity sensitive transgenic animals have been produced test chemicals.Spider silk spliced spider silk gene into the cell of lactating goats. The goat along with milk started manufacturing silk.

Issues related to transgenic technology:

There may be long term effects on the environment when transgenic animals are released into the field and various bioethics argue that is wrong to create animals that would suffer as a result of genetic alternation.

REFERENCES

[1] Archibald AL, McClenaghan M, Hornsey V, Simons JP, and Clark A (1990) High-Level Expression of Biologically Active Human _1-Antitrypsin in the Milk of Transgenic Mice. Proc. Natl. Acad. Sci USA 87: 5178-5182.

[2] Baguisi, A, et al. (1999) "Production of Goats by Somatic Cell Nuclear Transfer." Nature Biotechnology 17: 456-461.

[3] Boyd, A. L. and Samid. 1993. "Review: Molecular Biology of Transgenic Animals". Journal of Animal Science 7 (Suppl. 3): 1-9.

[4] Donnelly, S., McCarthy, C.R. and Singleton, R. Jr. (1994). The Brave new World of Animal Biotechnology, Special Supplement, Hastings Center Report.

[5] E.T.S. (Emerging Technology Series). 1997. "Genetic Engineering and Biotechnology". Part, E., Applications Number 4: p.62.

[6] Gordon, J.W. and Ruddle, F.H. (1981). Integration and stable germ line transformation of genes injected into mouse pronuclei. Science 214:1244-1246.

[7] Gordon, J.W., G.A. Scangos, D.J. Plotkin, A. Bardosa and F.H. Ruddle, 1980. "Genetic transformation of mouse to embryos by microinjection". Proceedings of National Academic Science USA, 77: 7380-7384.

[8] Hammer, R.E., V.G. Pursel, C.E. Rexroad, R.J. Wall, D.J. Bolt, KM. Ebert, RD. Palmiter and R.L.Brinster.1985."Production of Transgenic Rabbits, Sheep and Pigs by Microinjection". Nature **315:**680-683.

[9] Mercier,J.C. 1987. "Genetic Engineering Applied to Milk Producing Animals: Some Expections". Exploiting New Technologies in Animal Breeding, p. 122-131. Oxford University press oxford.

[10] Moore, C.J. and Mepham, T.B. (1995). Transgenesis and animal welfare. ATLA 23:380-397.

Synthesis and Antimicrobial Studies of Novel 1-(5-(Substituted-Phenyl-N-(3-Alkyl/Substitutedaryl-Thiazol-2(3*h*)-Ylidene)-1,3,4-Thiadiazol-2-Amine Derivatives

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***Abstract*:-Development of microbial resistance against currently used antimicrobial agents has become a serious global health concern. It has been found in the literature that thiadiazole and thiazole heterocyclic derivatives show potent antimicrobial effects. Therefore, it was considered significant to synthesize some novel thiadiazole incorporated thiazole derivatives by a sequence of chemical reactions. The synthetic procedure was carried out by formation of benzoyl hydrazide which upon refluxing with ammonium thiocyanate produced thiosemicarbazide derivatives. These derivatives underwent cyclization with conc. sulphuric acid to give 5-(substituted-phenyl)-1,3,4-thiadiazol-2-amines. Furthermore, 5-(substituted-phenyl)-1,3,4-thiadiazol-2-amines were condensed with aryl/alkyl isothiocyanates to yield 1-(5-(substituted-phenyl)-1,3,4-thiadiazol-2-yl)alkyl/substituted-aryl-thiourea which upon cyclization with acetyl chloride afforded the synthesis of 1-(5-(substituted-phenyl-N-(3-alkyl/substitutedaryl-thiazol-2(3*H*)-ylidene)-1,3,4-thiadiazol-2 amine derivatives. Completion of reaction at each step was checked by TLC and the products were recrystallized with ethanol, also noted down the % yield and melting point. The synthesized compounds were strucuturally characterized by IR, NMR and Mass spectral data. Titled compounds were screened for their antimicrobial activities against gram-positive bacteria, gram-negative bacteria and fungal stains. Some compounds showed potent antimicrobial activities as compared with their respective standard drugs. This manuscript is a sincere endeavor to report antimicrobial potential of novel thiadiazole substituted thiazole derivatives in search of better antimicrobial agents for future.**

Keywords: Thiadiazole, thiazole, antibacterial, antifungal activity, drug design

I. INTRODUCTION

Microbial infections caused by various types of bacteria and fungi are one of the leading infections which are responsible for the deaths of the millions of patients worldwide [1]. Antimicrobial agents are used in the treatment of microbial infections but the development of resistance to antibiotics is a major problem in the treatment of such infections. So there is an urgent requirement for the discovery and development of some novel antimicrobial agents for the effective treatment of microbial infections [2].

Heterocyclic nucleus such as thiadiazole and thiazole act as highly functionalized scaffolds having pharmacological activities like antimicrobial, anticancer, antiviral, anti-inflammatory and antidepressant activities etc [3]. In view of these finding it was considered significant to synthesize and explore synergistic effect of novel thiadiazole bearing thiazole derivatives with a hope to get better antimicrobial agents.

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 thiadiazole substituted thiazole derivatives are presented as below:

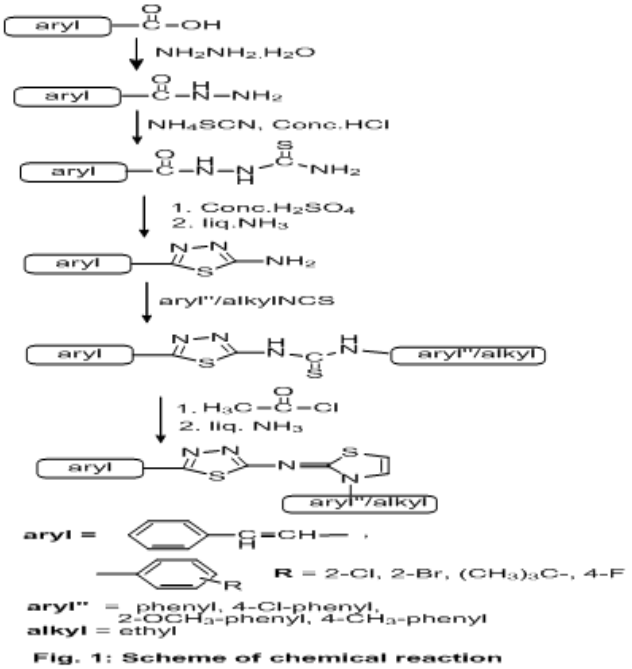

Fig. 1: Scheme of chemical reaction

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 [4].

III. RESULTS AND DISCUSSION

This section contains information about physicochemical properties, analytical data and results of biological experimental data as presented in **table no. 1-7**.

Table 1: Physico-chemical data of titled compounds

Compound	R_1	R_2	Mol. formula	Mol. weight	Yield (%)
PK01	2-Cl	4-Cl-C_6H_4	$C_{17}H_{10}Cl_2N_4S_2$	405.32	79
PK02	2-Cl	2-OCH_3-C_6H_4	$C_{18}H_{13}ClN_4OS_2$	400.91	72.7
PK03	2-Cl	4-CH_3-C_6H_4	$C_{18}H_{13}ClN_4S_2$	384.91	77.5
PK04	2-Br	C_6H_5	$C_{17}H_{11}BrN_4S_2$	415.33	72.7
PK04	2-Br	4-Cl-C_6H_4	$C_{17}H_{10}BrClN_4S_2$	449.78	80
PK06	2-Br	4-CH_3-C_6H_4	$C_{18}H_{13}BrN_4S_2$	429.36	70
PK07	2-Br	C_2H_5	$C_{13}H_{11}BrN_4S_2$	367.29	69.8
PK08	-	C_6H_5	$C_{19}H_{14}N_4S_2$	362.47	65
PK09	-	2-OCH_3-C_6H_4	$C_{20}H_{16}N_4OS_2$	392.5	76
PK10	-	C_2H_5	$C_{15}H_{14}N_4S_2$	314.43	69.2
PK11	4-$(CH_3)_3C$-	C_6H_5	$C_{21}H_{20}N_4S_2$	392.54	67
PK12	4-$(CH_3)_3C$-	2-OCH_3-C_6H_4	$C_{21}H_{20}N_4S_2$	422.57	78
PK13	4-$(CH_3)_3C$-	4-CH_3-C_6H_4	$C_{21}H_{20}N_4S_2$	406.57	75.8
PK14	4-F	4-Cl-C_6H_4	$C_{17}H_{10}ClFN_4S_2$	388.8	77
PK15	4-F	2-OCH_3- C_6H_4	$C_{18}H_{13}FN_4OS_2$	384.45	74

Table 2: Physico-chemical data of titled compounds

Compound	Mp (°C)	Solubility	Solvent system	R_f value
PK01	235	DMSO	Toulene: ethyl acetate: formic acid (5:4:1)	0.77
PK02	270	DMSO	Toulene: ethyl acetate: formic acid (5:4:1)	0.82
PK03	262	DMSO	Benzene : Benzene : acetone (8:2)	0.72
PK04	278	DMSO	Benzene : acetone (8:2)	0.78
PK04	200	DMSO	Toulene: ethyl acetate: formic acid (5:4:1)	0.76
PK06	292	DMSO	Toulene: ethyl acetate: formic acid (5:4:1)	0.71
PK07	220	DMSO	Benzene : acetone (8:2)	0.66
PK08	230	DMSO	Benzene : acetone (8:2)	0.67
PK09	273	DMSO	Toulene: ethyl acetate: formic acid (5:4:1)	0.73
PK10	212	DMSO	Toulene: ethyl acetate: formic acid (5:4:1)	0.80
PK11	260	DMSO	Benzene : acetone (8:2)	0.66
PK12	280	DMSO	Toulene: ethyl acetate: formic acid (5:4:1)	0.74
PK13	278	DMSO	Toulene: ethyl acetate: formic acid (5:4:1)	0.76
PK14	255	DMSO	Toulene: ethyl acetate: formic acid (5:4:1)	0.70
PK15	240	DMSO	Benzene : acetone (8:2)	0.72

Table 3: IR Spectral data of compounds

Compound Code	Wave Number (cm^{-1})	Functional Group
PK01	2917.03	Ar. CH (str.)
	1541.36	C=N
	1397.03	C-N
	1012.33	C-S-C
	775.11	C-Cl
PK02	2913.31	Ar. CH (str.)
	1501.05	C=N
	1390.88	C-N
	1008.32	C-S-C
	725.56	C-Cl
PK03	2810.78	Ar. CH (str.)
	1592.09	C=N
	1417.80	C-N
	1093.35	C-S-C
	761.56	C-Cl
PK06	2918.65	Ar. CH (str.)
	2849.75	CH_3
	1544.74	C=N
	1397.41	C-N
	1067.11	C-S-C
	784.10	C-Br
PK07	2919.39	Ar. CH (str.)
	1592.94	C=N
	1372.55	C-N
	1007.84	C-S-C
	716.62	C-Br

PK09	2915.76 2850.08 1523.64 1382.27 1058.67	Ar. CH (str.) OCH_3 C=N C-N C-S-C
PK10	2916.99 2848.13 1542.96 1396.61 1005.52	Ar. CH (str.) C_2H_5 C=N C-N C-S-C
PK11	2916.20 2847.85 1504.43 1396.57 1007.71	Ar. CH (str.) $(CH_3)_3$ C=N C-N C-S-C
PK12	2916.14 2848.43 1521.16 1384.20 1009.64	Ar. CH (str.) $(CH_{3)3-}$ C=N C-N C-S-C
PK13	2918.49 2850.06 1504.43 1398.06 1005.22	Ar. CH (str.) $(CH_{3)3-}$ C=N C-N C-S-C
PK24	2917.19 1444.41 1392.87 1011.91 718.87	Ar. CH (str.) C=N C-N C-S-C C-Cl
PK15	2916.75 2847.62 1512.66 1396.26 1006.91 1247.40	Ar. CH (str.) OCH_3 C=N C-N C-S-C C-F

Table 4: ^{1}H NMR Spectral data of compounds

Compound Code	Chemical Shift δ (ppm)
PK02	8.26 (8H, Ar-H) 4.42 (2H, 2NH) 2.25 (3H, OCH_3)
PK12	8.15 (11H, Ar-H) 5.31 (2H, 2NH) 3.92 (3H, $OCH_{3)}$ 2.53 (9H, CH_3)
PK13	8.22 (8H, Ar-H) 5.16 (2H, 2NH) 2.51 (12H, CH_3)
PK14	8.11 (8H, Ar-H) 4.53 (2H, 2NH)
PK15	8.33 (8H, Ar-H) 5.45 (2H, 2NH) 3.45 (3H, OCH_3)

Table 5: Mass Spectral data of compounds

Compound Code	m/z (M^+)
PK07	363
PK11	420

Table 6: Antibacterial activity of test compounds (Zone of inhibition (mm) ± SEM)

Compound Code	Zone of inhibition (mm) ± SEM			
	SA	BS	EC	PA
PK01	29.46±0.906	28.63±0.654	30.36±0.514	32.50±0.560
PK02	30.16±0.514	31.23±0.523	29.36±0.682	28.36±0.467
PK03	28.63±0.654	26.16±0.707	27.46±0.467	26.36±0.327
PK04	25.33±0.542	24.70±0.514	24.13±0.467	23.33±0.299
PK04	26.13±0.654	25.03±0.710	25.36±0.0.523	24.56±0.707

PK06	25.53±0.747	24.3±0.420	24.43±0.383	23.33±0.373
PK07	20.73±0.467	21.3±0.467	19.26±0.467	18.46±0.775
PK08	18.56±0.523	17.8±0.707	18.33±0.635	17.43±0.607
PK09	18.76±0.439	18.1±0.467	19.2±0.654	18.60±0.467
PK10	16.70±0.467	17.36±0.710	16.43±0.607	15.90±0.514
PK11	12.20±0.794	12.33±0.747	11.53±0.803	11.60±0.850
PK12	12.03±0.570	12.06±0.373	10.83±0.514	10.60±0.467
PK13	11.76±0.616	12.50±0.887	11.26±0.467	11.13±0.682
PK14	30.16±0.514	29.73±0.707	31.3±0.420	32.50±0.560
PK15	29.0±0.373	29.70±0.813	31.10±0.738	32.26±0.327
Control	-	-	-	-
Ciprofloxacin	34.7±0.607	32.6±0.514	35.7±0.570	37.4±0.887

Keys: SA – *Staphylococcus aureus*; BS – *Bacillus subtilis*; EC – *Escherichia coli*; PA – *Pseudomonas aeroginosa*

Table 7: Antifungal activity of test compounds (Zone of inhibition (mm) ± SEM)

Compound code	**Zone of inhibition (mm) ± SEM**	
	AN	**CA**
PK01	13.56±0.523	12.06±0.377
PK02	14.03±0.656	13.86±0.470
PK03	15.96±0.514	15.60±0.612
PK04	18.10±0.612	16.63±0.608
PK04	14.43±0.421	17.16±0.321
PK06	18.20±0.612	20.03±0.514
PK07	19.23±0.514	20.73±0.470
PK08	16.96±0.700	19.26±0.470
PK09	18.20±0.612	20.03±0.514
PK10	20.03±0.514	22.20±0.583
PK11	24.33±0.514	22.46±0.608
PK12	28.63±0.663	30.0±0.560
PK13	26.96±0.514	28.63±0.755
PK14	10.63±0.563	12.23±0.608
PK15	11.56±0.907	13.7±0.830
Control	-	-
Fluconazole	33.4±0.607	34.5±0.701

Keys: AN – Aspergillus niger; CA – Candida albicans

IV. CONCLUSION

In conclusion, a close examination of in-vitro antibacterial and antifungal activities of variously 1-(5-(Substituted-phenyl-N-(3-alkyl/substitutedaryl-thiazol-2(3H)-ylidene)-1,3,4-thiadiazol-2-amine derivatives against the tested bacterial and fungal strains provided a better structure–activity correlation and by applying biostatical studies ($p<0.05$, $p<0.01$) upon comparing with standard drugs Ciprofloxacin and Fluconazole respectively. Of the tested compounds, those with fluoro and chloro functional group in derivatives PK14 and PK01 exerted highest level of antibacterial due to presence of strongly electron withdrawing functional group, as far as fungi is concerned, compound PK12 containing bulky substituent exerted highest antifungal activity.

REFERENCES

[1] R. Kharb, P.C. Sharma, M. Shaharyar, "Pharmacological significance of triazole scaffold," J. Enzyme Inhib. Med. Chem., vol. 26, pp. 1-21, 2011.

[2] R. Kharb, P.C. Sharma, M. Shaharyar, "New insights into chemistry and anti-infective potential of triazole scaffold," Curr. Med. Chem., vol. 18, pp. 3265-3297, 2011.

[3] Silverman RB. Organic Chemistry of Drug Design and Drug Action, Academic Press, San Diego, 1992.

[4] K. Sztanke, T. Tuzimski, J. Rzymowska, "Synthesis, determination of the lipophilicity, anticancer and antimicrobial properties of some fused 1,2,4-triazole derivatives," Eur. J. Med. Chem., vol. 43, pp. 404-419, 2008..

Dendrimers: Need More to Explore The Molecule of Millennium

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***Abstract*- Dendrimers proved itself to be the molecule of millennium. It acclaimed its most fascinating position in nanoworld. Despite of its short history of nearly three decades it has proved itself in the market. Dendrimers based products are contributing significantly and efficiently. Top leaders and Pharma giant companies are further strengthening their global presence by launching dendrimer based products. Starpharma solely dedicated to dendrimers based product have launched couple of products in market and many more are in clinical trials. Scientists actively involved in research, number of patents filed every year; new drug applications submitted to FDA are witnessing and forecasting the future of dendrimers. Dendrimers if trusted will surely going to deal with the challenges of medical science. Dendrimers may address the problem in healthcare and our beloved one may live long or we may provide them the quality of life.**

Key words: Dendrimers, clinical trial, nanoworld

I. INTRODUCTION: JOURNEY OF MOLECULE OF MILLENNIUM (DENDRIMERS)

In early 1980 Donald A. Tomalia started and published the birth of new member of nanofamily. Vogtle, Jean Fréchet, Newkome has initiated, dedicated their work for dendrimers and has contributed significally [1,2]. Journey has started from providing proof of concepts. Number of research publications and patents filed every year are witnessing its global presence. The science of miniature has gained attraction of both beginners and advanced scientists **(**Fig No: 1)

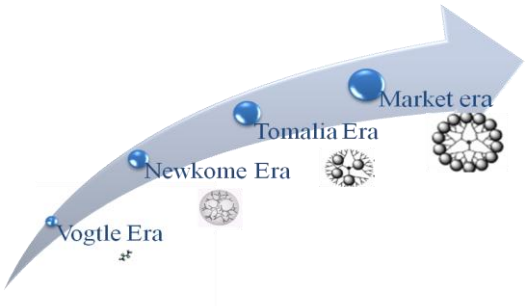

Fig . 1 Growth track of Dendrimers

II. DENDRIMERS GLOBAL PRESENCE: PROVED ITSELF TO BE MOLECULE OF MILLENNIUM

Dendrimers proved itself to be a molecule of millennium. Potted seeds in early 1980 have started giving froots (dendrimer based products)**.** More than 10 products are commercialized and are doing well in market. Top dendrimers based products Vivagel, Stratus CS®, SuperFect®, Starburst®, Priofect®, SPL7013, NanoJuice™ and many more are proving themselves to be the products of choice [3]. Continuousally increasing number of Investigational new drug application to the United States Food and Drug Administration (FDA) is forecasting the future of this magical segment of drug delivery. Dendrimers being a architecture of functional groups mimics the natural material such as amylopectin (natural dendrimer) and proteins as well as the drug candidates already in market. Starpharma commences Dendrimer-Docetaxel clinical trial and working with full potential especially in cancer segment. Dade Behring, Qiagen, Sigma Aldrich, Starpharmassl, Starpharma, Baker, Stiefel, EMD Chemicals are the top leaders engaged with dendrimers based formulation developmet especially in drug delivery [4,5,6]. **(**Table.1)

Table.1: Dendrimers based products and market prospects

S. No.	DENDRIMERS PRODUCTS	Application	Company
1	Stratus CS®	Cardiac Marker diagnostic	Dade Behring
2	SuperFect®	Gene Transfection technology	Qiagen
3	Starburst®	Dendrimers commercial	Sigma Aldrich
4	Priofect®	SiRNA & DNA transfection reagents	MERCK
5	VivaGel®SPL7013	HIV and genital herpes Condom coating	Starpharmassl

6	SPL7013	Arthritis and cosmetic treatment	STARPHARMA
7	NanoJuice™	DNA transfection agent kit	EMD Chemicals
8	Targeted	MRI imaging Contrast agent	Baker
9	Drug Delivery	Cancer ,Dermatological	Stiefel

III. DENDRIMERS IN LAB: BUSY WITH PROVIDING THE PROOF OF CONCEPT

Dendrimer based products hitting the market, number of patents every year, IND applications to FDA have strongly motivated the scientists across the globe to participate in the research dedicated to dendrimers (Fig. no. 2).

Concepts/hypothesis is day by day increasing and getting converted to reality. Number of Products in market and many more in clinical trial are explaining that how this nanomolecule is doing big things. Scientists are going small to achieve big. Contextual reviews and comprehensive research work on dendrimers disclosed inherent properties especially its medicinal claims and health benefits.

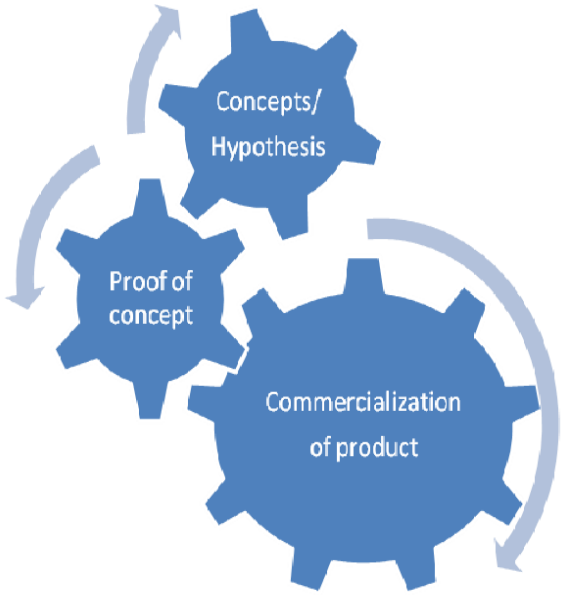

Fig. 2 Dendrimers triangle domains

IV. DRUG DELIVERY APPLICATIONS OF DENDRIMERS: CURRENT UPDATE

Dendrimers branches emanating in all direction is almost serving every field. Some applications enlisted are like: for cellular transport, as artificial cells, for diagnostics and analysis, as protein / enzyme mimics or modeling, for manufacture of artificial bones, for development of topical microbicide creams,antimicrobial, antiviral (e.g. for use against HIV), antiparasitic agents, biomedical coatings (e.g. for artificial joints), artificial antibodies, biomolecular binding agents, carbon fibre coatings, ultra thin films, plastics additives (e.g. for lowering viscosity, increasing stiffness, incorporating dyes, compatibilisers, etc.) ,creation of foams (i.e. synthetic zeolites or insulating material),building blocks for nanostructured materials,dyes and paints,industrial adhesives,manufacture of nanoscale batteries, lubricants, decontamination agents (trapping metal ions),ultrafiltration, molecular electronics for data storage, 3D optical materials, light-harvesting systems, quantum dots, liquid crystals and printed wire boards, etc [7,8,9,10] **(**Fig. no. 3)

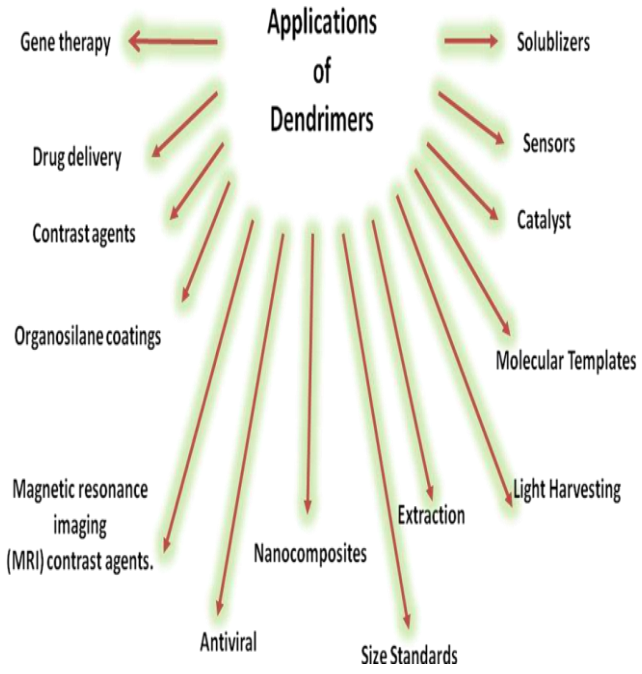

Fig.3 Dendrimers applications

V. NEED OF SCREENING STUDIES TO EXPLORE MEDICINAL ACTIVITIES

Closely structurally related drug molecules are showing the clinical value why not dendrimers. druglikeness and druggability, innovative nanomadicine terminologies are already assigned for these naocarriers. Nature is working at nanolevel. Diseases are originating from nonolevel. To fight we have to go down to have a healthy competition and to destroy the root cause. Nember of drugs are already in market having diverse clinical application having ethylenediamine as core or starting material. PAMAM dendrimer core moiety is ethylenediamine. Drug candidates e.g.Ethambutol (Antituberclosis drug), Tripelennamine (Antipruritic) Ethylenediaminedisuccinic acid (Antiviral and immunomodulatory activity), Buspirone (psychoactive drug) and Pyrilamine (first generation antihistamine) have etylenediaine in their basic backbone structure [14]. Already dendrimers are claimed for variety of medicinal claims. Dendrimers of different category and their surface modification capabilities can used to synthesize and screening them against the dieases.

VI. FUTURE PROSPECTS

Dendrimers unique feature and intrinsic qualities made it to capture global presence. They are impacting almost all the fields. Contribution towards the health segment is really significant. They are mushrooming like anything. Concepts and hypothesis have became reality and doing miracle in the market .In this era of innovation this innovative molecules is have gained the most fascinating position in nanoworld. Dendrimers as a drug carrier, and as a molecule having inherent medicinal activities. Mingling with the receptor opened a new avenue of research because interaction with the receptor may regulate the cascade of pathway that may regulate the plethora of clinical responses.

REFERENCE

[1] Tomalia DA, Baker H, Dewald JR, Hall M, Kallos G, Martin S Roeck , J, Ryder J: A new class of polymers: Starburst-dendritic macromolecules. *J. Polym.* 1985, **17**: 117–132.

[2] Tomalia DA, Naylor AM, Goddard WA: Molecular-level control of size, shape, surface chemistry, topology, and flexibility from atoms to macroscopic matter. *Chem, Int. Edn.* 1990, **29:** 138-175

[3] Peterson J, Ebber A, Allikmaa V, Lopp M : Synthesis and CZE analysis of PAMAM dendrimers with an ethylenediamine core. *Proc. Estonian Acad. Sci. Chem* 2001,**50** :156-166

[4] Esfand R, Tomalia D: Poly (amidoamine) (PAMAM) dendrimers: from biomimicry to drug delivery and biomedical applications. *Drug Discov. Today* 2001, **6**:427-436

[5] McCarthy TD, Karellas P, Henderson SA, Giannis M, O'Keefe DF, Heery G, Paull JR, Matthews BR: Dendrimers as drugs: discovery and preclinical and clinical development of dendrimer-based microbicides for HIV and STI prevention. *Mol Pharm.* 2005, **2**:312-31

[6] Rupp R, Rosenthal SL, Stanberry LR: VivaGel (SPL7013 Gel): a candidate dendrimer--microbicide for the prevention of HIV and HSV infection. *Int J Nanomedicine* 2007, **2** :561-6.

[7] Stiriba SE, Frey H, Haag R.: Dendritic polymers in biomedical applications: From potential to clinical use in diagnostics and therapy.Angew. *Chem. Int. Ed*. 2002, **41**: 1329-1334

[8] Namazi H, Adeli M: Dendrimers of citric acid and poly (ethylene glycol) as the new drug-delivery agents. *Biomat* 2005, **26**: 1175–1183

[9] Twyman LJ, Beezer AE , Esfand R, Hardy MJ, Mitchell JC: The synthesis of water soluble dendrimers, and their application as possible drug delivery systems. *Tetrahedron Lett.* 1999,**40**: 1743-1746.

[10] Sunil S, Sharyn T, Elisabetta G, Antony G, Emma J, Ian T, Kamiar M, Philip L, Ruth D, Steve P, Peng K: Polyvalent dendrimer glucosamine conjugates prevent scar tissue formation Nature Biotechnology 2004,**22**: 977 - 984

[11] Schols D: HIV co-receptors as targets for antiviral therapy. *Curr Top Med Chem* 2004, **4**:883-93.

[12] Tulu M, Aghatabay NM, Senel M., Dizman C, Parali T: Synthesis, characterization and antimicrobial activity of water soluble dendritic macromolecules. *Eur. J. Med. Chem* 2009, **44**:1093-99

[13] Sugandhi EW, Falkinham JO, Gandour RD: Synthesis and antimicrobial activity of symmetrical two-tailed dendritic tricarboxylato amphiphiles Bioorganic & Medicinal Chemistry **2007,** 15 : 3842-53

[14] Klajnerta BM., Cortijo-Arellanob J, Bryszewska M: Influence of dendrimer's structure on its activity against amyloid fibril formation aBiochemical and Biophysical Research Communications 2006 , **34**:5:21-28 .

Track-3

Technical Session 2

PHARMACOLOGY & BIOTECHNOLOGY

Hs-CRP as a Marker of Systemic Low Grade Inflammation in Diabetic Retinopathy

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***Abstract*— Inflammation has been recognized as a critical contributor to retinal capillary closure, one of the main pathogenic events in diabetic retinopathy. The relationship between acute phase markers of inflammation and diabetic retinopathy was studied. Diabetic retinopathy (DR) is the most frequent cause of adult blindness in patients 30-70% worldwide, which is a highly specific vascular complication of both type 1 and type-2 diabetes. The prevalence of retinopathy is strongly related to the duration of diabetes and the degree of metabolic control of patients. Serum hs-CRP levels have shown significant stepwise increase with the progression of diabetic retinopathy.**

Keywords—Diabetic retinopathy, inflammation, C-Reactive Protein

I. INTRODUCTION

Diabetic retinopathy (DR) is a microangiopathy primarily affecting the precapillary arterioles, and post-capillary venules, though larger vessels may be involved [1], which is a highly specific vascular complication of both type 1 and type-2 diabetes. It is now generally accepted that the pathogenesis of diabetic retinopathy involves low grade inflammation and vascular endothelial dysfunction [2,3]. In a study it has been found that retinopathy is a low-grade, chronic inflammatory condition associated with increased leukocyte adhesion to the diabetic retinal vasculature, resulting in blood-retinal barrier breakdown, capillary non-perfusion, and endothelial cell damage [4]. Low-grade systemic inflammation is characterized by a two to threefold increase in systemic plasma & serum concentrations of cytokines such as tumor necrosis factor-α (TNF-α), interleukin-6 (IL-6) and C-reactive protein (CRP) [5]. Raised levels of CRP are suggestive of low grade inflammation and are independent marker of vascular disease in diabetes [6]. There have been extensive prospective cross sectional studies done, in the last decade, relating various markers such as high sensitivity CRP (hs-CRP), fibrinogen, nitric oxide metabolites (NO_x), total leukocyte count, TNF-α, interleukins (IL-6, IL-1β, IL-8), vascular endothelial growth factor (VEGF) [7,8,9].

II. PREVELENCE AND INCIDENCE

Diabetic retinopathy (DR) is one of the most common complications of diabetes and is leading cause of blindness in people of the working age in industrialized countries [10]. In India with the epidemic increase in type 2 diabetes mellitus as reported by the World Health Organization (WHO), DR is fast becoming an important cause of visual disability (Rema and Pardeepa, 2007). Approximately 25% of type 1 diabetic patients may have signs of retinopathy after 5 years of diabetes, increasing to 60% after 10 years. Eventually, after 25 years, almost all (97%) type 1 diabetic patients will develop retinopathy. Type 2 diabetic patients may already have diabetic retinopathy at the time of diagnosis, and over 60% will develop some form of retinopathy after 20 years [11].

III. ROLE OF INFLAMMATION IN DIABETIC RETINOPATHY

Inflammation is an important pathogenetic aspect of diabetic retinopathy based on the findings that inflammatory cytokines and mediators are up regulated in the diabetic retina, and that leukostasis occurs because of adhesion molecule up regulation [12]. It has been identified that chronic inflammation resulting from diabetes as a potential cause of damage to the retina via proinflammatory proteins, including cyclooxygenase-2 (COX-2), interleukin-1 (IL-1), and tumor necrosis factor-alpha (TNF-α) [13] [14]. A large body of evidence supports the role of proinflammatory cytokines, chemokines and other inflammatory mediators in the pathogenesis of diabetic retinopathy leading to persistent low grade inflammation, and influx of leukocytes contributing to damage to the retinal vasculature and neovascularization [15].

IV. CRP AS INFLAMMATORY MARKER IN DIABETIC RETIONOPATHY

C-reactive protein, a member of the pentraxin family of oligomeric proteins, is involved in pattern recognition in innate immunity [16]. C - reactive protein (CRP) is an acute phase reactant that is synthesized by the liver. Its production is controlled primarily by IL-6 [17]. It can activate the classic complement pathway, induce release of cytokines, and up-regulate the expression of certain adhesion molecules [18].

The serum CRP concentration may increase by up to 1000-fold with infection, trauma, surgery, and other acute inflammatory events. It is now well accepted that CRP is a strong predictor of future cardiovascular events [19]. However, less is known about its relationship with microvascular complications of diabetes. In this regard, some, though not all, studies (especially prospective studies) have reported that circulating CRP is associated with diabetic nephropathy (DN) [20]. DR in the last decade, have shown that the increase of CRP may be an early event or even one of driving forces in the development of microvascular complications of diabetes. Therefore, it is plausible to hypothesize that genetic

variants of CRP may have impact on the risk of these complications.

Recent studies have shown that inflammation, and more specifically pro-inflammatory cytokines, play a determinant role in the development of microvascular diabetic complications like retinopathy. The inflammatory response involves the activation of leukocytes (white blood cells) and is mediated, in part, by a family of cytokines and chemokines. Although inflammation is beneficial, if this response is chronically activated it can have a detrimental effect. Diabetes has long been considered a state of chronic, low-level inflammation. Inflammation is also an important pathogenetic aspect of diabetic retinopathy based on the findings that inflammatory cytokines and mediators are up regulated in the diabetic retina, and that leukostasis occurs because of adhesion molecule up regulation[12]. It has been identified that chronic inflammation resulting from diabetes as a potential cause of damage to the retina via proinflammatory proteins, including cyclooxygenase-2 (COX-2), interleukin-1 (IL-1), and tumor necrosis factor-alpha (TNF-α)[2]. A large body of evidence supports the role of proinflammatory cytokines, chemokines and other inflammatory mediators in the pathogenesis of diabetic retinopathy leading to persistent low grade inflammation, and influx of leukocytes contributing to damage to the retinal vasculature and neovascularization[15].

V. CONCLUSION

In summary Diabetic retinopathy (DR) is one of the most common microvascular complications of diabetes and one of the leading causes of blindness worldwide. According to the World Health Organization (WHO) report, dated 2004, India has 31.7 million diabetics, and the number is expected to increase to a staggering 79.4 million by 2030. The present review was designed to find out the progression of inflammation with severity of disease by assessing inflammatory markers hs-CRP. Inflammatory pathway plays pivotal role in development and progression of diabetic complications. Elevated concentration of CRP may be good predictor of onset of microvascular complications and also of cardiovascular disease in diabetic retinopathy.

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REFERENCES

[1] F. Harney, " Diabetic Retinopathy," Medicine,2006,vol 34, pp. 95-98.

[2] AM. Joussen, V. Poulaki, M.L. Le, K. Koizumi, C. Esser, H. Janicki, "A central role for inflammation in the pathogenesis of diabetic retinopathy," FASEB J, 2004, vol 18, pp. 1450-1452.

[3] C. Gerhardinger, M.B. Costa, M.C. Coulombe, I. Toth, T. Hoehn, P. Grosu, "Expression of acute-phase response proteins in retinal Müller cells in diabetes," Invest Ophthalmol Vis Sci, 2005, vol 46, pp. 349-357.

[4] R. Chibber, B.M. Ben-Mahmud, S. Chibber, E.M. Kohner, " Leukocytes in diabetic retinopathy,"Curr Diabetes Rev, 2007,vol 3, pp. 3-14.

[5] M.C. Calle, M.L. Fernandez, "Inflammation and type 2 diabetes,"Diabetes Metab, 2012, vol 38**,** pp. 183-191.

[6] A.R. Tall, "C-reactive protein reassessed," N Engl J Med,2004, vol 350, pp. 1450-1452.

[7] M.B. Schulze, E.B. Rimm, I. Shai, N. Rifai, F.B. Hu, "Relationship between adiponectin and glycemic control, blood lipids, and inflammatory markers in men with type 2 diabetes, "Diabetes Care 2004, vol **27**, pp. 1680-1687.

[8] F.O. Pereira, T.S. Frode, Y.S. Medeiros, "Evaluation of tumour necrosis factor alpha, interleukin-2 soluble receptor, nitric oxide metabolites, and lipids as inflammatory markers in type 2 diabetes mellitus,"Mediators Inflamm, 2006, vol 2006, pp. 1-10.

[9] M. Swellam, Sayed Mahmoud, M. Abdel-Fatah Ali,"Clinical implications of adiponectin and inflammatory biomarkers in type 2 diabetes mellitus," Dis Markers, 2009, vol 27, pp. 269-278.

[10] W. Zhang, H. Liu, M. Al-Shabrawey, R.W. Caldwell, R.B. Caldwell, "Inflammation and diabetic retinal microvascular complications," J Cardiovasc Dis Res, 2011, vol 2, pp. 96-103

[11] M. Rema, R. Pradeepa, "Diabetic retinopathy: an Indian perspective," Indian J Med Res, 2007, vol 125, pp. 297-310.

[12] H.P. Hammes, Y. Feng, F. Pfister, M. Brownlee, "Diabetic retinopathy: targeting vasoregression,"Diabetes, 2011, vol 60, pp. 9-16.

[13] A.M. Joussen, V. Poulaki, M.L. Le, K. Koizumi, C. Esser, H. Janicki, " A central role for inflammation in the pathogenesis of diabetic retinopathy,"Faseb j, 2004, vol 18, pp. 1450-1452.

[14] T.S. Kern, "Contributions of inflammatory processes to the development of the early stages of diabetic retinopathy.,"Exp Diabetes Res, 2007,doi: 10.1155/2007/95103

[15] A.M El-Asrar, "Role of inflammation in the pathogenesis of diabetic retinopathy,"Middle East Afr J Ophthalmol, 2012, vol 19, pp. 70-74.

[16] R. Medzhitov, C.A. Janeway, "Innate immunity: impact on the adaptive immune response," Curr Opin Immunol, 1997, vol 9, pp. 4-9.

[17] W.L. Roberts, L. Moulton, T.C. Law, G. Farrow, M. Cooper-Anderson, J. Savory, "Evaluation of nine automated high-sensitivity C-reactive protein methods: implications for clinical and epidemiological applications: Part 2,"Clin Chem, 2001, vol 47, pp. 418-425.

[18] A.C. Cohn, L. Busija, L.D. Robman, P.N. Dimitrov, M. Varsamidis, L.L. Lim, "Younger Siblings, C-Reactive Protein, and Risk of Age-Related Macular Degeneration,"Am J Epidemiol, 2013, vol **177**, pp. 933-943.

[19] W. Koenig, M. Sund, M. Frohlich, H.G. Fischer, H. Lowel, A. Doring, "C-Reactive protein, a sensitive marker of inflammation, predicts future risk of coronary heart disease in initially healthy middle-aged men: results from the MONICA (Monitoring Trends and Determinants in Cardiovascular Disease) Augsburg Cohort Study, 1984 to 1992," Circulation, 1999, vol 99(2), pp. 237-42.

[20] A.J. Overgaard, J.N. McGuire, P. Hovind, H.H. Parving, P. Rossing, F. Pociot, "Serum amyloid A and C-reactive protein levels may predict microalbuminuria and macroalbuminuria in newly diagnosed type 1 diabetic patients," J Diabetes Complications, 2013, vol 27(1), pp. 59-63.

[21] M.V. Van Hecke, J.M. Dekker, G. Nijpels, A.C. Moll, R.J. Heine, L.M. Bouter, "Inflammation and endothelial dysfunction are associated with retinopathy: the Hoorn Study,"Diabetologia, 2005, vol 48(7), pp. 1300-6.

Design and Development of Cyclodextrin Inclusion Complex Matrix Tablets of Curcumin for Colonic Delivery

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***Abstract*-The aim of the present investigation was to prepare inclusion complex of curcumin and β-cyclodextrin to impart better solubility to curcumin , an anti-inflammatory drug. Inclusion complex of curcumin with β-cyclodextrin was prepared by physical mixing and the matrix tablets were prepared using curcumin alone and curcumin- β-cyclodextrin (1:0.5 and 1:1) inclusion complexes by wet granulation method. Here ethyl cellulose was added as matrix forming polymer to facilitate control release of curcumin . Then outer coat was applied on the matrix tablets with eudragit S100 (10%w/v) solution to deliver maximum drug to the colonic region. All the prepared formulations were evaluated for hardness , drug content ,thickness, friability and diameter. Matrix tablet formulations of curcumin- β-cyclodextrin (1:0.5 and 1:1) inclusion complexes shows better drug release profile as compared to matrix tablets using curcumin alone .The optimized and selected matrix tablet formulations were further enteric coated with eudragit S100(10%).The eudragit coated formulations are able to withstand the drug release in the upper GIT. Hence these formulations can be selected for drug delivery specifically in the colonic region.**

***Keywords—curcumin* , β-cyclodextrin ,ethyl cellulose, matlix tablets**

I. INTRODUCTION

Drugs administered through oral route are the most convenient and important method of administering drugs for systemic effect. Almost 50% of the drug delivery systems available in the market are oral drug delivery system. and these systems have more advantages due to patient acceptance and ease of administration .During the last decade there has been interest in developing site-specific formulations for targeting drug to the colon. Colonic drug delivery is not only used for the delivery of the drugs for the treatment of local diseases like Crohn's disease, ulcerative colitis, irritable bowel syndrome and constipation but also for the systemic delivery of proteins, therapeutic peptides, anti asthmatic drugs, antihypertensive drugs and anti diabetic agents due to which colon drug delivery has gained importance for the targeting drug delivery. The various methods or techniques which are used for colon drug targeting are as, formation of prodrug , coating with pH sensitive polymers, coating with biodegradable polymers, designing formulations using polysaccharides, timed released systems, pressure-controlled drug delivery systems, osmotic pressure controlled systems. Coating of the drugs with pH-sensitive polymers provides simple approach for colon-specific drug delivery **.**Colon specific drug delivery system is not only beneficial for treatment of disorders such as ulcerative colitis, crohn's disease, carcinomas, inflammatory bowel disease and infections but also achieving higher local concentration with minimum side effects. In addition, colon has a longer retention time which helps to improve absorption and ultimately bioavailability of poorly absorbed drug molecule. Localized drug delivery to colon protects drug molecule to release and absorbed from hostile environment of upper GIT. Delivery of proteins and peptide drugs direct to colon is carried out by help of colon specific drug delivery system because protein and peptide drugs are destroyed and inactivated by acidic environment of stomach and by pancreatic enzymes.

Targeted delivery of drugs to the colon is used for local treatment of variety of colonic diseases such as irritable bowel syndrome (IBS), colorectal cancer, and inflammatory bowel diseases (IBD), which includes both ulcerative colitis and chorn's disease. Apart from these local treatments, the colon is used for the systemic absorption of proteins and peptides and also for those drugs where a delay in drug absorption is required from a therapeutic point of view

The objective of the present investigation is to design enteric coated matrix of curcumin. Curcumin is a bis-α,β-unsaturated β-diketone with molecular weight 368.37 ,used in the treatment of inflammation . Ethyl cellulose used as a rate retarding and matrix forming polymer to minize the influence of the stomach emptying time on drug release and to guarantee that the tablet could enter the small intestine intact for treatment of some colonic diseases like ulcerative colitis ,irritable bowel syndrome.

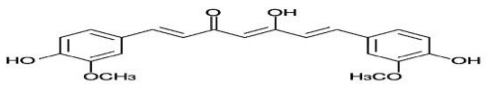

Fig 1: Structure Of Curcumin

II. MATERIALS AND METHODS:

A. *Materials*

UV-visible double beam spectrophotometer, Shimadzu Model 1800 with matched quartz cells was used for all spectral measurements. Curcumin was a gift sample obtained from RYM Exporters, New Delhi. β-cyclodextrin ,ethyl cellulose obtained from Loba chemie , Mumbai, India.All other solvents and reagents were of analytical grade purchased from local suppliers.

B. *Experimental Method*

- Identification of drug:

The drug was identified for physical appearance, FTIR, UV spectral analysis .

- Formulation of curcumin-β-cyclodextrin inclusion matrix tablets:

Among the various approaches ,preparation of drug-embedded matrix tablets is one of the least complicated approaches for obtaining controlled release and is widely used in the industry.In the present study matrix tablets of curcumin alone and curcumin-β-CD (1:0.5) and (1:1) inclusion complexes were formulated employing ethyl cellulose as matrix forming polymer in different proportions of drug and polymers and tablets were evaluated for drug release.

Preparation of cyclodextrin inclusion complexes by physical mixing:Curcumin with β-CD in different ratios(1:0.5,1:1)were mixed in a mortar for about 1hour with constant trituration ,passed through sieve No. 80 and stored in desiccators over fused calcium chloride.

- Method of preparation of matrix tablets:

Matrix tablets of curcumin were prepared as per the formula given in table 1&2.The required quantities of medicament, lactose and matrix forming polymer were mixed thoroughly by following geometric dilution technique .The granulating fluid(solvent blend of water and alcoholin 1:1 ratio) was added and mixed thoroughly to form dough mass .The mass was passed through mesh no.12 to obtain wet

granules .The wet granules were dried ar40^0 C for 6hrs.The dried granules were passed through mesh No.16 to break the aggregates. Lubricant talc and magnesium stearate were passed through mesh No.100 on to dry granules and blended in a closed polyethylene bag. The tablet granules were compressed on tablet punching machine using 13 mm concave punches.

Table1: List of curcumin matrix tablets prepared employing curcumin alone and curcumin inclusion complexes

S.No.	Drug form	Matrix polymer	Code
1	Curcumin	Ethyl cellulose	F1
2	Curcumin-β-CD(1:0.5)	Ethyl cellulose	F2
3	Curcumin-β-CD(1:1)	Ethyl cellulose	F3

Table 2:Formulation design of curcumin matrix tablets

Ingredient(mg/tablet)	F1	F2	F3
Curcumin	100		
Curcumin-β-CD(1:0.5)		150	
Curcumin-β-CD(1:1)			200
Ethyl cellulose	40	40	40
Lactose	250	200	150
Magnesuium stearate	10	10	10
Total weight of tablet(mg)	400	400	400

- Preparation of enteric coated curcumin matrix tablets:

The coating solution of different concentrations (5,10%,15%) of Eudragit S100 were prepared by dissolving powder of Eudragit S100 in ethanol and isopropyl alcohol (1:1).This coating solutions were used to coat on different batches of the tablets using dip coating method to prevent the drug release in the upper GIT.

C. *Evaluation of Matrix Tablet Formulation*

- Physical characterization of tablet

All the formulations batches were characterized for official evaluation parameters like weight variation ,hardness ,friability , tablet thickness and reported for further optimization and evalution.

- Drug content uniformity

Ten tablets from each formulation were powdered and a quantity equivalent to 100mg of drug content was dissolved in 100 ml of phosphate buffer pH 6.8. Then 10 ml of filtrate was suitably diluted and analyzed for drug content by spectrophotometer at its corresponding wavelength.

- In-vitro dissolution studies

Dissolution studies were carried out on all the formations according to the USP apparatus 2, i.e. paddle type at 50 rpm and at a temperature of 37±0.5℃. Studies were carried out in 900 ml of 6.8 pH phosphate buffer in 2 hours. The samples were withdrawal at predetermined time interval and replaced with fresh media. Then the samples were analysed using UV-Spectrophotometer at the λmax 430 nm.

III. RESULTS AND DISCUSSION

A. *Characterization of drug and analytical studies*

After selection of model drug(curcumin)through analytical study and characterization of the drug was done The UV spectral analysis showed the maxima at 430 nm in 0.1 N HCl, which is relevant to litreatures and the monograph for curcumin.

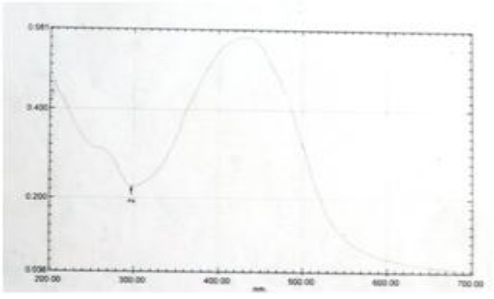

Figure2:curcumin showing absorption maxima

Table 3:Curcumin wavelength and their absorbance

Sr No	Wavelength (nm)	Absorbance
1	430	0.581

B. I.R SPECTRA OF CURCUMIN

FTIR spectrum of curcumin was shown in figure 3 and interpretation was done using standard wavenumber ranges. Observed wavenumbers along with assignments of specific chemical groups are listed in the presence of curcumin. GGI.

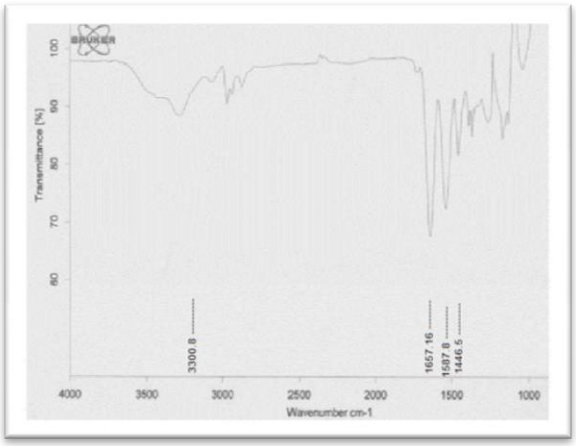

Table4:Group confirmed of curcumin FTIR

Observedwave number (cm^{-1})	Group frequency range (cm^{-1})	Group confirmed
3300.8	3500-3300	Phenolic OH
1657.16	1750-1650	C=O
1587.6	1650-1550	C=C
1446.5	1400-1600	Arc=c

Table5:Evaluation parameters of matrix tablets:

*Formulation code	*Weight variation (IP)	*Friability (%)	*Hardness (Kg/cm^2)	*drug content (%)
F1	Passed	0.43±0.13	5.01±0.31	98.85±0.48
F2	Passed	0.34±0.12	5.51±0.41	97.12±0.86
F3	Passed	0.52±0.16	6.10±0.51	96.02±0.45

*Each value is the average of three determinations:

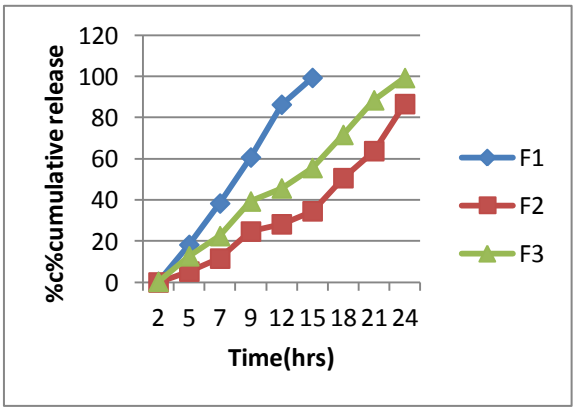

Figure 4:Percentage cumulative release for curcumin

IV. CONCLUSION

From the above study it can be concluded that β-CD inclusion complexes of poorly soluble drugs improves drug release rate as compared to the drug alone and the ethyl cellulose can be exploited as matrix forming polymer to design control release formulations, further an out coat of enteric coating polymer , eudragit S100 may be suitable for preventing drug release in upper part of GIT and drug delivery specifically to colonic region for better bioavailability of drugs.

REFERENCES

[1] Glibert S Banker (ed.), Modern Pharmaceutics (4th edn), Marcel Dekker, New York, 2002, 527-584.

[2] Abdul B, John B. Perspectives on Colonic Drug Delivery, Business Briefing, Pharmatech, 2003, 185–190.

[3] Bajpai S K, Bajpai M, Dengree R. Chemically treated gelatin capsules for colon-targeted drug delivery: a novel approach, J. Appl. Polym.Sci., 2003, 89, 2277–2282.

[4] .Vyas S.P .,Khar R.K.2002.controlled drug delivery concept and advances first edition vallabh prakashan.218-253

[5] 5.Ramprasad Y V, Krishnaiah Y S, Satyanarayana S. Studies of guar gum compression-coated 5-aminosalicylic acid tablets for colon-specific drug delivery, Drug development and industrial pharmacy, 25(5), 1999, 651-657.

[6] Sinha V R, Kumria R. Colonic drug delivery: prodrug approach, Pharmaceutical research, 224(1-2), 2001, 19-38.

[7] Sinkula A A, Yalkowsky S H. Rationale for design of biologically reversible drug derivatives: prodrugs, J Pharm Sci., 64, 1975, 181-210.

[8] Bronsted H, Hovgaard L, Simonsen L. Dextran hydrogels for colon-specific drug delivery, Part 3. *In vitro* and *in vivo* degradation, STP-Pharm-Sciences, 5(1), 1995, 60-64.

[9] Krishnaiah.Y S, Satyanarayana S. Inc: Advances in controlled and novel drug delivery: Colon-specific drug delivery systems, CBS Publishers and Distributors, New Delhi: India, 2001, 89-119.

[10] Ramprasad Y V, Krishnaiah Y S, Satyanarayana S. *In vitro* evaluation of guar gum as a carrier for colon-specific drug delivery. Journal of controlled release, 59, 1998, 281-287.

Diabetic Nephropathy & Its Herbal Management

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***Abstract:-*Diabetic nephropathy is a leading cause of end-stage renal failure and its morbidity and mortality is continuously increasing. It is a clinical syndrome characterized by decreased Glomerular Filtration Rate (GFR), excessive deposition of extracellular matrix proteins, thickening of the peripheral glomerular basement membrane, glomerular hypertrophy, tubulointerstitial fibrosis, decreased excretion of albumin and decreased creatinine clearance. Over the past few decades, herbal medicines have attracted much attention as potential therapeutic agents in the prevention and treatment of diabetic complications due to their multiple targets and less toxic side effects. This review aims to assess the current available knowledge of medicinal herbs for attenuation and management of diabetic nephropathy and its underlying mechanisms.**

Keywords: Diabetic nephropathy, GFR, ESRF, Glomerulus, Herbal plants

I. INTRODUCTION

Diabetic nephropathy is an important cause of morbidity and mortality, and is now among the most common causes of end-stage renal failure (ESRF) in developed countries [1]. It progresses to end-stage renal disease via a number of stages including normoalbuminuria, microalbuminuria/incipient diabetic nephropathy, macroalbuminuria and finally end-stage renal disease [2]. Progression to end stage renal disease is enhanced by hyperglycaemia, hypertension and proteinuria, which are all common in diabetes [3], [4], [5]. It is clinically defined as progressively increasing proteinuria accompanied by increasing blood pressure and impairment of glomerular filtration. Histologically, diabetic nephropathy is characterised by diffuse or nodular glomerulosclerosis, tubulointerstitial fibrosis and atrophy, and variable degrees of hyaline arteriolosclerosis and arterial sclerosis. Diabetic nodular glomerulosclerosis shares similar histological features with other clinical conditions that produce a nodular glomerulosclerosis injury pattern such as membranoproliferative glomerulonephritis, monoclonal immunoglobulin deposition disease, amyloidosis, fibrillar glomerulopathy and idiopathic nodular glomerulosclerosis [6]. Diabetic nephropathy progression is divided into different stages as follow:

A. Stage 1

Hyperfiltration (Glomerular hypertrophy) (very early diabetes)-Increased demand upon the kidneys is indicated by an above-normal Glomerular Filtration Rate (GFR).

B. Stage 2

Hyperfiltration (Mesangial expansion / basement membrane thickening (developing diabetes)-The GFR remains elevated or has returned to normal, but glomerular damage has progressed to significant microalbuminuria (small but above-normal level of the protein albumin in the urine). Patients in stage 2 excrete more than 30 mg of albumin in the urine over a 24-hour period. Significant microalbuminuria will progress to End-Stage Renal Disease (ESRD). Therefore, all diabetes patients should be screened for microalbuminuria on a routine (yearly) basis.

C. Stage 3

Microalbuminuria (Mesangial sclerosis) (Overt, or dipstick positive diabetes) — Glomerular damage has progressed to clinicalalbuminuria. The urine is "dipstick positive," containing more than 300 mg of albumin in a 24-hour period. Hypertension (high blood pressure) typically develops during stage 3.

D. Stage 4

(Overt-proteinuria Hypertension (Progressive sclerosis) late-stage diabetes)—Glomerular damage continues, with increasing amounts of protein albumin in the urine. The kidneys' filtering ability has begun to decline steadily, and Blood Urea Nitrogen (BUN) and Creatinine (Cr) has begun to increase. The Glomerular Filtration Rate (GFR) decreases about 10% annually. Almost all patients have hypertension at stage 4.

E. Stage 5

ESRD (Fibrosis/sclerosis) GFR has fallen to approximately 10 milliliters per minute (<10 mL/min) and renal replacement therapy (i.e., hemodialysis, peritoneal dialysis, kidney transplantation) is needed [7].

Herbal plants used in diabetic nephropathy

S.NO	Botanical name	Family	Common name	Parts of plant used	Dose and route of administration	Animal model
1	*Angelica acutiloba*	Apiaceae	Dong Dang Gui	Roots	50, 100, 200 mg/kg/day (p.o.)	STZ induced diabetes in Wistar rats [8]

2	*Croatian propolis*	Kasiopea	Bee glue	Whole plant	Water and ethanolic extract 50mg/kg (p.o.)	Alloxan induced diabetes in male and female CBA inbred mice [9]
3	*Epimediumbrevicornum*	Berberidaceae	Barrenw-ort, Horny goat weed	Leaves	Icariin 80mg/kg (i.g.)	STZ induced diabetes in male Sprague Dawley rats [10]
4	*Puerarialobata*	Fabaceae	Kudzu, Kudzu wine	Roots	80 mg/kg/day i.ppuerarin	STZ induced diabetes in male Sprague Dawley rats [11]
5	*Rheum officinalis*	Polygonaceae	Rhubarb	Roots	150 mg/kg rhein (p.o.)	Diabetic db/db mice [12]
6	*Silybummarianum*	Asteraceae	Milk thistle, Cardusmarianus	Seeds	100 mg/kg silibinin (p.o.)	STZ induced diabetes in male Sprague Dawley rats [13]
7	*Zingiberofficinale*	Zingiberaceae	Ginger	Rhizomes	200 mg/kg/day body weight (p.o.) ethanol extract	STZ induced diabetes in Wistar rats [14]
8	*Murraya koenigii*	Rutaceae	Curry leave	Leaves	200 mg/kg body weight (p.o.) aqueous extract	STZ induced diabetes in Sprague Dawley rats [15]
9	*Hibiscus sabdariffa*	Malvaceae	Hibiscus, Jamaica sorrel	Flowers	100 and 200 mg/kg/day methanolic extract	STZ induced diabetes in male Sprague Dawley rats [16]
10	*Hibiscus sabdariffa*	Malvaceae	Hibiscus, Jamaica sorrel	Herb	100 mg/kg aqueous extract (p.o.)	STZ induced diabetes in male Sprague Dawley rats [17]
11	*Aster koraiensis*	Asteraceae	Korean starwort	Aerial parts	100 and 200 mg/kg/day (p.o.) ethanolic extract	STZ induced diabetes in Wistar rats [18]
12	*Psidiumguajava*	Myrtaceae	Guava	Leaves	60, 120 mg/kg (p.o.)total triterpenoids	STZ induced diabetes in male albino Wistar rats [19]
13	*Asparagus racemosus*	Asparagaceae	Shatavari	Roots	100 and 250 mg/kg/day (p.o.) ethanolic extract	STZ induced diabetes in Wistar rats [20]
14	*Gongronema latifolium*	Asclepidaceae	Senegal	Leaves	100 mg/kg (p.o.) daily of aqueous and ethanol extract	STZ induced diabetes in Wistar rats [21]
15	*Panaxquinquefolius*	Araliaceae	American ginseng	Roots	200 mg/kg body weight (p.o.)alcohol extract	STZ induced diabetes in male C57BL/6 mice [22]
16	*Smallanthussonchifolius*	Asteraceae	Yacon	Leaves	10 % leaves water decoction (70mg dry extract/kg/day body weight (p.o.)	STZ induced diabetes in male Wistar rats [23]
17	*Calotropis procera*	Asclepidaceae	Apple of Sodom	Latex	100 mg/kg/day (p.o.) aqueous extract	Alloxan induced diabetes in Wistar rats [24]
18	*Acacia nilotica*	Leguminosae	Babul	Pods	150 mg/kg body weight (p.o.) aqueous methanolic extract	STZ induced diabetes in male Sprague Dawley rats [25]
19	*Parkinsoniaaculeata*	Caesalpiniaceae	Palo verde	Leaves and flowers	125 mg/kg (p.o.) hydroalcoholic extract (1: 1)	Alloxan induced diabetes in male Wistar rats [26]
20	*Allium sativum*	Alliaceae	Garlic	Bulbs	200 and 400 mg/kg body weight (p.o.) fresh garlic homogenate	STZ induced diabetes in male Sprague Dawley rats [27]
21	*Curcuma longa*	Zingiberaceae	Turmeric	Rhizomes	150 mg/kg (p.o.) curcumin	STZ induced diabetes in Sprague Dawley rats [28]
22	*Eugenia jambolana*	Myrtaceae	Jaman	Fruits	10, 15 and 20 mg/kg body weight (p.o.) α-hydroxy succinamic acid	STZ induced diabetes in male albino Wistar rats [29]
23	*Hydrangea paniculata*	Hydrangeaceae	Panicle hydrangea	Herb	7.5, 15 and 30 mg/kg (p.o.) skimming	STZ induced diabetes in adult Wistar rats [30]
24	*Magnolia officinalis*	Magnoliaceae	Houpu magnolia	Cortex	100 mg/kg body weight (p.o.) magnolol	Non-obese type 2 diabetic Goto-Kakizaki(GK) rats [31]
25	*Paeonialactiflora*	Paeoniaceae	Garden peony	Roots	5, 10 and 20 mg/kg (p.o.)paeoniflorin	STZ induced diabetes in female Harlan Sprague Dawley pathogen free rats [32]

REFERENCES

[1] Montserrat B Duran-Salgado, Alberto F Rubio-Guerra, 2014. Diabetic nephropathy and inflammation. World J Diabetes 2014 June 15; 5(3): 393-398.

[2] Giacchetti, G., L. A. Sechi, et al. (2005). "The renin-angiotensin-aldosterone system, glucose metabolism and diabetes." Trends EndocrinolMetab 16(3): 120-6.

[3] Mene, P., F. Festuccia, et al. (2001). "Diabetic nephropathy and advanced glycation end products." ContribNephrol(131): 22-32.

[4] Marshall, S. M. (2004). "Recent advances in diabetic nephropathy." Postgrad Med J 80(949): 624-33.

[5] Wolf, G. (2004). "New insights into the pathophysiology of diabetic nephropathy: from haemodynamics to molecular pathology."Eur J Clin Invest 34(12): 785-96.

[6] FerdinandoGiacco, Michael Brownlee, 2010. Oxidative stress and diabetic complications. National Institutes of Health ; 107(9): 1058–1070.

[7] Deepak N Parchwani1, Amit A Upadhyah, 2012Diabetic Nephropathy: Progression and Pathophysiology. International Journal of Medical Science and Public Health.Vol 1 Issue 2

[8] Liu, I.M., Tzeng, T.F., Liou, S.S., Chang, C.J., 2011. Angelica acutiloba root alleviates advanced glycation end-product-mediated renal injury in streptozotocin diabetic rats. Journal of Food Science 76, H165–H174.

[9] Orsolic, N., Sirovina, D., Kon, M.Z., Lackovi, G., Gregorovi, G., 2012. Effect of Croatian propolis on diabetic nephropathy and liver toxicity in mice. BMC Complementary and Alternative Medicine 12, 1–15.

[10] Qi, M.Y., Kai-Chen, Liu, H.R., Su, Y.H., Yu, S.Q., 2011. Protective effect of Icariin on the early stage of experimental diabetic nephropathy induced by streptozotocin via modulating transforming growth factor β1 and type IV collagen expression in rats. Journal of Ethnopharmacology 138, 731–736.

[11] Li, Q., Xiao, Y., Gong, H., Shen, D., Zhu, F., Wu, Q., Chen, H., Zhong, H., 2009. Effect of puerarin on the expression of extracellular matrix in rats with streptozotocin induced diabetic nephropathy. The National Medical Journal of India 22, 9–12.

[12] Gao, Q., Qin, W.S., Jia, Z.H., Zheng, J.M., Zeng, C.H., Li, L.S., Liu, Z.H., 2010. Rhein improves renal lesion and ameliorates dyslipidemia in db/db mice with diabetic nephropathy. PlantaMedica 76, 27–33.

[13] Vessal, G., Akmali, M., Najafi, P., Moein, M.R., Sagheb, M.M., 2010. Silymarin and milk thistle extract may prevent the progression of diabetic nephropathy in streptozotocin-induced diabetic rats. Renal Failure 32, 733–739.

[14] Ramudu, S.K., Korivi, M., Kesireddy, N., Lee, L.C., Cheng, I.S., Kuo, C.H., Kesireddy, S.R., 2011. Nephro-protective effects of a ginger extract on cytosolic and mitochondrial enzymes against streptozotocin (STZ)-induced diabetic complications in rats. The Chinese Journal of Physiology 54, 79–86.

[15] Yankuzo, H., Ahmed, Q.U., Santosa, R.I., Akter, S.F.U., Talib, N.A., 2011. Beneficial effect of the leaves of Murraya koenigii (Linn.) Spreng (Rutaceae) on diabetes induced renal damage in vivo. Journal of Ethnopharmacology 135, 88–94.

[16] Lee, W.-C., Wang, C.-J., Chen, Y.-H., Hsu, J.-D., Cheng, S.-Y., Chen, H.-C., Lee, H.-J., 2009. Polyphenol extracts from Hibiscus sabdariffa Linnaeus attenuate nephropathy in experimental type 1 diabetes. Journal of Agricultural and Food Chemistry 57, 2206–2210.

[17] Wang, S.C., Lee, S.F., Wang, C.J., Lee, C.H., Lee, W.C., Lee, H.J., 2011. Aqueous extract Hibiscus sabdariffa Linnaeus Ameliorate diabetic nephropathy via regulating oxidative status and Akt/Bad/14-3-3γ in an experimental animal model. Evidence-Based Complementary and Alternative Medicine, 938126.

[18] Eunjin, S., Junghyun, K., Chan-Sik, K., Young Sook, K., DaeSik, J., Jin Sook, K., 2010. Extract of the aerial parts of Aster koraiensis reduced development of diabetic nephropathy via anti-apoptosis of podocytes in streptozotocin-induced diabetic rats. Biochemical and Biophysical Research Communications 391, 733–738.

[19] Kuang, Q.T., Zhao, J.J., Ye, C.L., Wang, J.R., Ye, K.H., Zhang, X.Q., Wang, Y., Ye, W.C., 2012. Nephro-protective effects of total triterpenoids from Psidiumguajava leaves on type 2 diabetic rats. Zhong Yao Cai 35, 94–97.

[20] Somani, R., Singhai, A.K., Shivgunde, P., Jain, D., 2012. Asparagus racemosusWilld (Liliaceae) ameliorates early diabetic nephropathy in STZ induced diabetic rats. Indian Journal of Experimental Biology 50, 469–475.

[21] Ugochukwu, N.H., Cobourne, M.K., 2003. Modification of renal oxidative stress and lipid peroxidation in streptozotocin-induced diabetic rats treated with extracts from Gongronema latifolium leaves. ClinicaChimicaActa 336, 73–81.

[22] Sen, S., Chen, S., Feng, B., Wu, Y., Lui, E., Chakrabarti, S., 2012. Preventive effects of North American ginseng (Panaxquinquefolium) on diabetic nephropathy.Phytomedicine 19, 494–505.

[23] Honore, S.M., Cabrera, W.M., Genta, S.B., Sanchez, S.S., 2012. Protective effect of yacon leaves decoction against early nephropathy in experimental diabetic rats. Food and Chemical Toxicology 50, 1704–1715.

[24] Kumar, V.L., Padhy, B.M., 2011. Protective effect of aqueous suspension of dried latex of Calotropis procera against oxidative stress and renal damage in diabetic rats.Biocell 35, 63–69.

[25] Omara, E.A., Nada, S.A., Farrag, A.R.H., Sharaf, W.M., El-Toumy, S.A., 2012. Therapeutic effect of Acacia nilotica pods extract on streptozotocin induced diabetic nephropathy in rat. Phytomedicine 19, 1059–1067.

[26] Leite, A.C.R., Araujo, T.G., Carvalho, B.M., Maia, M.B.S., Lima, V.L.M., 2011. Characterization of the antidiabetic role of Parkinsoniaaculeata (Caesalpineaceae). Evidence-Based Complementary and Alternative Medicine 692378, 1–9.

[27] Mariee, A.D., Abd-Allah, G.M., El-Yamany, M.F., 2009. Renal oxidative stress and nitric oxide production in streptozotocin-induced diabetic nephropathy in rats: the possible modulatory effects of garlic (Allium sativum L.). Biotechnology and Applied Biochemistry 52, 227–232.

[28] Huang, J., Huang, K., Lan, T., Xie, X., Shen, X., Liu, P., Huang, H., 2013. Curcumin ameliorates diabetic nephropathy by inhibiting the activation of the SphK1-S1P signaling pathway. Molecular and Cellular Endocrinology 365, 231–240.

[29] Tanwar, R.S., Sharma, S.B., Singh, U.R., Prabhu, K.M., 2010. Attenuation of renal dysfunction by anti-hyperglycemic compound isolated from fruit pulp of Eugenia jambolana in streptozotocin-induced diabetic rats. Indian Journal of Biochemistry & Biophysics 47, 83–89.

[30] Zhang, S., Yang, J., Li, H., Li, Y., Liu, Y., Zhang, D., Zhang, F., Zhou, W., Chen, X., 2012. Skimmin, a coumarin, suppresses the streptozotocin-induced diabetic nephropathy in wistar rats. European Journal of Pharmacology 692, 78–83.

[31] Eun-Jin, S., Chan-Sik, K., Young Sook, K., Dong Ho, J., DaeSik, J., YunMi, L., Jin Sook, K., 2007. Effects of magnolol (5,5′-diallyl-2,2′-dihydroxybiphenyl) on diabetic nephropathy in type 2 diabetic Goto–Kakizaki rats. Life Sciences. 80, 468–475.

[32] Jianfang, F., Yuan, L., Li, W., Gao, B., Zhang, N., Ji, Q., 2009. Paeoniflorin prevents diabetic nephropathy in rats. Comparative Medicine 59, 557–566.

Antimicrobial Activity of Cannabis Sativa

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Abstract: ***Cannabis sativa*** **is a member of the family Cannabinaceae. It was used as anesthetic in india during 10th century BC. The seed oil, petroleum ether and methanol extracts of the whole plant of Cannabis *sativa* are screened for their antimicrobial activity against two Gram positive organisms (*Bacillus subtilis*, *Staphylococcus aureus*), two Gram negative organisms (*Escherichia coli*, *Pseudomonas aeruginosa*) and two fungi namely *Aspergillus niger* and *Candida albicans* using the cup plate agar diffusion method. The oil of *Cannabis sativa* exerted showed antibacterial activity (21 - 28 mm) against *Bacillus subtilis* and *Staphylococcus aureus*, moderate activity (15 mm) against *Escherichia coli* and high activity (16 mm) against *Pseudomonas aeruginosa* and inactive against the two fungi tested. The petroleum ether extract of the whole plant exhibited pronounced antibacterial activity (23 - 28 mm) against both *Bacillus subtilis* and *Staphylococcus aureus* organisms, high activity (16 mm) against *Escherichia coli* and inactive against *Pseudomonas aeruginosa* and both fungi. The methanol extract of the whole plant showed also pronounced antibacterial activity (29 mm) against *Bacillus subtilis*, low activity (12 mm) against *Staphy-lococcus aureus* and high activity (16 - 18 mm) against both Gram negative organisms, inactive against *Aspergillus niger* and low activity (13 mm) against *Candida albicans.***

I. INTRODUCTION

Cannabis sativa preparation is known by various names worldwide. It is called Marijuana in America; Bhang, Ganja and Charas in India; Kif in North Africa; Dogga in South Africa; Krori in Tunisia, Habak in Turkey; Hashish in Middle East; Djomba or Liamba in Central Africa and Brazil; Sodom, Tampl, Gum, Gauge and stuff in Kinshasa, Swala and Whiskt in Ghana; Grifa in Mexico and Macohna in some parts of South America. The chemical meaning encompasses a diversity of diverse chemical classes. The traditional cannabinoids are structurally related to Tetrahydrocannabinol commonly abbreviated as THC, the nonclassical cannabinoids, the aminoalkylindoles, the eicosanoids related to the endocannabinoids, 1,5-diarylpyrazoles, quinolines and aryl- sulphonamides and other compounds that do not fall into these usual classes but bind to cannabinoid receptors. *Cannabis sativa* has long been identified to contain antibacterial cannabinoids, whose potential to tackle antibiotic resistance has not yet been investigated. All five major cannabinoids (cannabidiol (**1b**), cannabichromene (**2**), cannabigerol (**3b**), Δ9-tetrahydrocannabinol (**4b**), and cannabinol (**5**)) showed potent activity against a variety of methicillin-resistant *Staphylococcus aureus* (MRSA) strains of current clinical relevance. Activity was remarkably tolerant to the nature of the prenyl moiety, to its comparative position compared to the *n*-pentyl moiety (abnormal cannabinoids), and to carboxylation of the resorcinyl moiety (pre-cannabinoids). Conversely, methylation and acetylation of the phenolichydroxyls, esterification of the carboxylic group of pre-cannabinoids, and introduction of a second prenyl moiety wereall detrimental for antibacterial activity.

Cannabis was used in the ancient times in Egypt to treat sore eyes. In India, prior to the tenth century B.C., it was used as an anesthetic and antiphlegmatic . It is also used in both the Hindu and Moslem systems of drugs as spasmolytic, hypnotic, analgesic in mental conditions and to increase resistance to severe physical stress. Cannabis is administered to patients suffering from rabies, cholera, rheumatism, epilepsy and tetanus. In northeastern India, some of the plants species have been used for the treatment of specific human ailments such as allergies, burns, cuts and wounds, inflammation, leprosy, leucoderma, scabies, smallpox and STDs.

II. ANTIMICROBIAL ACTIVITY

The antimicrobial action from ethanol and petroleum ether extracts against multiple microorganisms was reported. Essential oils extracted from five fiber varieties of *C. sativa* had antimicrobial activity with the degree of antimicrobial activity varying between cultivars. *C. sativa* has been reported to have pharmacological and also antimicrobial effects. Cannabidiol has been identified as constituents of hemp oil useful against Gram positive bacteria and yeast. The *C. sativa* chemotypes grown in northern latitudes are reported to have a elevated ratio of cannabidiol to tetrahydrocannabinol resulting in stronger antimicrobial activity. *Cannabis sativa* grown in Pakistan has strong antimicrobial activity against all strains of bacteria and fungi.

III. METHODS USED IN THE STUDY

The seeds and the whole plant of *Cannabis sativa* were taken. 50 grams of the air-dried and crudely powdered plant material of *Cannabis sativa* was extracted for 20 hours with petroleum ether (40°C - 60°C) in a Soxhlet apparatus. The petroleum ether extract was filtered and evaporated under reduced pressure. The extracted plant material was then air dried and repacked in the Soxhlet and exhaustively extracted with methanol. The methanol extract was filtered and evaporated under

reduced pressure. Each deposit was weighed and the percentage yield was determined.

The extract was tested against Two gram positive organisms *Bacillus subtilis* (NCTC8236) and *Staphylococcus aureus* (ATCC 25923), and two gram negative organism *Escherichia coli* (ATCC25922), and *Pseudomonas aerugi nosa* (27853) and two fungi *Aspergillus niger* (ATCC9763) and *Candida albicans* (ATCC7596). The cultures were obtained by growing the organisms on nutrient agar plates at 37°C. Then the bacterial cultures were performed on nutrient agar slopes. Nutrient agar slopes are used for bacterial cultures and for fungus Sabouraud dextrose agar slopes are used.

IV. OUTCOME WITH SEED OIL

The oil of the seeds of *Cannabis sativa* exerted noticeable antibacterial activity against *Bacillus subtilis* i.e. 21 - 28 mm and *Staphylococcus aureus*. It showed fair activity against *Escherichia coli* i.e. 15mm and high activity against *Pseudomonas aeruginosa* i.e. 16mm. It was inactive against both the fungal organisms. This result was similar to the result reported by Novak *et al.* who found that the oil extracted from *C.sativa* had antimicrobial activity and this could be due to the presence of sesquiterpenes or to the presence of cannabidiol. The oil of *Cannabis sativa* seeds exerted high antibacterial activity against *Bacillus subtilis*, which is similar to that produced by 20 µg/ml Gentamicin. It also inhibited the growth of *Staph. aureus* which is similar to 10 µg/ml Benzyl penicillin and 40 µg/ml Cloxacillin. It also inhibited growth of *E. coli* similar to 10 µg/ml Gentamicin and inhibited *Pseudomonas aeruginosa* similar to 20 µg/m Gentamicin.

V. OUTCOMES WITH PETROLEUM ETHER EXTRACT

The petroleum ether extract exhibited evident antibacterial activity (23 - 28 mm) against both Gram positive organisms, high activity (16 mm) against *Escherichia coli* and inactive against *Pseudomonas aeruginosa* and both fungi. The petroleum ether extract of the whole plant of *Cannabis sativa* inhibited *Bacillus subtilis* which is similar to 40 µg/ml Gentamicin and inhibited *Staphylococcus aureus* almost similar to 5 µg/ml Benzyl penicillin and 10 µg/ml Cloxacillin. It inhibited *Escherichia coli* which is almost similar to 10 ug/ml Gentamicin and inhibited *Pseudomonas aeruginosa* similar to 20 µg/ml Gentamicin.

VI. OUTCOMES WITH METHANOL EXTRACT

The methanol extract of the whole plant also showed well-defined antibacterial activity against *Bacillus subtilis* (29 mm), low activity against *Staph. aureus* (12 mm) and high activity against both Gram negative organisms (12 mm), it was inactive against *Aspergillus niger* and showed low activity (13 mm) against *Candida albicans.* The methanol extract of the whole plant *Cannabis sativa* inhibited *Bacillus subtilis* and *Pseudomonas aeruginosa* almost comparable to 40 µg/ml Gentamiin, *Staphylococcus aureus* similar to 5 µg/ml Gentamicin and inhibited *Escherichia coli* related to 10 µg/ml Gentamicin.

VII. DISCUSSION

Overall study showed that using cannabis as an antimicrobial agent is not a thing of loses. In western countries where gram positive bacteria are prevalent in causing infections, we can use cannabis seed oil as a safer antimicrobial. As the study shows us that seed oil has a good effect against gram positive organisms. Petroleum ether extract and methanol extract also shows very good activity against gram positive organisms. Some studies have also situated that cannabis extract is also useful in treatment of Methicillin Resistant Staph. Aureus. If we improve the activity of cannabis extracts it will solve the forthcoming problem of drug resistance which our coming generations may face.

At the end we would like to conclude that we can achieve a better future via cannabis phytochemistry. It is achievable goals through further research of the entourage effect in this versatile plant that may help in fulfill its promise as a pharmacological treasure trove.

REFERENCE

[1] Christison A (1851). On the natural history, action, and uses of Indian hemp. Monthly J Med Sci Edinburgh, Scotland 13: 26–45. 117-121.

[2] Franz C, Novak J (2010). Sources of essential oils. In: Baser KHC, Buchbauer G (eds). Handbook of Essential Oils: Science,Technology, and Applications. CRC Press: Boca Raton, FL, pp. 39–82.

[3] N. Sachindra and A. Pradhan, "*Marijuana* Drug Abuse Clinical and Basic Aspects," The C.V. Mosby Company, Saint Louis, 1977, pp. 148-173.

[4] R. Mechoulam and N. Lander, "Cannabis a Possible Source of New Drugs," *Journal Pharmacy International*, Vol. 1, 1980, pp. 19-21

[5] F. Kavanagh, "Analytical Microbiology," Academic Press, New York and London, Vol. II, 1972.

[6] J. R. Borchardt, D. L. Wyse, C. C. Sheaffer, K. L. Kauppi, R. G. Fulcher, N. J. Ehlke, D. D. Biesboer and R. F. Bey, "Antimicrobial Activity of Native and Naturalized Plants of Minnesota and Wisconsin," *Journal of Medicinal Plants Research*, Vol. 2, No. 5, 2008, pp. 98-110

[7] E. Russo, "Cannabis Treatments in Obstetrics and Gyne-cology: Historical Review," *Journal of Cannabis Thera-peutics*, Vol. 2, No. 3-4, 2002, pp. 5-35.

[8] K. Wasim, I. U. Haq and M. Ashraf, "Antimicrobial Studies of the Leaf of *Cannabis sativa* L.," *Pakistan Journal of Pharmaceutical Sciences*, Vol. 8, 1995, pp. 22- 38.

Experimental Study and Modeling of Moth Bean Drying Quality

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***Abstract*— Drying of agricultural grains, seeds is widely used to prevent biodegradation and for further processing. Drying is one of the most effective means for the preservation and storage of grains. When applied to drying of non-porous moist solid particles, the water is drawn-off driven by the difference in water concentration between the solid phases. The drying rates curves in terms of moisture content versus drying time for moth beans is obtained experimentally using a hot air oven dry, the drying rates were found to be dependent on the inlet air temperature and velocity. Experimental curves of moisture content vs. drying time, as well as drying rate and the size characteristics of the products, were determined at temperatures between 40°C and 80°C, and air velocity of 0.5m/s. for moisture content 50-56 % (wb) to about 2-3%(wb).**

Keywords - moisture content, drying rate, quality of drying, biodegradation, kinetics.

I. INTRODUCTION

Moth beans are the seeds of a tropical tree botanically known as vigina aconitifolia from family Fabaceae. Moth beans grow in small pods on thick, matted bushes. In the winter, the pods are picked, dried and threshed, either by hand or mechanically. Moth beans can be found under cultivation throughout Southeast Asia and the Middle East. They are also sometimes cultivated in the Mediterranean, in places like Italy. The hardy creeping plant favors arid conditions, and neutral to acidic soils. The plant produces bright yellow flowers which turn into elongated seedpods, which will ultimately produce small seeds around the size of a grain. These seeds can be dried and cooked, or some are saved for planting next year. Drying is usually carried out using natural sun drying and artificial hot air techniques. Moth beans produced in small quantity would prefer sun drying while for the larger plantation the artificial hot air method is preferred.

To grow moth beans, start by preparing a patch of soil in a warm, dry part of the garden. You may want to amend the soil with sand to promote good drainage, and avoid the use of excessive mulch, which will retain water. Seedlings indoors or plant the beans outdoors in the early, keep them lightly watered until they sprout and establish themselves, and then allow the soil to dry between watering. Provide runners to encourage the plant to grow up off the ground, reducing the risk of mold, mildew. Small, elongated beans with a brown skin and a brownish yellow interior. They have a nutty flavor and a strong earthy smell. Because of its size and colour, moth attracts adulteration and almost always contains dust and small stones which are mixed with it. Pick out the impurities before cooking and rinse it well in cold water. It can be stored in an airtight jar for up to 1year. Nutritional values of moth beans are Fat is 2%, carbohydrates 20%, proteins 46%, with vitamin A, B, C and calcium and others 34%. It is easily available in the local market costing about Rs.60-80 per kg.

II. MATERIALS AND METHODS

A. Samples:

The hot air drying experiments were conducted at 40, 60 and 80°C temperatures and a constant air circulation. In each experiment, about 100 gm. of soaked moth beans samples were used. Moisture loss of samples were recorded at 15 min intervals for earlier and 30 min interval subsequently thereafter for determination of drying curves.

B. Drying Procedure:

The soaked moth beans about 100 gm. were dried using an air-ventilated oven at temperature of 40, 60 and 80°C with natural convective airflow (Fig. 1). The relative humidity was 7%, 5.7% and 3.8% at these temperatures, respectively. The beans were spread thinly in single layer on a metallic sample tray. Heat was generated by the heater integrated into the walls of the oven and the distribution of the air by natural convection environment of the moth bean drying. The exhaust air escaped through a ventilation hole of 5 cm diameter at the top of the oven. Drying was conducted up to no further drying takes place. The experiment at each drying temperature was conducted in three batches.

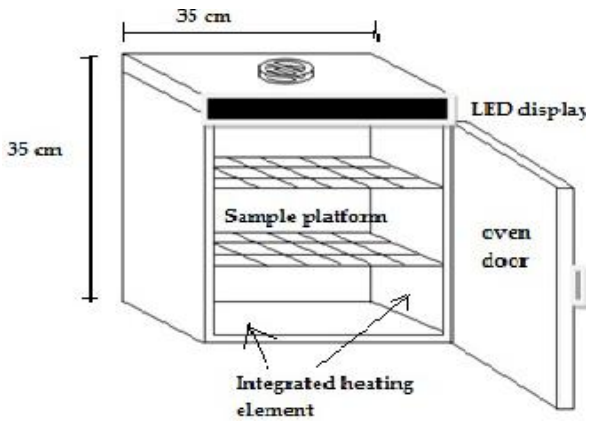

Fig 1: Schematic of the oven drying

C. Moisture content:

The beans used in each experiment were weighed initially 15 min. and later 30 min. interval during drying by using an analytical balance. The moisture content of the beans was determined with reference to the bone dry weight of the beans using the formula below,

$$Moisture\ content = \frac{M_i - M_d}{M_i} X\ 100\%\ (w.b.)$$

Where, Mi and Md are the initial and bone-dry weight, respectively. The equilibrium moisture contents (EMC) were determined by prolonging the drying process until no further change in weight was observed for the beans in each treatment. The EMC values determined were 7%, 5.7% and 3.8% for the oven drying at 40, 60 and 80°C, respectively.

D. Drying rate:

The drying rate is calculated based on the following formula as used in the drying.

$$Rd = \frac{M_t - M_{t+dt}}{t}$$

E. Mathematical modeling:

Models are used for modeling are shown in Table 1. The calculations required to fit in the models are mentioned in the next segment. The moisture ratio (MR) is calculated using the following equations:

$$MR = \frac{Mi - Me}{Mo - Me}$$

Where, the Mi, Me and Mo are weights at time ti, equilibrium and initial, respectively. Statistical parameters such as the chi-square and root mean square error were used to assess the goodness of fitting.

Modeling was carried out using the least square method and the excel spreadsheet was used to perform the calculations.

$$\chi^2 = \frac{\sum_{i=1}^{n}(MR_{exp.i} - MR_{pre.i})^2}{N - n}$$

$$RSME = \left[\frac{1}{N}\sum_{i=1}^{N}(MR_{exp.i} - MR_{pre.i})^2\right]^{\frac{1}{2}}$$

Model Name	Model	References
Newton	MR = exp (-k t)	Mujumdar (1987)
Page	MR = exp (-k t^n)	Diamante and Munr (1993)
Wang and Singh	MR = 1 + at + bt^2	Wang and Singh (1978)
Logarithmic	MR = a exp (-k t) + c	Yagcioglu et al. (1999)
Two-term exponential	MR =a exp (-k t) + (1-a) exp (-k a t)	Sharaf-Eldeen et al. (1980)
Handerson and Pabis	MR = a exp (-k t)	Henderson and Pabis (1961)
Verma et al.	MR = a exp (-k t) + (1-a)exp(-g t)	Verma et al. (1985)
Magee	MR=a+$kt^{1/2}$	Magee et al. (1983)

III. Results and discussion

- Drying kinetics and modeling:

The drying kinetics of the moth beans dried artificially inside the oven are as shown in Figs. 2 and 3. The initial moisture content before drying was about 52% w.b. The drying temperature had a significant effect on the drying kinetics of the samples. The moisture content decreased continuously with time and an increase in temperature resulted in reduced drying time. The longest drying time recorded at 6-7 hr (40°C) and shortest drying time was 3-4 hr (80°C), respectively. The drying rate curves showed falling trend beyond moisture content of 40%, 42% and 52.7% at drying temperatures of 40, 60 and 80 °C, respectively (Fig. 2). The highest drying rate achieved in 80°C was 55-56 (gw/gd hr) while at 60°C was 40-41 (gw/gd hr) and at 40 °C was 39-40 (gw/gd hr), respectively as in Fig. 3. It can be seen that at higher moisture content the increase in temperature has more considerable effect on the drying rates as compared to lower temperature which is almost negligible towards the end of drying. The availability of free water at this stage is getting lesser. In general, too high drying rate was not recommended for moth bean drying as this will retain moist in the dried product.

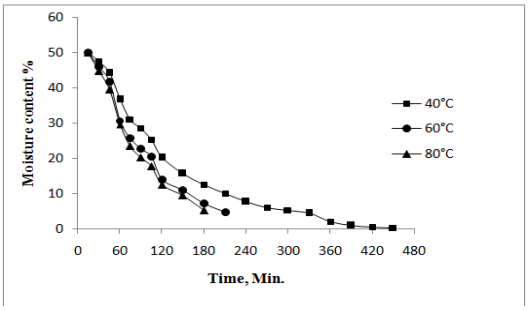

Fig 2: Drying curve of moth beans

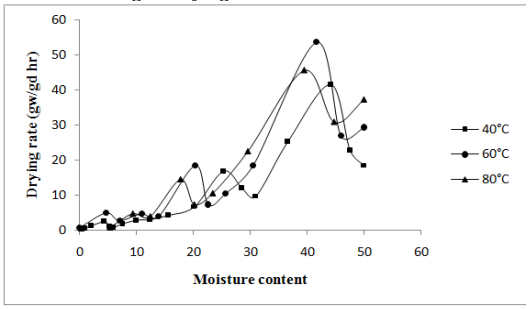

Fig 3: Drying rate of moth beans

IV. CONCLUSION

Drying kinetics and modeling of the artificial hot air drying process of moth beans were studied. Initial warm up period was observed in the 40 and 60°C temperatures. Although, these periods were short and subsequent drying only took place in the falling rate period. In the experimental work it was possible to conclude that the modeling can be used to describe the drying kinetics of moth bean drying at 40, 60 and 80°C with inclusion. All the beans were found to be acceptable in terms of physical appearance, texture, taste and colour which resemble desired quality bean. Moth beans dried at the 40°C temperature, which is at 40°C, were found to have more acceptable quality, appearance and good flavour.

REFERENCES

[1]. Akpinar, E.K., 2006. Determination of suitable thin layer drying curve model for some vegetables and fruits. Journal of Food Engineering 73, 75–84.

[2]. Akpinar, E.K., Bicer, Y., 2008. Mathematical modeling of thin layer drying process of long green pepper in solar dryer and under open sun. Energy Conversion and Management 49, 1367–1375.

[3]. Arun S. Mujumdar & Chung Lim Law, Drying Technology: Trends and Applications in Postharvest Processing" Food Bioprocess Technol (2010) 3:843–852.

[4]. Bhosale, B.S. and Arya, A.B. (2004), Effect of different modes of drying on moisture content and drying time of the selected vegetables, The Indian Journal of Nutrition and Dietetics, 41, 293.

[5]. Doymaz, I., 2005b. Drying characteristics and kinetics of okra. Journal of Food Engineering 69, 275–279.

[6]. I.Domyaz, Drying of green bean and okra under solar energy CI&CEQ17(2) 199-205(2011)

[7]. K.R.Ajao, A.A.Adedeji, Assessing the Drying rates of some Crops in Solar Dryer. Journal of Research information in Civil Engineering, Vol.5, No.1, 2008

[8]. Kudra, T., & Mujumdar, A. S. (2001). Advanced drying technologies (pp. 81–111). New York: Marcel Dekker.

[9]. Midilli, A., Kucuk, H., Yapar, Z., 2002. A new model for single layer drying. Drying Technology 20 (7), 1503–1513.

[10]. Mujumdar, A. S. (1991). Drying technologies of the future. Drying Technology, 9, 325–347.

[11]. Mujumdar, A. S. (1995). Handbook of industrial drying (second ed.). New York: Marcel Dekker.

[12]. P.K. Wankhade, R.S. Sapkal, V.S. Sapkal, Drying characteristics of okra slices on drying in hot air dryer, Elsevier Procedia Engineering 51 (2013) 371-374.

[13]. Sacilik, K., Elicin, A. K. (2006). The thin layer drying characteristics of organic apple slices. Journal of Food Engineering, 73(3), 281–289.

[14]. Yaldiz, O., Ertekin, C., Uzun, H.B., 2001. Mathematical modeling of thin layer solar drying of sultana grapes. Energy 26, 457–465.

Track-3

Technical Session 3

INTEGRATED LIFE SCIENCES

Clinical Evaluation of Metabolic Syndrome

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***Abstract*: Metabolic syndrome is a cluster of multiple risk factors which include increase in weight, insulin resistance, genetic factors, low grade systemic inflammation etc. responsible for the epidemiology and lead to the conditions like Obesity, type 2 Diabetes Mellitus, hypertension and dyslipidemia. Metabolic Syndrome is a core component of these diseased conditions. The treatment of Metabolic Syndrome is mostly non-pharmacological and it aims at promoting changes in the lifestyle. If this aim is not achieved by lifestyle changes then pharmacological treatment can be given. The major goals treatment is not only limited to weight loss, but also to an improvement in quality of life. The new developments in the treatment of metabolic syndrome with drugs, like PPAR agonists, Dalcetrapib, Lorcaserin will broaden the horizons of the current treatment options in metabolic syndrome. The results of this review reveals the strong positive influence of synthetic compound on these inflammatory processes which must be considered while developing treatment and prevention plans for Metabolic Syndrome**.

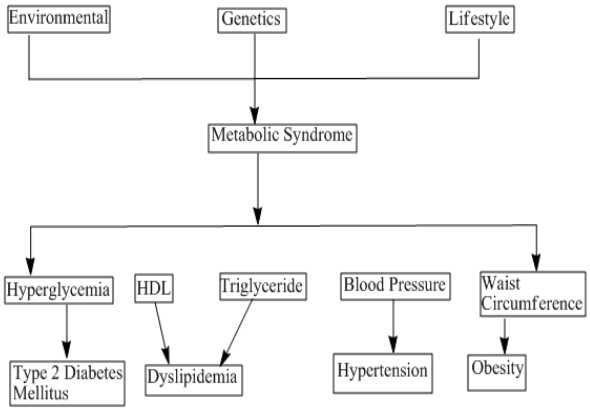
Keywords: Metabolic syndrome, diagnosis, treatment etc

I. INTRODUCTION

Multiple set of risk factors that commonly appear together, forming what is now known as the 'Metabolic Syndrome', but which has previously been termed 'Syndrome X', (1) the 'Deadly Quartet' (2) and more recently, the 'Insulin Resistance Syndrome' (3, 4). Metabolic syndrome is a group of metabolic risk factors that exist in one person. Some of the underlying causes of this syndrome that give rise to the metabolic risk factors include: being overweight or obese, having insulin resistance, being physically inactive, Genetic factors etc. MetS is a core component of these diseased conditions. The metabolic risk factors are recognized by atherogenic dyslipidemia, elevated BP and elevated plasma glucose. Also a pro-thrombotic state and pro-inflammatory state are included in this. The patients who are suffering from metabolic syndrome experience more cardiovascular risks. Also if they ignore these signs of metabolic Syndrome they get more prone to CHAOS-physically and literally. CHAOS stands for (5)**:** C- Coronary artery disease, H- Hypertension, A- Adult onset diabetes, O-Obesity and S- Stroke.

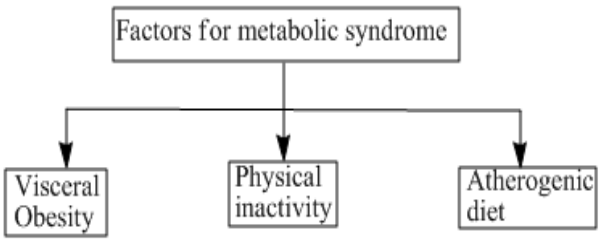
Parameter	**Clinically significant level**
Abdominal obesity	
Men	Waist circumference >40 in (102 cm)
Women	Waist circumference >35 in (88 cm)
Blood pressure	
Systolic	>130 mm Hg
Diastolic	>85 mm Hg
HDL Count	
Men	<40 mg/dL (<1.04 mmol/L)
Women	<50 mg/dL (<1.30 mmol/L)
Fasting glucose	
Men/women	>110 mg/dL (>6.11 mmol/L)
Triglycerides	
Men/women	>150 mg/dL (>1.70 mmol/L)
* If 3 risk factors are present, suspect metabolic syndrome	

II. DIAGNOSIS OF METABOLIC SYNDROME



III. CURRENT ONGOING THERAPY FOR METABOLIC SYSTEM

The metabolic syndrome (MetS) is a condition characterized by a set of clinical criteria: insulin resistance, visceral obesity, atherogenic dyslipidemia, and hypertension.



The available current evidence suggests that the first step in management of patients with metabolic syndrome should be focused on lifestyle modifications (example: weight loss and physical activity). The treatment should be based on two major components: behavioral change to reduce caloric intake and an increase in physical activity. A realistic goal for weight reduction should be 7% to 10% over 6 to 12 months. The general dietary recommendations include low intake of saturated fats, Trans fats and cholesterol, and diets with low glycemic index. (7)

Medication therapy is a critical step in the management of patients with metabolic syndrome when lifestyle modifications fail to achieve the therapeutic goals. There is no single best therapy and the treatment should consist of treatment of individual component(s).

Metabolic complication	Nondrug interventions	Medications
Abdominal obesity	• Encourage weight loss • Increase physical activity	**Orlistat:** • Lipase inhibitor
		Metformin: • prevent weight gain primarily through a direct anorectic effect or possibly indirectly by stimulating glucagon-like peptide 1 (GLP-1) secretion
		Noradrenergic drugs: phentermine, chlorphentermine, phenylpropanolamine and amphepramone • decrease appetite and food intake
		Octreotide: • suppresses pancreatic insulin secretion
		Topiramate: • Decrease food intake
Hypertriglyceridemia	• Encourage weight loss • Increase physical activity • Increase low-glycemic-index food intake • Reduce total carbohydrate intake • Increase consumption of omega-3 fatty acids • Limit alcohol consumption	**Fibrates:** • Reduce fasting and postprandial triglycerides 20% to 50% • Shift small dense LDL to large buoyant particles • Increase HDL particles 10% to 35%
		Nicotinic acid: • Reduces triglycerides 20% to 50%
		Statins: • Reduce fasting and postprandial triglycerides 7% to 30% • Reduce LDL particles • Increase HDL particles • Reduce major coronary vascular events
		Bile acid sequestrants: • Poor palatability hence used less
		Ezetimibe: • Reduce LDL level
		Omega 3 fatty acid: • Rich source of PUFA • decreases triglyceride concentration
		Sterols and stanols: • Sterol containing palnt reduce LDL level • Beneficial in hypercholesterolemia
		PPARα/γ dual agonist: • Efficacious glucose- and lipid-lowering activities
		Colesevelam: • Newest bile resin • Safe alone or in combination with statin therapy in lowering LDL levels
Hypertension	• Encourage weight loss • Increase physical activity • Reduce saturated fat intake • Reduce sodium intake • Limit alcohol consumption	**ACE inhibitors:** • May slow progression to diabetes • Decrease CVD events • Delay progression of microalbuminuria
		Angiotensin receptor blockers: • May improve dyslipidemia associated with metabolic syndrome • Delay progression of microalbuminuria
		Darusentan: • Selective endothelin receptor antagonist • Causes vasodilatation through the production of nitric oxide
		Aliskiren: • renin inhibitor • prevents the formation of both angiotensin I and II
		Omapatrilat: • Vasopeptidase inhibitor • Block both neutral endopeptidase and ACE, resulting in greater availability of natriuretic peptides that have vasodilatory effects and reducing levels of angiotensin II
Hyperglycemia	• Encourage weight loss • Increase physical activity • Reduce total carbohydrates	**Insulin** (rapid-acting, short-acting, intermediate-acting, and long-acting forms) • provide a basal level of insulin in the blood in an attempt to approximate the amount of insulin circulating in the body when not stimulated by glucose
		Insulin secretogogues (the sulfonylureas and the non sulfonylureas): • Stimulate insulin secretion from the pancreatic β-cells in response to glucose
		Insulin sensitizing agents : METFORMIN • Improves insulin sensitivity • Decreases hepatic glucose production • Inhibits hepatic glycogenolysis • It suppresses the release of fatty acids and lipid oxidation • Reduce triglycerides, very low density lipoprotein (VLDL) cholesterol, and total cholesterol, as well as decrease plasminogen activator inhibitor-1 levels **Thiazolidinediones** • Improve tissue and liver

		sensitivity to insulin by binding to the nuclear receptor PPARγ, whose highest level of expression is in adipocytes
		Glucose absorption inhibitors: • competitively inhibit α-glucosidase
		Pramilintide: • synthetic analog of amylin • Slowing the rate of gastric emptying and thereby reducing the postprandial rise in plasma glucose • Decreasing postprandial glucagon levels and reducing hepatic glucose production • Increasing satiety, possibly by inhibiting the appetite-stimulating stomach hormone ghrelin.
		Endogenous GLP-1: • An incretin hormone • Stimulates insulin secretion from pancreatic βcells, inhibits glucagon secretion, delays gastric emptying, suppresses appetite, and may stimulate islet cell regeneration.
		Glitazars: • combined PPARα and PPARγ agonist activity • Modulate lipid metabolism, lowering triglycerides and raising HDL
		AMP kinase activators: • Its glucose-lowering effect results from decreased hepatic glucose production and increased glucose utilization. • Beneficial effects on circulating lipids have been linked to reduced fatty liver. • AMP-activated protein kinase (AMPK) is a major cellular regulator of lipid and glucose metabolism.
Reference 6, 8		

IV. NEWER DRUGS AND DRUGS UNDER CLINICAL TRIALS

Medication	Action
11β-Hydroxysteroid Dehydrogenase Type 1 (inhibitors)	• Selectively manipulate tissue levels of glucocorticoids through targeted inhibition of cortisol metabolic pathways. • Improved glucose tolerance and weight reduction. • In the liver, facilitating hepatic glucose output through stimulated gluconeogenesis, and in adipose tissue, stimulating adipogenesis and lipolysis with release of free fatty acids.
Stearoyl-coenzyme A desaturase 1 inhibitior	• SCD1 converts saturated fatty acids (SFAs) to monounsaturated fatty acids (MUFAs). • SCD1 inhibition protects against diet-induced obesity, hepatic steatosis, and insulin resistance. • This suggests SCD1 may play a critical role in suppressing inflammatory diseases by shuttling proinflammatory SFAs into less biologically active MUFA-enriched neutral lipids. • SCD1 inhibitors given in conjunction with anti-inflammatory agents may provide a useful strategy to prevent the metabolic syndrome without deleterious side-effects seen with SCD1 inhibition alone.
IkB kinase *β* (Ikk*β*) inhibitors	• Reduction of IKK activity or IKK*β* expression improves insulin sensitivity. • High doses of IKK*β* inhibitors such as aspirin and salicylate reverse insulin resistance by sensitizing insulin signaling in obese rodents.
Protein tyrosine phosphatase 1B (PTP1B) inhibitor	• Protein tyrosine phosphatase 1B (PTP1B) is closely associated with insulin signaling through the dephosphorylation of activated insulin receptor or insulin receptor substrates.
Acetyl-CoA carboxylase (ACC) inhibitors	• Acetyl-CoA carboxylase (ACC) is a key determinant of energy homeostasis because increased malonyl-CoA by ACC activation inhibits mitochondrial fatty acid uptake and oxidation. • A lack of malonyl-CoA in the muscle and heart of ACC-deficient mice show increased oxidation of fatty acid, decreased fat in adipose and liver tissue, and decreased the storage of glycogen in the liver.
Dalcetrapib	• It increased level of HDL Cholesterol and decrease incidence of cardiovascular risk.
β3 AR agonists	• Stimulators of thermogenesis
Promising drugs for the treatment of obesity	
Phase III drugs	
Empatic (zonisamide + bupropion)	• Antiepileptic dopamine and noradrenaline reuptake inhibitor
Pramlintide/metreleptin	• Leptin analog + amylin analog
Cetilistat	• Pancreatic lipase inhibitor
Phase II drugs	
Liraglutide	• Long-acting GLP-1 analog
Velneperit	• Neuropeptide Y5 receptor antagonist
Tesofensine	• Triple monoamine reuptake inhibitor
Obinepitide	• PYY 3-36 and pancreatic polypeptide analog
Phase I drugs	
TPN435	• AgRP (agouti-related protein) inhibitor
ZGN-433	• MetAP2 (methionine aminopeptidase 2) inhibitor
PP1420	• Pancreatic polypeptide analog
GSK 598809	• D3 (dopamine) antagonist
AZD 7687	• DGAT1 (diglyceride acyltransferase) inhibitor
Reference 9, 10,11	

V. CONCLUSION

Medication therapy is a crucial step in the treatment of patients with metabolic syndrome. The first goal is a lifestyle modification, when lifestyle modifications fail to achieve the therapeutic goals then medication therapy is needed to achieve that goal. There is no single best therapy which can be used in metabolic syndrome. Atherogenic dyslipidemia should be controlled with statins if there is concomitant increase in low-density lipoprotein cholesterol and if indicated with combination therapy, including fibrates, nicotinic acid, bile acid-binding resins, or ezetimibe. Some evidence suggests that angiotensin-converting enzyme inhibitors and β blockers are more beneficial for treatment of hypertension in patients with metabolic syndrome. Patients with metabolic syndrome also have elevations in fibrinogen and other coagulation factors leading to prothrombotic state and aspirin may be beneficial for primary prevention in these patients. The new developments in the treatment of metabolic syndrome with drugs, such as PPAR agonists, Dalcetrapib, Lorcaserin will broaden the horizons of the current treatment options in metabolic syndrome. (7) The results of this review reveals the strong positive influence of synthetic compound on these inflammatory processes which must be considered while developing treatment and prevention plans for MetS.

REFERENCES

[1] Reaven GM. Banting Lecture 1988. Role of insulin resistance in human disease. *Diabetes 1988;***37**:1595-607

[2] Kaplan NM. The deadly quartet. Upper-body obesity, glucose intolerance, hypertriglyceridemia, and hypertension. *Arch Intern Med 1989*;**149**:1514-20.

[3] Alexander CM, Landsman PB, Teutsch SM, Haffner SM. NCEP-defined metabolic syndrome, diabetes, and prevalence of coronary heart disease among NHANES III participants age 50 years and older. *Diabetes 2003*;**52**:1210-4

[4] Haffner SM, Cassells HB. Metabolic syndrome – a new risk factor of coronary heart disease. *Diabetes, Obesity and Metabolism 2003*;**5**:359-70

[5] SRL Global Knowledge forum, January 2012, voice 127

[6] Richard A, Bernudes, Primary care update, Metabolic Syndrome: 5 risk factors guide therapy, volume 4, no.4/ April 2005

[7] Deedwania PC, Volkova N, Current treatment options for the metabolic syndrome, curr treat option for cardiovasc Med. 2005 May,7(1):61-74

[8] Johanna T. Mallare, Ana H. Karabell, Pedro Velasquez- Mieyer, Sarah R.S. Stender, and Michael L. Christensen, Diabetes Spectrum Volume 18, Number 4, 2005

[9] Min-Chul Cho, Kyoung Lee, Sang-Gi Paik, and Do-Young Yoon, Peroxisome Proliferators-Activated Receptor (PPAR),Modulators and Metabolic Disorders Volume 2008, Article ID 679137 doi:10.1155/2008/679137

[10] Gregory G. Schwartz, M.D., Ph.D., Anders G. Olsson, M.D., Ph.D., Markus Abt, Ph.D., Christie M. Ballantyne, M.D., Philip J. Barter, et al, *The* new engl and journal *o f* medicine november 29, 2012

[11] AG Powell, CM Apovian and LJ Aronne, New Drug Targets for the Treatment of Obesity, State of the art, VOLUME 90 Number 1, july 2011

Biomarkers of Nephrotoxicity

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***Abstract*—Kidneys being the major organ associated with the detoxification process of body receives high amount of toxins from blood. The accumulation of these toxins in kidneys causes structural and functional damage, which leads to acute kidney damage and on longer duration chronic kidney damage leading to renal failure if left untreated. For the detection of kidney injury different biomarkers are used like creatinine and blood urea nitrogen but these markers lacks sensitivity and specificity. So there is a need of identification and use of novel biomarkers which can predict and identify nephrotoxicity at early stages.**

Keywords: Biomarkers, Nephrotoxicity, Renal failure.

I. INTRODUCTION

Biomarker is a specially used term in biomedical sciences for laboratory measurements that support the diagnosis of a disease or as indicator of disease activity by assessing the specific biomarker [1].

Kidney being the filtrations units of body, receives major supply of blood making them major site of organ damage caused by drugs, heavy metals and other toxins present in the blood. During filtration and reabsorption process these toxins get accumulated in kidney cells. 19-25% of all cases of acute kidney injury, drug exposure were found to be the case of nephrotoxicity [2]. Drug induced nephrotoxicity in standard clinical care and during the clinical phase of drug development process found to be major cause of nephrotoxicity as compared to other toxins like heavy metals. In older adults who are using multiple medications the risk of drug induced nephrotoxicity may be as high as 66% [3].

Kidney damage occurs in two phases:

- Acute kidney damage- It mainly develops following high doses of toxins, drugs or ischemic insults. The damage can be characterized by acute tubular cell injury and kidney dysfunction [4].
- Chronic kidney damage- It is a progressive pathological condition caused by prolonged exposure of toxins to kidneys and may take years to significant damage. Chronic kidney damage is characterized by deteriorating renal function over time [5].

Acute kidney injury (AKI) is a complex disorder leading to high prevalence of morbidity and mortality in recent years. The epidemiological studies showed that this problem is continuously growing across the globe especially in developing countries at a faster rate. The treatment approaches for AKI have been found unsuccessful form a long time because of unavailability of methods of early detection and less knowledge of pathogenesis of disorder [6].

For successful treatment of kidney injury the complete understanding of different factors required includes- pathogenesis of the injury, patient related risk factors, drug-related risk factors and preventive measures [3].

Early detection is very important in kidney injuries. Most of the drugs excluded during drug development process due to toxic effect on kidneys. The commonly used biomarkers such as creatinine and blood urea nitrogen lack sensitivity and early injury responses are missed [7]. To overcome this problem Novel biomarkers are required to improve the early detection, assessment and management of AKI cases [8].

Characteristics of Ideal Biomarker:

- The ideal biomarker is one that can predict and diagnose AKI
- Identify the location of injury
- The type and etiology of injury
- Inexpensive and easy to perform
- Inexpensive and easy to perform
- Predict outcomes and enables the initiation and monitoring of therapeutic interventions
- Minimally invasive measurement techniques using readily available body fluids or tissues
- Tracks progression of injury and recovery from damage
- Displays similar reliability across multiple species, including humans
- Should have high sensitivity and specificity
- Should be specific for renal injury in presence of concomitant injury involving other organs
- Should be able to differentiate AKI from chronic kidney disease [2, 6, 8, 9, 10].

Table I: Traditional biomarkers and their limitations [1, 2, 6, 7, 8, 9, 11, 12, 16, 18, 19, 20, 21]

Biomarker	Use	Limitation
Creatinine	Glomerular filtration marker Biomarker of acute and chronic reduced kidney function	Variability in generation rates across individuals Significant extra-renal elimination Tubular reabsorption in low urine flow states Increase late after AKI Levels alters in case of congestive heart failure, dehydration, eclampsia, muscle metabolism, rhabdomyolysis After acute fall in glomerular filtration rate, creatinine excretion is low
Albuminuria	Biomarker of glomerular filtration barrier dysfunction Biomarker of proximal tubular dysfunction Early biomarker of AKI	24 hour collection unreliable Significant intra-individual variability.
Cystatin C	Glomerular filtration rate estimation Biomarker of proximal tubular dysfunction Biomarker of acute and chronic reduced kidney function	Increase late after AKI May increase in inflammatory states Altered in case of albuminuria
Creatinine clearance	Biomarker of glomerular filtration rate	Complicated Costly Time consuming
Blood urea nitrogen	Glomerular filtration marker	Reabsorbed by different nephron parts Levels increased when urea production increases Increases late Altered levels in case of hypovolemia, shock, dehydration, heart attack

Table II: Novel Biomarkers of Nephrotoxicity [3, 6, 7, 8, 11, 12, 13, 14, 15, 16, 17]

Nephron Part	Novel Biomarkers
Glomerulus	Cystatin-C, α_1-microglobulin, β_2-microglobulin, Retinol binding protein, cytokines, Interferons, Macrophage Migration Inhibitory Factor, Podocin, Transferrin, Inulin
Proximal Convoluted Tubule	α-Glutathione S-Transferases, α_1-microglobulin, β_2-microglobulin, Clusterin, Cysteine-rich protein, Cystatin-C, Exosomal fetuin-A, Hepatocyte growth factor, Interleukin-18, Kidney injury molecule-1, Liver-type fatty acid-binding protein, N-Acetyl-β-glucosaminidase, Netrin-1, Neutrophil gelatinase-associated lipocalin, Osteopontin, Retinol-binding protein, Sodium/hydrogen exchanger isoform 3, Trefoil factor 3, Alanine aminopeptidase, Alkaline phosphatase, γ-Glutamyl transpeptidase, Vascular endothelial growth factor, Tissue inhibitor of metalloproteinase 1, Cysteine-rich angiogenic inducer 61, Interleukins, Transfferin, Immunoglobulin G, Interferons, Colony-stimulating factors, β-Trace protein
Loop of Henle	Osteopontin, Sodium/hydrogen exchanger isoform 3
Distal Convoluted tubule	Clusterin, Heart-type fatty acid-bindng protein, Hepatocyte growth factor, Neutrophil gelatinase-associated lipocalin, Osteopontin, α-Glutathione S-Transferases, CalbindinD28, Vascular endothelial growth factor
Collecting Ducts	α-Glutathione S-Transferases, CalbindinD28, Renal papillary antigen 1
Renal Papilla	Kidney injury molecule-1, Clusterin

Nephrocheck is new innovation for assessing kidney function. In this fluorescence immunoassay to measure urinary levels of tissue inhibitor of metalloproteinase-2 (TIMP-2) and insulin-like growth factor binding protein 7 (IGFBP 7). First device approved by FDA as novel biomarker of kidney damage [22].

REFERENCES

[1] M. Haase and P. R. Mertens. "Biomarkers: more than just markers", Nephrol Dial Transplant, pp. 1-6, 2014.

[2] J. V. Bonventre, V. S. Vaidya, R. Schmouder, P. Feig and F. Dieterle. "Next-generation biomarkers for detecting kidney toxicity", Nat Biotechnol, vol. 28, pp. 436-440, May 2010.

[3] D. K. Dhodi, S. B. Bhagat, D. Pathak, S. B. Patel. "Drug-induced nephrotoxicity", Int J Basic Clin Pharmacol, vol. 3, pp. 591-597, July-August 2014.

[4] Baradaran, H. Nasri, M. Rafieian-Kopaei. "Protection of renal tubular cells by antioxidants: current knowledge and new trends", Cell Journal (Yakhteh), vol. 16, pp. 568-571, 2015.

[5] Z. Khan and M. Pandey. "Role of kidney biomarkers of chronic kidney disease: An update", Saudi J Biol Sci, vol. 21, pp. 294-299, 2014.

[6] J. R. Charlton, D. Portilla and M. D. Okusa. "A basic science view of acute kidney injury biomarkers", Nephrol Dial Transplant, vol. 29, pp. 1301-1311, 2014.

[7] L. Meer, M. Moerland, A. F. Cohen and J. Burggraaf. "Urinary kidney biomarkers for early detection of

nephrotoxicity in clinical drug development", Br J Clin Pharmacol, vol. 77, pp. 947-957, 2013.

[8] P. Devarajan and P. Murray. "Biomarkers in Acute Kidney Injury: Are We Ready for Prime Time?", Nephron Clin Pract, vol. 127, pp. 176-179, 2014.

[9] G. M. McMahon and S. S. Waikar. "Biomarkers in Nephrology", Am J Kidney Dis, vol. 62, pp. 165-178, July 2013.

[10] E. Tsigou, V. Psallida, C. Demponeras, E. Boutzouka and G. Baltopoulos. "Role of New Biomarkers: Functional and Structural Damage", Crit Care Res Pract, vol. 2013, Article ID 361078, 13 pages, http://dx.doi.org/10.1155/2013/361078

[11] S. Lopez-Giacoman and M. Madero. "Biomarkers in chronic kidney disease, from kidney function to kidney damage", World J Nephrol, vol. 4, pp. 57-73, February 2015.

[12] C. Briguori, C. Quintavalle, E. Donnarumma and G. Condorelli. "Novel Biomarkers for Contrast-Induced Acute Kidney Injury", Biomed Res Int, vol. 2014, Article ID 568738, 5 pages. http://dx.doi.org/10.1155/2014/568738

[13] D. A. Brott, S. H. Adler, R. Arani, S. C. Lovick, M. Pinches, S. T. Furlong. "Characterization of renal biomarkers for use in clinical trials: biomarker evaluation in healthy volunteers", Drug Des Devel Ther, vol. 8, pp. 227-237, 2014.

[14] G. Currie, G. McKay, C. Delles. "Biomarkers in diabetic nephropathy: Present and future", World J Diabetes, vol. 5, pp. 763-776, December 2014.

[15] S. Y. Kim and A. Moon. "Drug-Induced Nephrotoxicity and Its Biomarkers", Biomol Ther, vol. 20, pp. 268-272, 2012.

[16] T. C. Fuchs and P. Hewitt. "Biomarkers for Drug-Induced Renal Damage and Nephrotoxicity-An Overview for Applied Toxicology", The AAPS Journal, Vol. 13, December 2011.

[17] M. A. Ferguson, V. Vaidya and J. V. Bonventre. "Biomarkers of Nephrotoxic Acute Kidney Injury", Toxicology, vol. 245, pp. 182-193, March 2008.

[18] R. S. Sundaram, B. R. Abhirama, L. Gowtham, G. Kalpana, M. Sudha, T. Thiyagarajan, S. Pushpa and G. K. Priyadharsini. "Limitations of Conventional Parameters and Role of Urinary Protein Biomarkers in the Determination of Drug Induced Acute Kidney Injury in Very Early Stage", Br J Pharm Res, vol. 4, 2014.

[19] S. Gowda, P. B. Desai, S. S. Kulkarni, V. V. Hull, A. K. Math and S. N. Vernekar. "Markers of renal function tests", N Am J Med Sci, vol. 2, pp. 170-173, April 2010.

[20] J. X. Huang, M. A. Blaskovich and M. A. Cooper. "Cell- and biomarker-based assays for predicting nephrotoxicity", Expert Opin Drug Metab Toxicol, vol. 10, pp. 1621-1635, 2014.

[21] J. C. Sirota, J. Klawitter and C. L. Edelstein. "Biomarkers of Acute Kidney Injury", J Toxicol, vol. 2011, Article ID 328120, 10 pages http://dx.doi:10.1155/2011/328120.

[22] Z. H. Endre and J. W. Pickering. "Cell cycle arrest biomarkers win race for AKI diagnosis", Nat Rev Nephrol advance online publication 28 October 2014; http://dx.doi:10.1038/nrneph.2014.198

Clinical Relevance of Stress on Diseased Condition

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***Abstract*: Stress leads to disease it's a widespread public belief, the biomedical community also remains skeptical of this conclusion. Stress occurs when an individual perceives that environmental demands tax or exceeds his or her adaptive capacity. When stress grips our body, sometimes this response may have far-ranging negative effects on our physical health. Nearly all body systems become potential targets, and long term effects may be devastating. Stress may contribute to condition like anxiety, irritability and fatigue, punctuate our social interactions with hostility and anger. Effects of stress on regulation of immune and inflammatory processes have potential to influence depression, infectious and coronary artery disease. The provision of fuel for energy production will have highest priority, when body mobilizes energy for fight or flight respone, this means that the concentration of glucose and fatty acids will increase. In this review, we discuss the plausibility of the belief that stress contributes to variety of disease processes and summarize the role of stress in 3 major diseases: clinical depression, diabetes and obesity. Additionally, this paper is an attempt to list the plants with anti-stress effect and related beneficial effects on the above diseased condition.**

Keywords: Stress, Diabetes, Depression, Obesity, Herbal Therapy.

I. INTRODUCTION

Stress is the physiological demand placed on the body when one must adapt, cope or adjust [1]. It can be healthful and essential in keeping an individual alert. Stress as a concept describes the effects of psychosocial and environmental on factors on physical or mental well-being. Hence stress implies a challenge (stimulus) that requires behavioural, psychological and physiological changes (adaptations) to be successfully met and a state of hyperarousal for the initiation of necessary counteracting reactions (stress response). A stressor is any real or perceived physical, social or psychological stimulus that causes our body to react or respond. Through an extremely complicated homeostasis, all living organism maintain their survival in the face of both internally and externally generated stimuli. Thus all life forms have developed mechanisms to overcome immediate perturbation (protective perturbation response). Two well-known molecules that play a major role in the allostatic stress response, each represents one 'arm' of the response the hypothalamic-pituitary adrenal axis (HPA) axis and the sympathoadrenal medullary (SAM) system, are cortisol and norepinephrine (NE)/epinephrine. Hence the objective of this work is to elucidate common pathophysiological patterns of stress over diseased condition and herbal therapy to overcome this stress over diabetes, depression and obesity. Stress itself an accumulation of stress hormones over time may contribute to infection and illness.

Stress affects our physical health as shown in fig below:

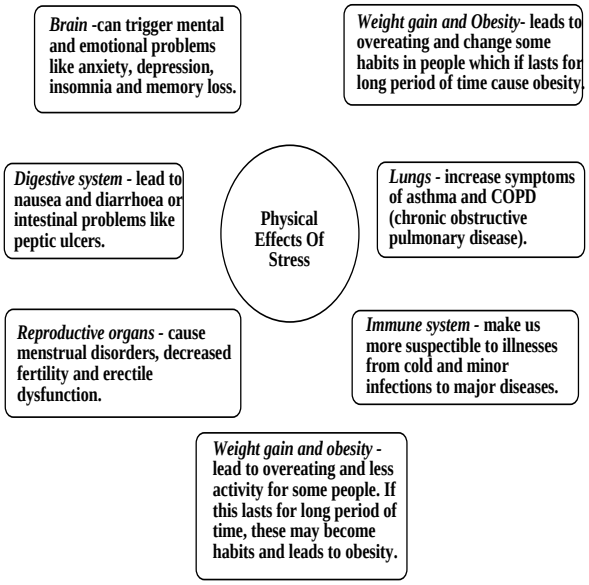

Fig. 1: Stress affects our physical health

II. STRESS AND DIABETES

Stress increase the blood sugar level and give rise to diabetes [3]. In people who have diabetes, the fight or flight response doesn't work well. Glucose piles up in the blood because insulin is not able to allow extra energy to pass into the cells [4].Long term stress can cause long term high blood sugar levels. Physical stress such as illness and injury causes higher blood glucose levels in people with type 2 diabetes. Stress alters the blood sugar levels in diabetic patients in 2 ways:

- First, People under stress are anxious and may lose appetite. The intake of alcohol may be increased. Further anxiety leads to less exercise. The result can be disastrous for people with diabetes.
- Second, stress hormones antagonizes the action of insulin and directly alters the blood sugar levels. Diabetic mice under physical or mental stress have elevated glucose levels. People with type 1 diabetes may develop elevated blood glucose levels and ketoacidosis. Those with type 2 diabetes usually weight

gain and develop obesity and often blood glucose levels are raised [4]. Inflammatory signalling pathways can also become activated by metabolic stresses originating from inside the cell as well as by extra-cellular signalling molecules. The overproduction of oxygen free radicals occur due to hyperglycemia and consequently increases the protein oxidation and lipid oxidation

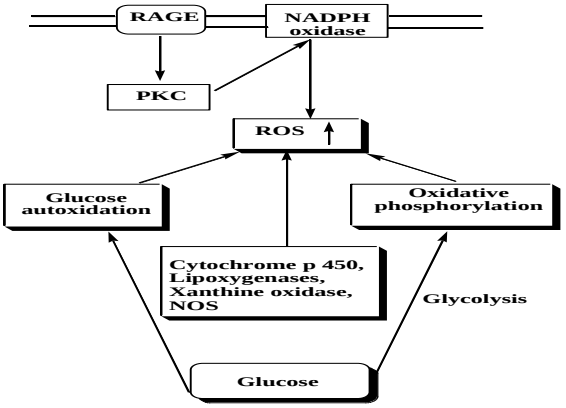

Fig. 2: Reactive oxygen

Reactive oxygen species (ROS), such as superoxide, hydroxyl radical and hydrogen peroxide, arise from many cellular sources such as oxidative phosphorylation, glucose autoxidation, nicotinamide adenine dinucleotide phosphate (NADPH) oxidase, and other enzymes, such as xanthine oxidase, lipoxygenase, cytochrome P450 monooxygenases and nitric oxide synthase in response to hyperglycemia. ROS also arise from the production of advanced glycation end products (AGE) and activation of AGE receptors (RAGE).

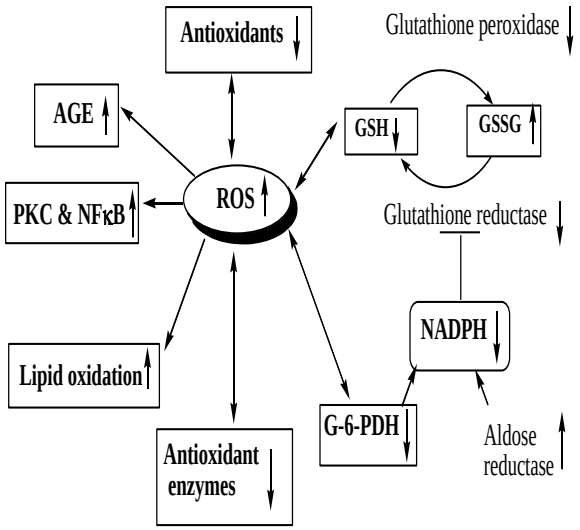

Fig. 3 Production of ROS

Production of ROS (reactive oxygen species) depletes antioxidants and antioxidant enzymes, leading to additional ROS (denoted by double-headed arrows). This ROS accumulation subsequently causes lipid and protein oxidation and activates signaling pathways through protein kinase C and NFκB

III. STRESS AND OBESITY

Stress is a challenge to the natural homeostasis of an organism. Autonomic nervous system (ANS) which include sympathetic nervous system and parasympathetic nervous system and HPA axis are the two major components of stress response. These symptoms work centrally and peripherally to produce several responses.

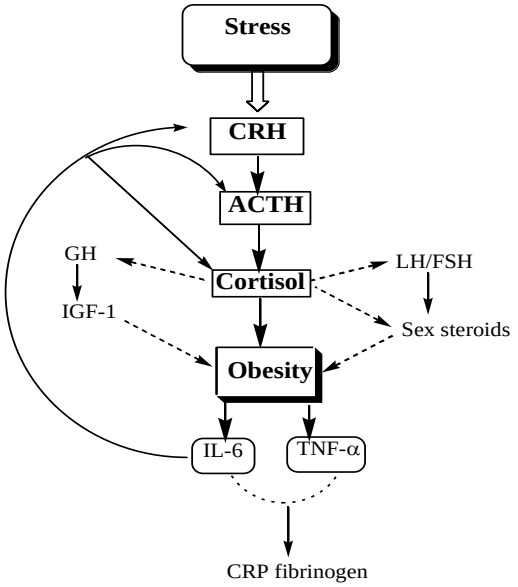

Fig. 4: Chronic HPA axis activation

Chronic HPA axis activation leads to obesity and lean body (muscle and bone) mass reduction by stimulating adipocyte proliferation and suppressing gonadal and growth hormone functions. IL-6 and TNF-α both are overproduced. CRH: corticotropin-releasing hormone.

Chronic stress increases the complications of the obesity, especially upper body obesity and other metabolic syndromes. Stress causes alteration in the hypothalamic-pituitary-adrenal (HPA) axis. In obesity during stress response, the para-ventricular nucleus of the hypothalamus secrete corticotropin-releasing hormone (CRH) which stimulates adrenocorticotropin synthesis (ACTH) from the anterior pituitary gland. Physical stressors activate the PVN neurons expressing ACTH secretagogues such as arginine vasopressin and CRH [7].

Increased generation of reactive oxygen species (ROS) in obesity is due to the increased synthesis of pro-inflammatory cytokines such as TNF-α, IL-6 and IL-1, which could lead to chronic obesity complications due to stress. Lowered SNS (sympathetic nervous system) activity also increases the risk of obesity. If the SNS is activated, metabolism, energy expenditure, thermogenesis mobilization of stores also increased [7].

IV. STRESS AND DEPRESSION

The timing of glucocorticoid receptors (GR) activation determines the effective repression of cyclic AMP-induced transcription of the CRH gene, thus clarifying that in vivo a critical time window may exist for effective repression of CRH gene and HPA axis by glucocorticoids.

- Knowledge on the functioning of the HPA axis under acute and chronic challenge is also a key to

understanding the intimate link between stress response and pathogenesis of depression [8]. In figure 5, stress stimulate TrKB receptors of hippocampus which cause decreases the hippocampal function and affects mood and causes depressive complications.

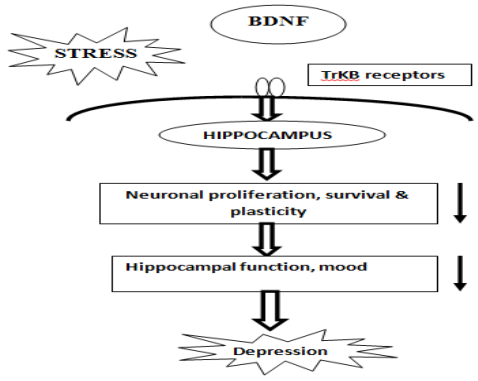

Fig.5 Pathway of Stress leads to depression

V. HERBS TO TREAT STRESS

Herbs which reduce stress over diabetes, obesity and depression are given in table below:

Plant name	**Ayurvedic/ common name**
Herbs used in diabetes	
Areca catechu	Supari
Beta vulgaris	Chukkander
Boerhavia diffusa	Punarnava
Camellia sinensis	Tea
Caesalpinia bonducella	Sagarghota
Emblica officinalis	Amla , a constituent of herbal formulation ,"Triphala"
Gymnema sylvestre	Gudmar
Hemidesmus indicus	Anantamul
Terminalia chebula	Hirda
Vinca rosea	Sada bhar
Withania somnifera	Ashvagandha
Herbs used in obesity	
Acacia arabica	Babbula
Acorus calamus	Vacha
Aloe vera	Kumari
Betula utilis	Burja
Cassia tora	Chakramardha
Cedrus deodara	Devadaru
Commiphora mukul	Guggulu
Moringa oleifera	Sigru
Santalum album	Candana
Terminalia chebula	Haritaki
Tinospora cordifolia	Guduchi
Trigonella foenum graceum	Methika
Valeriana jatamansi	Tagara
Herbs used in depression	
Hypericum perforatum	Amber
Lavandula angustifolia	Lavender oil
Borago officinalis	Borage
Rhodiola rosea	Roseroot
Matricaria chamomilla	Chamomile
Crocus sativus	Saffron
Panax ginseng	Ginseng

REFERENCES

[1] Nevid, J. & Rathus, S. (2003),"Psychology and the Challenges of Life: Adjustments in the New Millenium", 8th edition. Hoboken, NJ: John Wiley and Sons, Inc.

[2] Tobias Esch, George B. Stefano, Gregory L. Fricchione, Herbert Benson,"Stress-related diseases – a potential role for nitric oxide": Med Sci Monit, 2002; 8(6): RA103-118.

[3] Kahn, C. R. and G. C. Weir. (Eds.). 1996. "Joslin¢s Diabetes Mellitus" New Delhi: B.I. Waverly Pvt. Ltd

[4] American Diabetes Association. Official Home Page of American Diabetes Association. 2007. How Stress Affects Diabetes. Retrieved on 14. 2. 2007 from http://www.diabetes.org/type-1-diabetes/stress.jsp.

[5] Wijenaike, Nishan. Official Home Page of Diabetes Suffolk.com. 23rd November 2002. "Diabetes and Stress". Retrieved on 22. 3. 2007 from http://www. diabetesuffolk.com.

[6] Vadde, Ramakrishna and Rama Jailkhani. 2007."Evaluation of oxidative stress in Insulin Dependent Diabetes Mellitus (IDDM) patients." Diagnostic Pathology, doi: 10.1186/1746-1596-2-22.

[7] Ioannis Kyrou, Constantine Tsigos," Chronic stress, visceral obesity and gonadal dysfunction": HORMONES,2008;7(4):287-293.

[8] Alessandro Bartolomucci, Rosario Leopardi," Stress and Depression: Preclinical Research and Clinical Implications", PLoS ONE:2009;4(1):e4.

Clinical Evaluation of Alzheimer Disease

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***Abstract*— Alzheimer disease is a neurodegenerative brain disease of unknown cause that is the most common form of dementia, which usually starts in late middle age or in old age and results in progressive memory loss, impaired thinking, and disorientation, marked histologically by the degeneration of brain neurons especially in the cerebral cortex. Pathophysiology of Alzheimer disease is based on the intracellular aggregates of the hyperphosphorylated microtubule-associated protein, tau in microtubules tangles and Amyloid β and cholinergic hypothesis. Cholinesterase inhibitors (Galantamine, Rivastigmine, Donepezil), Memantine are the approved drugs for the treatment of the Alzheimer Disease. Studies on some drugs like Paclitaxel, Phosphodiesterase inhibitors, Physostigmine, Piracetam, Propentofylline; Rosiglitazone has been completed but none of these compounds are approved for treatment in the Alzheimer disease. Phase III randomised clinical trials with Latrepirdine are ongoing which is a non-selective anti-histaminic agent. Trials on passive immunization with intravenous immunoglobulin's and monoclonal antibodies against Aβ. Several of the agents described are currently in phase II-III clinical trials. In this, we have discussed about the pathology, treatment and ongoing clinical trials study on the drugs that may be thought to be useful in the Alzheimer Disease.**

Keywords—Alzheimer,Tauproteins,Betaamyloid,Cholinesterase inhibitors.

I. INTRODUCTION

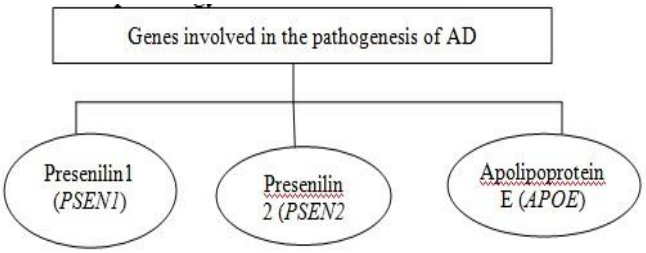
Alzheimer disease (AD) is a most common type of dementia. It is a chronic, progressive neuronal degeneration disease. It is a relentlessly progressive disorder that typically manifests initially by severe loss of memory, particularly of episodic memory.

Alzheimer's gets more regretful/riskier over time. The symptoms of disease can vary widely; the first symptom appears many people notice forgetfulness and less severe ability to function at home or at work, or to enjoy lifelong hobbies.

The disease may cause a person to become confused, lost in familiar places, misplace things or have problem with language.

AD is characterized by various neuropathological changes such as neurofibrillary tangles (NFTs), neuronal loss, amyloid plaque deposition and behavioural changes such as learning and memory impairment, anxiety and depression.

In AD the area of brain that are most affected are the hippocampus, Amygdala, cerebral cortex. Alzheimer described the "miliary bodies" (plaques) and "dense bundles of fibrils" (tangles) these two are known as hallmarks of the disease. In 1985, researchers succeeded in purifying plaque cores and amyloid angiopathy, and the 4 kD β-amyloid (Aβ) peptide which was identified as the main component which is responsible for the AD. [1]



Genes involved in pathology of Alzheimer disease [2]

A. Stages of Alzheimer disease:-

- **Early stage Alzheimer disease:-**In the early stage of AD the people is having problem with word-finding, vision/spatial issues, and poor judgment.
- **Mild Alzheimer's Disease;-** As Alzheimer's disease progresses, memory loss occurs, and changes in other cognitive abilities are prominent. Problems can include, for example, trouble handling money and paying bills, repeating questions, using poor judgment. People diagnosed in this stage for Alzheimer disease.
- **Moderate Alzheimer's disease**:-In this stage of Alzheimer disease, damage occurs in areas of the brain that involve in reasoning, sensory processing, and conscious thought. Memory loss and confusion grow worse, and people begin to have problems in recognizing family and friends. In this stage of Alzheimer Disease people having problem like hallucination and delusions.
- **Severe Alzheimer's disease:-**In the final stage, plaques and tangles are found throughout the brain, and brain tissue has shrunk significantly. People with severe Alzheimer's disease having the problem with communication and are completely dependent on others for their care. Near the end, the person may be in bed most or all of the time as the body shuts down. [3]

II. EPIDEMIOLOGY OF AD

AD affects more than 35 million individuals worldwide, including more than 5.4 million Americans. AD is a typical age-dependent neurodegenerative disease affects

5% of individuals >65 years,

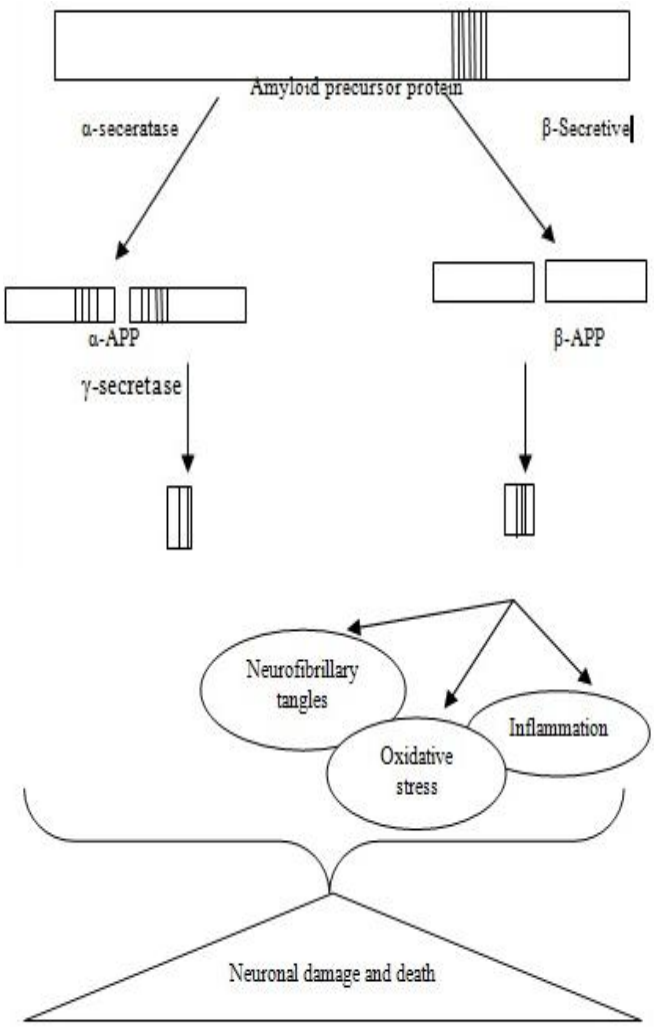
20% of individuals> 85 years,

One-third of those >90 years, [4]

III. PATHOLOGY OF AD

It involves the following hypothesis:

- Amyloid-β Hypothesis
- Tau protein Hypothesis
- Glutamenergic Hypothesis [5]



At present, approved pharmacological therapy for Alzheimer's disease (AD)

1) Donepezil
2) Rivastigmine
3) Memantine
4) Galantamine [6]

Treatment of AD in current practice:-

S. No.	Therapy	Description
1.	Symptomatic treatments	• Drugs for symptomatic treatments are cholinesterase inhibitors- - Donepezil - Rivastigmine - Galantamine - Memantine • Enhance cognitive function[7] • Memantine is the only currently available symptomatic treatment of mild to moderate Alzheimer Disease protection against the effects of excitatory neurotransmitter glutamate.
2.	Antiamyloid disease modifying treatments	• These drugs decrease amyloid β production. • These class of drugs are currently evaluated in the phase 2 and phase 3 clinical trials. • They include:- - Immunotherapies - Secretase inhibitors - Anti amyloid beta aggregation agents.[8]
3.	Immunotherapy	• Amyloid vaccine AN-1792, with aggregated amyloid peptide as the immunogen-reduced A-β accumulation in brain. Phase 2 trial is done on this vaccine.[9]
4.	Passive immunization	• Anti-Aβ antibodies are administered intravenously for better safety and efficacy. • Phase 3 clinical trials on Monoclonal antibodies like Bapineuzumab and Solanezumab antibodies are done. • On the pooled human immunoglobin phase 2 trials are done that show the promising effects on cognitive enhancements.[10]
5.	RAGE (Receptors for advanced glycated end products) Inhibitor	• For advanced glycated end products on the surface of cells amyloid bind to the receptors. • This binding leads to the inflammation and neuronal death. • PF-04494700 is orally bioavailable small molecule antagonist of the RAGE (Receptors for advanced glycated end products). • Investigated in phase 2 trial[11]
6.	Tarenflurbil	• enantiomer of the non-steroidal anti-inflammatory drug Flurbiprofen • Modulate the activity of gamma secretase, thereby reducing Aβ. • In phase 2 trial in patients with mild to moderate AD, this drug shows possible beneficial effects. • Phase 3 (18 months trial) does not show any beneficial effects in AD therapy.[12]
7.	Gamma secretase inhibitors	• Semagacestat, a gamma secretase inhibitor. • Phase 3 studies are conducted on this drug. • These studies shows reduction in the amyloid peptide generation in the blood and cerebrospinal fluid of patients with AD.[13]
8.	Targetting tau protein	• GSK-3 inhibitor, lithium with certain antioxidants like vitamin E, vitamin B, used to target the tau.[14]
9.	Methlene blue	• Interfere with tau aggregation. • On this stain phase 2 study has been completed • Piviotal phase 3 trials are planned.[15]
10.	Dimebon	• Antihistaminic drug studied in Russia • 6months phase 2 trial of Dimebon (20 mg three times a day) in 183 patients • Drug shows improvement in the all cognitive and behavioural outcomes[16]
11.	AC-1204	• Target metabolic deficits and imbalance associayed with Alzheimer Disease. • Improve memory and cognition functions in

		AD patients.[17]

IV. CLINICAL EVALUATION OF AD:-

Compounds under trial for the treatment of AD

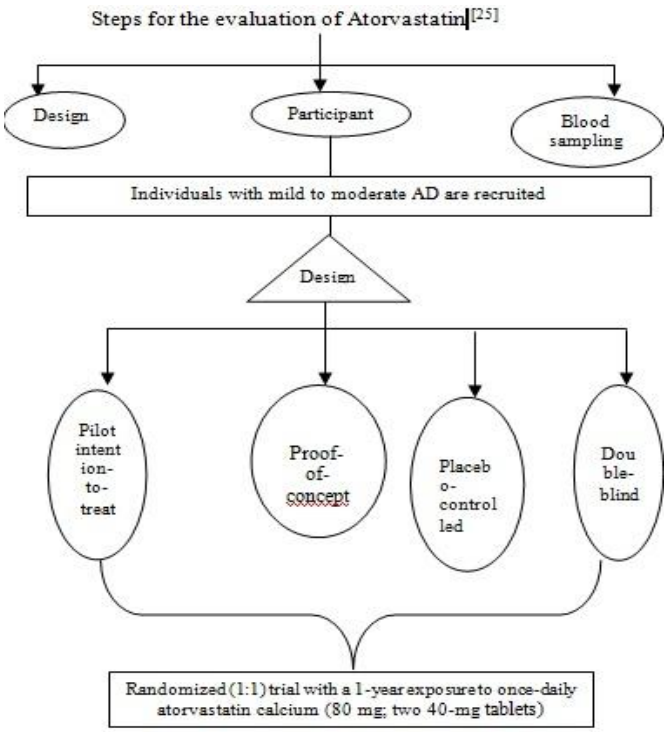
A. Modifying AD with monoclonal antibodies:

Monoclonal antibodies those have been or are being tested for the treatment of Alzheimer's disease:-

Monoclonal antibodies	**Type**	**Trial results**
Gantenerumab	full human	Phase 2a trial showed reduction in brain amyloid β on PET [19,20]
Crenezumab	humanized IgG4	Phase 1 trial showed compound was safe and well-tolerated [21,22]
BAN2401	humanized mAb158	Phase 1 trial showed compound was safe and well-tolerated [23,24]
Phenserine	Acetylcholinesterase inhibitor	Phase II (USA)
AIT-082	Neutrophic factors	Phase III Europe
AN-1792 (AD vaccine)	Amyloid neutralizing property	Phase (USA)

B. Clinical evaluation of the drugs for AD (Eg. Atorvastatin calcium):

The clinical evaluation of atorvastatin calcium is done to determine cognitive and/or behavioral decline in patients with mild to moderate AD.



Atorvastatin reduced circulating cholesterol levels and produced a positive signal on each of the clinical outcome measures compared with placebo.

Atorvastatin treatment may be of some clinical benefit and could be established as an effective therapy for Alzheimer disease if the current findings are substantiated by a much larger multicenter trial.

Consistent with results in individuals with normal cognition, atorvastatin treatment produced significant decreases in total cholesterol low-density lipoprotein cholesterol, and very low-density lipoprotein cholesterol levels (not shown) among the individuals with mild to moderate AD compared with placebo (P<.01).

REFERENCES

[1] K. Blennow, H. Zetterberg, AM. Fagan, "Fluid biomarkers in Alzheimer disease", Cold Spring Harb Perspect Med, vol 2[9], pp.1-23, 2012.

[2] J.Williamson, J.Goldman, KS. Marder, "Genetic Aspects of Alzheimer Disease", Neurologist, vol 15[2], pp. 80–86, 2009.

[3] Alzheimer's Disease Education and Referral [ADEAR] Centre, Alzheimer's disease, Fact Sheet, July 2011, NIH Publication No. 11-6423.

[4] JE.Lee, PL.Han, "An Update of Animal Models of Alzheimer Disease with a Reevaluation of Plaque Depositions", Exp Neurobiol, vol 22[2], pp.84-95, 2013.

[5] J. Kang, HG. Lemaire, A. Unterbeck, "The precursor of Alzheimer's disease amyloid A4 protein resembles a cell-surface receptor", *Nature.*vol [325], pp.733-736, 1987.

[6] F.Massoud , S.Gauthier, "Update on the Pharmacological Treatment of Alzheimer's Disease", Current Neuropharmacology,vol[8], pp.69-80,2010.

[7] IA. Lockhart, SA.Mitchell, S.Kelly, "Safety and tolerability of donepezil, rivastigmine and galantamine for patients with Alzheimer's disease: systemic review of the 'real world' evidence", Dement Geriatr Cogn Disord, vol [28], pp.389-403, 2009.

[8] WQ.Henry, ML.Frank, "Alzheimer's disease: the mechanism of disease",N Engl J Med, vol [362], pp.329-344,2010.

[9] A.Ghochikyan, "Rationale for peptide and DNA based epitope vaccines for Alzheimer's disease immunotherapy",CNS Neurol Disord Drug Targets,vol 20[8], pp.128-143,2009.

[10] S.Salloway, R.Sperling , S.Gilman , NC.Fox, K.Blennow , M.Raskind , M.Sabbagh, LS.Honig, R.Doody , CH.Dyck, R.Mulnard , J.Barakos, KM.Gregg , E.Liu, I. Lieberburg , D.Schenk, R.Black, M.Grundman, "Bapineuzumab 201 Clinical Trial Investigators A phase 2 multiple ascending dose trial of bapineuzumab in mild to moderate Alzheimer disease",Neurology,vol [73], pp.2061-2070,2009.

[11] E.Kojro , R.Postina, "Regulated proteolysis of RAGE and AbetaPP as possible link between type 2 diabetes mellitus and Alzheimer's disease", J Alzheimers Dis, vol[16], pp.865- 878,2009.

[12] WK.Gordon, "Efficacy and safety of tarenflubil in mild to moderate Alzheimer's disease: a randomized phase 2 trial",The Lancet Neurology,vol 7[6],pp.483-493,2009.

[13] RJ. Bateman, ER. Siemers, KG. Mawuenyega, G. Wen, KR. Browning, WC. Sigurdson, KE. Yarasheski, SW. Friedrich, RB.

Demattos, PC. May, SM. Paul, DM. Holtzman, " A gammasecretase inhibitor decreases amyloid-beta production in the central nervous system", Ann Neurol, vol [66], pp.48- 54,2009.

[14] HG. Lee, G. Perry, PI. Moreira , MR. Garrett , Q. Liu , X. Zhu , A. Takeda , A. Nunomura , MA. Smith, "Tau phosphorylation in Alzheimer's disease: pathogen or protector"? Trends MolMed,vol [11], pp.164-169,2005.

[15] M. Necula, L. Breydo, S. Milton, R. Kayed R, WE. Van der Veer, P. Tone , CG. Glabe, "Methylene blue inhibits amyloid Abeta oligomerization by promoting fibrillization. Biochemistry", vol [46], pp.8850-8860,2007.

[16] W. Grigor'ev , T. Garibova , T. Voronina , S. Litvinova, S. Bachurin, "Effects of chronic administration of dimebon on behavior and memory of SAMP 10 mice", Eksp Klin Farmakol, vol [72],pp.52-56,2009.

[17] Montgomery, A. Stuart, JL. Thal, R. Amrein, "Meta-analysis of double blind randomized controlled clinical trials of acetyl-L-carnitine versus placebo in the treatment of mild cognitive impairment and mild Alzheimer's disease", International Clinical Psychopharmacology,vol 18[2], pp.61-67,2009.

[18] F. Colciaghi, B. Borroni, M. Zimmermann, C. Bellone, A. Longhi, A. Padovani, F. Cattabeni, Y. Christen, M. Di Luca, "Amyloid precursor protein metabolism is regulated toward alpha-secretase pathway by Ginkgo biloba extracts", Neurobiology of disease, vol [16], pp.454-460,2004.

[19] B. Bohrmann, K. Baumann, j. Benz, F. Gerber, W. Huber, F. Knoflach, J. Messer, K. Oroszlan, R. Rauchenberger, WF. Richter, C. Rothe, M. Urban, M. Bardroff, M. Winter, C. Nordstedt, H. Loetscher, "Gantenerumab: a novel human anti- Aβ antibody demonstrates sustained cerebral amyloid-β binding and elicits cell-mediated removal of human amyloid-β", J Alzheimers Dis, vol [28], pp.49–69,2012.

[20] S. Ostrowitzki, D. Deptula, L. Thurfjell, F. Barkhof, B. Bohrmann, DJ. Brooks, WE. Klunk, E. Ashford, K. Yoo, ZX. XU, H. Loetscher, L. Santarelli, "Mechanism of amyloid removal in patients with Alzheimer disease treated with gantenerumab," Arch Neurol, vol [69], pp.198–207,2012

[21] O. Adolfsson, M. Pihlgren, N. Toni,Y. Varisco , AL. Buccarello, K. Antoniello ,S. Lohmann, K. Piorkowska,V. Gafner, JK. Atwal, J. Maloney, M. Chen, A. Gogineni, RM. Weimer, DL. Mortensen, M. Friesenhahn , C. Ho, R. Paul, A. Pfeifer, A. Muhs, RJ.Watts, "An effector-reduced anti-β-amyloid (Aβ) antibody with unique aβ binding properties promotes neuroprotection and glial engulfment of Aβ"' J Neurosci, vol [32], pp.9677–9689,2012.

[22] K. Garber, "Genentech's Alzheimer's antibody trial to study disease prevention" Nat Biotechnol, vol [30], pp.731–732,2012.

[23] J. Moreth, C. Mavoungou, K. Schindowski, "Passive anti-amyloid immunotherapy in Alzheimer's disease: what are the most promising targets"? Immun Ageing, vol [10], pp.18, 2013.

[24] A Randomized, Double-blind, Placebo-controlled, Combined Single Ascending Dose and Multiple Ascending Dose Study. [http://www.clinicaltrials.gov/ct2show/NCT01230853?term=ban2401&rank=2].

[25] McKeith IGGalasko DKosaka K et al. Consensus guidelines for the clinical and pathologic diagnosis of dementia with Lewy bodies (DLB): report of the consortium on DLB international workshop. *Neurology* 1996;471113- 1124

Medicinal Plants Having Wound Healing Activity

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***Abstract*— Wound healing is a natural, complex and dynamic process that involve restoration of continuity after wounding, involving mainly four phases i.e. hemostasis, inflammation, proliferation and maturation. The care and management of wound involves dressing of wound, to minimize the wound pain (administration of painkillers), to prevent inflammation by using anti – inflammatory agents and topical systemic antimicrobial agents and to promote healing through healing promoting drugs and burns wounds are needed to be managed in accordance with their severity. Mostly herbal formulations are preferred over the allopathic medicines due to their ease of availability, safety, effectiveness and economical cost. The main purpose of this review is to discuss about Wound healing potential of plants, which are helpful for researcher to development new wound healing formulations for human use.**

***Keywords*— Wound healing, allopathic, safety, hemostasis.**

I. INTRODUCTION

Wound healing is a natural, complex and dynamic process that involves restoration of continuity after wounding. The primary aim of the healing is to fill the gap created by destruction of tissue. It is a versatile process that acts in a harmonious path [11], and is a complex cascade of biochemical and cellular actions, that leads to cell to cell and cell to matrix interactions and healing, involving four phases i.e. [18] hemostasis, (arrest of bleeding by platelet plug formation and migration of leukocytes and macrophages towards the wound), inflammation (self defensive response of the body to prevent further damage of injured tissues), proliferation (fibroblast proliferation, granulation tissue formation, angiogenesis and epithelialization) and remodeling or maturation phase (matrix components formation, maturation or remodeling and eventual closure of the gap created by injury) [14]. Wound healing response begins immediately after the injury [24].

There are umbrella of drugs that have been procured from the plants and it is estimated by WHO (World Health Organization) that about 80% of the population still depends upon the plant based medicines [22]. The utilization of herbal drugs in the market is at rise and in India the annual turnover of herbal medicinal industry is about Rs. 2,300 crore as against the pharmaceutical industry's turnover of Rs. 14,500 crore with a growth rate of 15 percent [33]. The Indian system of medicine "Ayurveda" is based on the vast/empirical knowledge of observations and experience over millennia and more than 1200 diseases are mentioned in it and there are more than 1000 medicinal plants (89.93%), 58 minerals, metals or ores (5.24%) and 54 animal and marine products (4.86%) are explained for the management of these diseases. It has been estimated that about 70% of the wound healing products are of plant origin and rest belongs to mineral origin (20%) and animal origin (10%). They promote the wound healing by influencing one or more phase of the healing process and are also involved in disinfection, debridement and maintaining a moist environment to fulfill conditions which are favorable for the natural healing process [22, 31]. Mostly herbal medicines are preferred over the allopathic medications as they cure the wounds in natural way and are also in huge demand in the world for health due to their ease of availability, economic cost, efficacy, safety and very few side effects [22]. The medicinal plants are rich in secondary metabolites such as flavonoids, saponins, tannins, sterols and poly phenols etc. which are potential sources of drugs of therapeutic importance. There are many plants that are scientifically reported to have wound healing activity for example *Azadirachta indica* (Neem), *Tinospora cordifolia* (Guduchi) [2], *Centella asiatica* (Brahmi) [36], *Aloe vera* (Kumari) [7], *Ficus mollis* (Fig) [14], *Carica papaya* (Papaya) [25], *Lantana camara* (Red sage) [21] etc.

II. PLANTS HAVING WOUND HEALING ACTIVITY

A. Azadirachta indica:

Azadirachta indica is commonly known as Neem, belonging to the family Meliaceae. Chemical constituents of neem are margosic acid, glycerides of fatty acids, butyric acid and traces of valeric acid, among these major active constituents of are azadirechtin, nimbin and nimbidin. It has found in the study that methanolic extract of leaves promote the wound healing rate by promoting epithelialization. Neem also possesses insect repellant, nematicide, anti-inflammatory and anti-microbial properties [2, 32].

B. Aloe vera:

Aloe vera is commonly known as aloe and kumari, belonging to the family Liliaceae [40]. It is the one of the oldest plant known for its healing properties. Major chemical constituents of aloe are Vitamin C, Vitamin E and amino acids which are essential for wound healing [1]. Today its gel is the one of the major component in the cosmetics such as skin lotions, creams etc. It is an excellent remedy for cuts, burns, insect stings, bruises, acne and blemishes, poisoning, welts, skin lesions, eczema, sunburns [33, 40].

C. Carica papaya:

Carica papaya is a fruit which is commonly known as Papaya, belonging to family Caricaceae. Chemical constituents of papaya are cysteine endopeptidases such as papain, chympopapain A and B, papaya endopeptidases II, papaya endopeptidases IV, omega endopeptidases, chinitase, protease-inhibitors, and proteins [1]. Among these papain is the principal constituent that possesses anti-ulcer properties and also exerts anti-inflammatory, anti-oxidant and anti microbial properties. It has found in the study that aqueous extract of papaya fruit promotes wound healing in burns and dead space wounds in diabetics by increasing the collagen turnover and hydroxyproline content of granulation tissue [24].

D. Catharanthus roseus

Catharanthus roseus is commonly known as Vinca, belonging to family Pocyanaceae. The chemical constituents of this plant are, alkaloids, tannins, and triterpenoids, major constituents are monoterpenoid indol alkaloid, vincristine and vinblastine which possess anticancer activity. It has been found in the study that the ethanolic extract of flowers of vinca plant also promote healing [24]. This plant is also used for the lymphomas, neuroblastoma, rhabolomy sarcoma, win's tumor, headache and diabetes [32].

E. Centella asiatica

Centella asiatica is a trailing herb which is commonly known as Brahmi or Indian penny wood, belonging to family Umbelliferae. It has been found in the study that the ethanolic extract of plant possesses a definite prohealing action in normal as well as in the steroid depressed wound healing. Major active constituents of brahmi are asiaticosides and madicassoides, which possesses wound healing activity. This plant also possesses ulcer protective and antimicrobial activity [32, 35, and 36].

F. Ginkgo biloba

Ginkgo biloba is commonly known as Kew tree, belonging to the family Gingkoaceae. The major chemical constituents of ginkgo are flavnoids and terpenoids such as quercitin, kameferol, bilobetin, ginkgolic acid, ginkgetin and ginkgolides A, B, C, J and M. Among these ginkolide B is most active. It has been found in the study that ethanolic extract of stem promotes the healing of the dead space wounds by promoting the breaking strength and hydroxyproline content of granulation and decreasing the epithelization period [2]. It also possesses anti-inflammatory and anti-allergic activity [32].

G. Lantana camara

Lantana camara is a shrub which is commonly known as Red sage, belonging to family Verbenaceae. The major active constituents of this shrub are lancamarone and lantamine. Former is a steroid that has cardiac tonic property and later is an alkaloid that has antipyretic and antispasmodic properties. Ethanolic extract of leaves promotes the wound healing by increasing wound contraction rate and epithelialization period. It possesses several activities such as anti-inflammatory, anti-microbial, fungicidal, insecticidal, hematicidal, immunosuppressive and antitumor activities [8, 21].

H. Momordica charantia:

Momordica charantia is a traditional commonly known as bitter guard belonging to family Cucurbitaceae and has a bitter taste so that's why called as bitter guard or bitter melon. It has been found in the study that methanolic extract of bitter guard promotes wound healing in diabetic patients. It also exhibit antidiabetic, antioxidant, contraceptive and antibacterial properties and used in the treatment of stomach ache, common cold, fever, gout, laxative, helminthes and rheumatism [38].

I. Ocimum sanctum

Ocimum sanctum is commonly known as Tulsi belonging to family Labiatae. Chemical constituents of tulsi leaves are in tannins like gallic acid, chlorogenic acid etc and alkaloids, glycosides, saponins and volatile oils. The major constituents include urosolic acid which contains eugenol, carvenol and eugenol-methyl-ether [32, 39]. Ethanolic extract of the plant is found to promote the healing of wounds by increasing wound tensile strength and epithelialization. Traditionally it is used in gastric disorders, malarial fever, bronchitis, ringworm and other infections, antidote for snake bite and scorpion sting and also possesses anti-inflammatory, analgesic and immuno-modulator properties [1].

J. Curcuma longa

Curcuma longa *is* commonly known as Turmeric, Indian saffron and in Hindi it is known as Haldi, belonging to family Zingiberaceae. The chemical constituents of turmeric contains curcumin (diferuloyl methane), turmeric oil or turmerol & 1, 7-bis, 6- hepta-diene-3, 5-Dione. Among these curcumin is the major active constituent which possesses anti-inflammatory and analgesic activities. Turmeric also contains protein, fats, vitamins (A, B, C etc), which play an important role in would healing and regeneration. It is also used as condiment, coloring agent, anticancer, antiseptic [20, 32].

K. Sesamum indicum

Sesamum indicum is one of the oldest cultivated plants for its oil rich seeds which are commonly known as Sesame seeds belonging to family Pedaliaceae. Chemical constituents of the sesame are oleic, linoleic, palmitic, stearic and arachidic acids. Major constituent of this oil is sesamin and sesamolin which are found to possess wound healing activity. Study has been shown that sesame oil promotes significant healing in dead space wound model by increasing breaking strength and granulation tissue formation [1, 33].

L. Lycopodium serratum

Lycopodium serratum is commonly known as club moss, belonging to family Lycopodiaceae [19]. It has been found in the study that aqueous and ethanolic extract of this plant promotes wound healing by reducing period of epithelialization, increasing wound contraction rate, tissue

breaking strength and hydroxy proline content at the site of wound [33].

Table 1: List of plants having wound healing activity:

Sr. no.	Scientific Name	Common Name	Part used	Reference
1.	*Acorus calamus* (Araceae)	Bach	Ethanolic extract of leaves	10
2.	*Aegle marmelos* (Rutaceae)	Bael	Methanolic extract of root.	15
3.	*Allium sativum* (Liliaceae)	Garlic	Ethanolic extract of bulbs	41
4.	*Aloe vera, Aloe barbedensis* (Liliaceae)	Aloe, Kumari	Aqueous Extract & juice of leaves	7
5.	*Andrographis paniculata* (Acanthacea)	Kalmegh	Alcoholic extract of whole plant	23
6.	*Annona squamosa* (Annonaceae)	Sugar apple	Ethanolic extract of leaves	28
7.	*Argemone Mexicana* (Papaveraceae)	Mexican/ prickly poppy	Ethanolic & aqueous extracts of Leaves	9
8.	*Butea monosperma* (Fabaceae)	Palas	Alcoholic bark extract	37
9.	*Calendula Officinalis* (Compositae)	Marigold	Methanolic extract Flower	29
10.	*Carapa guianensis* (Meliaceae)	Andiroba, Carapa	Ethanolic leaf extract	18
11.	*Catharanthus roseus* (Pocyanacea)	Vinca	Ethanolic extract of Flower	24
12.	*Centella asiatica* (Umbellifera)	Brahmi, Indian pennywort	Aqueous Extract of flowers	34, 35
13.	*Croton zehntneri* (Euphorbiaceae)	Canelinha	Essential oil extracted from the leaves	5
14.	*Cuminum cyminum* (Umbellifera)	Cumin seeds	Aqueous extract of leaves, Seed	27
15.	*Curcuma longa* (Zingiberace)	Turmeric	Rhizome, seeds (Aqueous and alcoholic)	20
16.	*Cyperus rotundus* (Cyperaceae)	Nagarmotha	Alcoholic extract of tubers	30
17.	*Eucalyptus globules* (Myrtaceae)	Eucalyptus	Oil	12
18.	*Ficus mollis* (Moraceae)	Fig	Methanolic extract of the bark	14
19.	*Ficus religiosa* (Moraceae)	Peepal	Ethanolic & aqueous extracts of leaves & plant	10
20.	*Ginkgo biloba* (Ginkgoacea)	Ginkgo, Kew tree	Ethanolic extract of stem	2
21.	*Glycyrrhiza glabra* (Leguminosae)	Liquorice	Vacuum dried Ethanolic extract of bark & root	17
22.	*Gymnema sylvestre* (Asteraceae)	Gudmar	Ethanolic extract of leaves	16
23.	*Phyllanthus emblica* (Euphorbiaceae)	Amla	Ethanolic extract of fruits	36
24.	*Stachytarpheta jamaicensis* (Verbenacea)	Brazillian tea, Blue porter weed	Hydro alcoholic extract of leaves	26
25.	*Terminalia arjuna* (Combretaceae)	Arjun	Ethanolic extract of Stem, bark	6
26.	*Terminala chebula* (Combretaceae)	Myrobalan	Alcoholic extract of leaves & fruit	8

REFERENCE

[1.] Alam G, Pratap M Singh & Singh A, "Wound Healing Potential of Some Medicinal Plants", Int J Pharma Sci Rev and Res, vol [9], pp 136-145, 2011.

[2.] Bairy KL & Rao CM, "Wound Healing Profile of *Ginkgo biloba*", J Nat Rem, Pp 25-27, 2001.

[3.] Barua CC, Talukdar A, BaruaAG, Chakraborty A, Sarma RK & Bora RS, "Evaluation of the Wound Healing Activity of Methanolic Extract of *Azadirachta indica* (neem) and *Tinospora cordifolia* (guduchi) in Rats", Pharmacology online, vol [1], pp 70-77, 2010.

[4.] Biswas TK & Mukherjee B, "Plants Medicines of Indian Origin for Wound Healing Activity: A Review", Lower Extr Wounds, vol [2], pp 25-39, 2003.

[5.] Cavalcanti JM, Leal-Cardoso JH, Leite Diniz LR et al, "The essential oil of Croton zehntneri and trans-anethole improves cutaneous wound healing", J Ethnopharmacology, vol [144], pp 240–247, 2012

[6.] Chaudhari M & Mengi S, "Evaluation of phytoconstituents of *Terminalia arjuna* for wound healing activity in rats", Phytother Res, vol [20], pp 799-805, 2006.

[7.] Chitra P, Sajithlal GB & Chandrakasan G, "Influence of *Aloe vera* on Collagen Turnover in Healing of Dermal Wounds in Rats", Indian J Exp Biol, vol [36], pp 896-901, 1998.

[8.] Choudhary GP, "Wound Healing Activity of the Ethanolic Extract of *Terminalia Chebula* retz. International J Pharma Bio Sci, vol [2], pp 48-52, 2011.

[9.] Dash GK & Murthy PN, "Evaluation of *Argemone Mexicana* Linn Leaves for Wound Healing Activity", J Nat Product Plant Resources, vol [1], pp 46-56, 2011.

[10.] Garg VK & Paliwal SK, "Wound-Healing Activity of Ethanolic and Aqueous Extracts of *Ficus benghalensis*", J Adv Pharma Tech Res, vol [2], pp 110-114, 2011.

[11.] Honnegowda TM, Kumar P, Udupa P et al, "Effect of Limited Access Dressing n Hydroxyproline and Enzymatic antioxidant Status in Non-healing Chronic Ulcers", Indian J Plast Surg, vol [47], pp 216-218, 2014.

[12.] Hukkeri VT, Karadi RV, Akki KS et al, "Wound Healing Property of *Eucalyptus globulus* Leaf Extract", Indian Drugs, vol [39], pp 481–483, 2002.

[13.] Jain N, Jain R, Jain A, Jain DK & Chandel HS, "Evaluation of Wound-Healing Activity of *Acorus Calamus* Linn", Nat Product Res, vol [24], pp 534-541, 2010.

[14.] Jameeluddin M, Janarthan M & Duraivel S, "Evaluation of Anti-Diabetic and Wound Healing Activities of 90% Methanolic Extract of *Ficus mollis* Bark by using Wistar Strain Rats", IJRPB, vol [2], pp 988 – 992, 2014.

[15.] Jaswanth A, Loganathan V, Manimaran S & Rukmani S, "Wound Healing Activity of *Aegle marmelos*", Indian J Pharma Sci, vol [63], pp 41–44, 2001.

[16.] Kiranmai M, Kazim SM & Ibrahim M, "Combined wound healing activity of *Gymnema sylvestere* and *Tagetes erecta* Linn", Int J of Pharm App, vol [2], pp 135-140, 2011.

[17.] Kishore GS, Kumar BS, Ramachandran S, Saravanan M & Sridhar SK, "Antioxidant and Wound Healing Properties of *Glycyrrhiza glabra* Root Extract", Indian Drugs, vol [38], pp 355–357, 2001.

[18.] Kumarasamyraja D, Jeganathan NS & Manavalan R, "Medicinal Plants with Potential Wound Healing Activity", Intl J Pharm Sci, vol [2], pp 105-111, 2012.

[19.] Manjunatha BK, Krishna V, Vidya SN, Mankani KL & Manohara KN, "Wound Healing activity of *Lycopodium serratum*", Indian J Pharma Sci, vol [69], pp 283-287, 2007.

[20.] Mehra KS, Mikuni I, Gupta U & Gode KD, "*Curcuma longa* (Linn) Drops in Corneal Wound Healing", Tokai J Exp Clin Med, vol [9], pp 27–31, 1984.

[21.] Mekala S, Kumar N, Das L, Shetty N, Amuthan A, Vulli V & Bhogireddy N, "Evaluation of wound healing activity of ethanolic extract of *Lantana camara* in streptozotocin induced diabetic rats", IJPPS, vol [6], pp 631-633, 2014.

[22.] Mittal A, Sardana S & Pandey A, "Herbal boon for wounds", IJPPS, vol [5], pp 1-12, 2013.

[23.] Mohanty A, Pradhan DK, Mishra MR, Sahoo JK & Mishra A et al, "Preliminary pytochemical screening and wound healing activity of *Andrographis peniculata",* J Chem Pharm Res, vol [2], pp 649-654, 2010.

[24.] Nayak B.S, P Pereira and M Lexley, "*Catharanthus roseus* flower showing wound healing activity in sprague dawley rat", BMC Complementary and Alternative Med, vol [6], pp 41-43, 2006.

[25.] Nayak BS, Pinto Pereira LM & Maharaj D, "Wound healing activity of *carica papaya l.* in experimentally induced diabetic rats", Indian J Exp Biol, vol [45], pp 739-743, 2007.

[26.] Pandian C, Srinivasan A and Pelapolu IC, "Evaluation of Wound Healing Activity of Hydro-alcoholic Extract of Leaves of *Stachytarpheta jamaicensis* in Streptozotocin Induced Diabetic Rats", Der Pharmacia Lettre, vol [5], pp 193-200, 2013.

[27.] Patil DN, Kulkarni AR, Shahapurkar AA, Hatappakki BC, "Natural Cumin Seeds for Wound Healing Activity in Albino Rats", Int J Biochem, vol [3], pp 148-152, 2009.

[28.] Ponrasu T, Subamekala MK, Ganeshkumar M & Suguna L, "Role of *Annona squamosa* on Antioxidants during Wound Healing in Streptozotocin Nicotinamide Induced Diabetic Rats", J Pharmacog Phytochem, vol [2], pp 77-84, 2013.

[29.] Preethi KC & Kuttan R, "Wound Healing Activity of Flower Extract of *Calendula officinalis",* J Basic Clin Physiol Pharma, vol [20], pp 73-79, 2009.

[30.] Puratchikody A, Devi CN & Nagalakshmi G, "Wound Healing Activity of *Cyperus rotundus* Linn. Indian J Pharma Sci, vol [68], pp 97–101, 2006.

[31.] Purna SK & Babu M, "Collagen based dressing- A Review", Burns, vol [26], pp 54-62, 2000.

[32.] Sabale P, Bhimani B, Prajapati C & Sabale V, "An Overview of Medicinal Plants as Wound Healers", J Applied Pharma Sci, vol [2], pp 143-150, 2012.

[33.] Sharma Y, Jeyabalan G, Singh R, & Semwal A, "Current Aspects of Wound Healing Agents from Medicinal Plants: A Review", J Med Plant Studies, vol [1], pp 1-11, 2013.

[34.] Shetty BS & Pemmineti S, "Evaluation of *Centella Asiatica* Leaf Extract for Wound Healing in Streptozotocin Induced Diabetic Rats", RJPBCS, vol [4], pp 1082-1090, 2013.

[35.] Shetty BS, Udupa SL, Udupa AL, Somayaji SN, "Effect of *Centella asiatica* L. (Umbelliferae) on normal and dexamethasone suppressed wound healing in wistar albino rats", J L Extre Wounds, vol [5], pp 137–143, 2006.

[36.] Suguna L, Sumitra M & Chandrakasan G, "Influence of *Phyllanthus emblica* Extract on Dermal Wound Healing in Rats", J Med Aro Plants, vol [32], pp 2–3, 2000.

[37.] Sumitra M, Manikandan P & Suguna L, "Efficacy of *Butea monosperma* on Dermal Wound Healing in Rats", J Biochem Cell Biol, vol [37], pp 566-573, 2005.

[38.] Teoh SL, Latiff AA and Das S, "The Effect of Topical Extract of *Momordica charantia* (bitter gourd) on Wound Healing in Non Diabetic Rats and in Rats with Diabetes Induced by Streptozotocin", Clin Exp Dermatol, vol [34], pp 815–822, 2009.

[39.] Udupa SL., Shetty S, Udupa AL & Somayaji SN. Effect of *Ocimum sanctum* Linn on normal and dexamethasone suppressed wound healing", Indian J Exp Biol, vol [44], pp 49–54, 2006.

[40.] Wadankar GD, Malode SN & Sarambekar SL, "Traditionally Used Medicinal Plants for Wound Healing in the Washim District, Maharashtra (India)", Int J Pharm Tech Res, vol [3], pp 2080-2084, 2011.

[41.] Zuber M, Rajesh V, Anusha K, Reddy CR & Tirupathi, "Wound healing activity of ethanolic extract of *Allium sativum* on alloxan induced diabetic rats family (liliaceae)". Int J Sci Invent Today, vol [2], pp 40-57, 2013.

Pathogenesis of Diabetic Nephropathy

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***Abstract:-*Incidence of diabetes is increasing worldwide. Diabetic nephropathy has become the main cause of chronic kidney disease in patients who require renal replacement therapy in the Western world, also known as Kimmelstiel- Wilson syndrome. According to WHO projection; it will be the single largest non-communicable disease worldwide by the year 2025 with the largest diabetic population in India. India leads the world with largest diabetic population thus, being termed the ''Diabetes Capital of the World''. However, the prevalence of diabetes is consistently increasing, but still an effective treatment is lacking for the management of this epidemic. It is an important cause of morbidity and mortality, and is now among the most common causes of end-stage renal failure (ESRF) in developed countries. It is clinically defined as progressively increasing proteinuria accompanied by increasing blood pressure and impairment of glomerular filtration. Histologically, diabetic nephropathy is characterised by diffuse or nodular glomerulosclerosis, tubulointerstitial fibrosis and atrophy, and variable degrees of hyaline arteriolosclerosis and arterial sclerosis. Despite many molecular mechanisms, the pathophysiology of diabetic nephropathy is not clearly understood and its management is unsatisfactory. Hence there is need for more research on mechanism, treatment and associated factors that leads to diabetic nephropathy.**

Keywords: Diabetic nephropathy, kidney, blood glucose, ESRF, management, GFR.

I. DIABETIC NEPHROPATHY

As the incidence of diabetes is increasing worldwide, diabetic nephropathy has become the main cause of chronic kidney disease in patients who require renal replacement therapy in the Western world, also known as Kimmelstiel- Wilson syndrome [1]. It is the most common cause of end stage renal disease and one of the leading causes of morbidity and mortality in patients with diabetes & characterized by glomerular hypertrophy, thickness of basement, tubular and glomerular membranes and accumulation of extracellular matrix in these membranes that finally cause tubulointerstitial and glomerular fibrosis and sclerosis [2]. It is a chronic complication of both type 1 DM (beta cell destruction – absolute lack of insulin) and type 2 DM (insulin resistance and/or decreased secretion of insulin) There are five stages in the development of diabetic nephropathy.

Stage I: Hypertrophic hyper filtration. In this stage, GFR is either normal or increased. Stage I lasts approximately five years from the onset of the disease. The size of the kidneys is increased by approximately 20% and renal plasma flow is increased by 10%-15%, while albuminuria and blood pressure remain within the normal range.

Stage II: The quiet stage. This stage starts approximately two years after the onset of the disease and is characterized by kidney damage with basement membrane thickening and mesangial proliferation. There are still no clinical signs of the disease. GFR returns to normal values. Many patients remain in this stage until the end of their life.

Stage III: The microalbuminuria stage (albumin 30-300 mg/dU) or initial nephropathy. This is the first clinically detectable sign of glomerular damage. It usually occurs five to ten years after the onset of the disease. Blood pressure may be increased or normal. Approximately 40% of patients reach this stage.

Stage IV: Chronic kidney failure (CKF) is the irreversible stage. Proteinuria develops (albumin > 300 mg/dU), GFR decreases below 60 mL/min/1.73 m2, and blood pressure increases above normal values.

Stage V: Terminal kidney failure (TKF) (GFR < 15 mL/min/1.73 m2). Approximately 50% of the patients with TKF require kidney replacement therapy (peritoneal dialysis, hemodialysis, kidney transplantation).

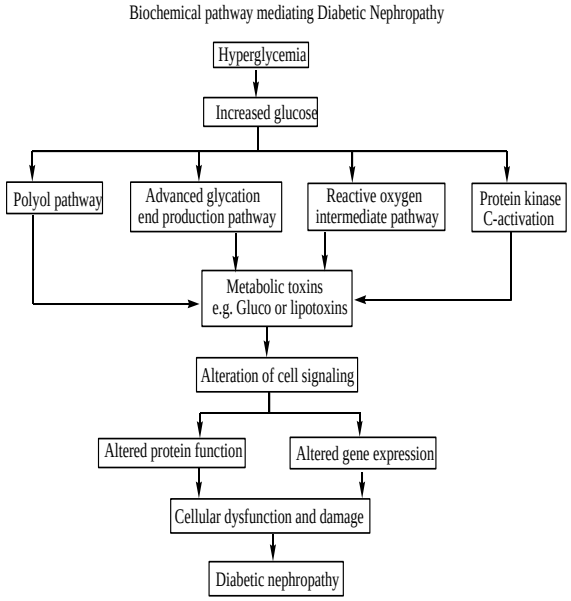
In the initial stages of diabetic nephropathy, increased kidney size and changed Doppler indicators may be the early morphological signs of renal damage, while proteinuria and GFR are the best indicators of the degree of the damage [3].

II. PATHOGENESIS OF DIABETIC NEPHROPATHY

Oxidative stress plays a pivotal role in the development of diabetes complications, both microvascular and cardiovascular [4]. The pathogenesis and progression of diabetic nephropathy are likely to be as a result of interactions between metabolic and hemodynamic pathways, which are often disturbed in the setting of diabetes. It occurs as a result of an interaction between hemodynamic and metabolic factors. Hemodynamic factors that contribute to the development of diabetic nephropathy include increased

systemic and intraglomerular pressure, as well as activation of vasoactive hormone pathways including the renin angiotensin system and endothelin. The metabolic abnormalities of diabetes cause mitochondrial superoxide overproduction in endothelial cells of both large and small vessels, and also in the myocardium. This increased superoxide production causes the activation of five major pathways involved in the pathogenesis of complications:

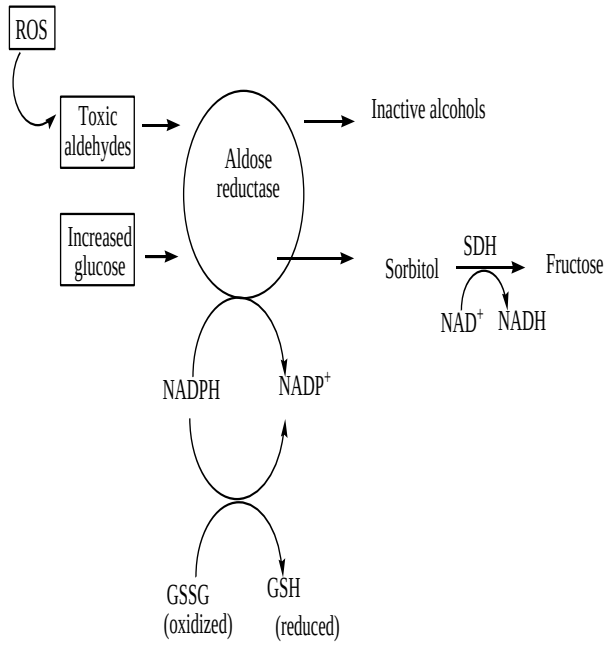
- Polyol pathway ,
- Advanced glycation end-products (AGEs) pathway
- Protein kinase C (PKC) pathway
- Reactive oxygen intermediate pathway



These hemodynamic pathways activate intracellular second messengers such as protein kinase C (PKC), Mitogen-activated protein(MAP kinase)3, nuclear transcription factors such as NF-kB and various growth factors such as the prosclerotic cytokine, TGF-β and the permeability enhancing growth factor, vascular endothelial growth factor, VEGF. Glucose dependent pathways are also activated within the diabetic kidney and result in enhanced oxidative stress, renal polyol formation4 and the accumulation of advanced glycation end products (AGEs). In combination, these pathways ultimately lead to increased renal albumin permeability and extracellular matrix accumulation, resulting in increasing proteinuria, glomerulosclerosis and ultimately tubulointerstitial fibrosis [5].

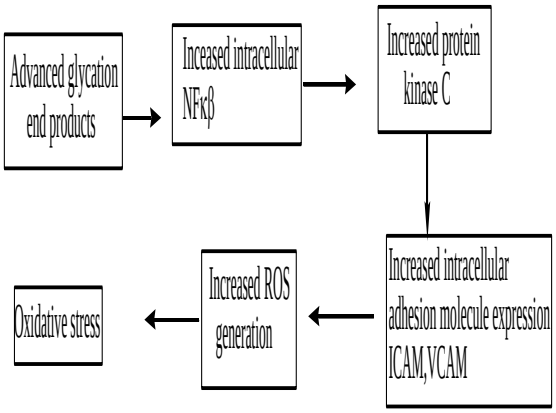
A. Polyol pathway:

It consists of two enzymes. The first enzyme, Aldose Reductase (AR), reduces glucose to sorbitol with the aid of its co-factor NADPH, and the second enzyme, sorbitol dehydrogenase (SDH), with its co-factor NAD+, converts sorbitol to fructose, a process that increases the ratio of NADH/NAD and may result in both oxidative stress and activation of protein kinase C [6]. Fructose and its metabolites fructose-3-phosphate and 3-deoxyglucosone are more potent nonenzymatic glycation agents than glucose, Sorbitol may interfere with the uptake and metabolism of myo-inositol. The physiological role of the AR pathway remains largely unknown. However, AR, sorbitol and myo-inositol are thought to play a role in the osmoregulation of the kidney. Consumption of NADPH by AR results in the depletion of the levels of NADPH. This NADPH also acts as a cofactor for glutathione reductase, which reduces oxidized glutathione into reduced glutathione. Excess sorbitol is oxidated to fructose. The flux of glucose through the polyol pathway would increase Advance Glycation End Products (AGE) formation. AGES, as well as binding of AGE to their receptors, are known to cause oxidative stress. It is active in the kidney when hyperglycemia is present. AR and SDH have been identified in glomerular cells, including mesangial cells, and increased sorbitol levels an observed in mesangial cells that are exposed to high concentration of glucose. In addition, the metabolic changes caused by increased flux of the Polyol pathway are consistent with renal changes that occur in the presence of hyperglycemia, including sorbitol accumulation, a substantial depletion of available NADPH caused by AR reaction that diminishes nitric oxide production by endothelial cells, increased prostaglandin production, and increased NADPH/NAD^+ ratio that blocks the glucolytic pathway resulting in oxidative stress, increased de novo diacylglycerol (DAG) synthesis, and increased production of AGEs that activate PKC. AR inhibitors have been tested in humans for retinopathy and nephropathy, but there is no clinical evidence for their benefit in nephropathy [7].



B. Advanced glycation end products pathway

Advanced glycation end products (AGEs) are formed by the non-enzymatic reaction of glucose and other glycating compounds derived both from glucose and from increased fatty acid oxidation in arterial endothelial cells and most likely heart (e.g. dicarbonyls such as 3- deoxyglucosone, methylglyoxal and glyoxal) with proteins [8]. In diabetes, AGEs are found in increased amounts in extracellular matrix. Intracellular production of AGE precursors can damage cells by three general mechanisms. Firstly, intracellular proteins modified by AGEs have altered function. Secondly, extracellular matrix components modified by AGE precursors interact abnormally with other matrix components and with matrix receptors that are expressed on the surface of cells. Finally, plasma proteins modified by AGE βprecursors bind to AGE receptors on cells such as macrophages, vascular endothelial cells and vascular smooth muscle cells. RAGE binding induces the production of ROS, which in turn activates the pleiotropic transcription factor, nuclear factor kappa B (NFκB), causing multiple pathological changes in gene expression [9].

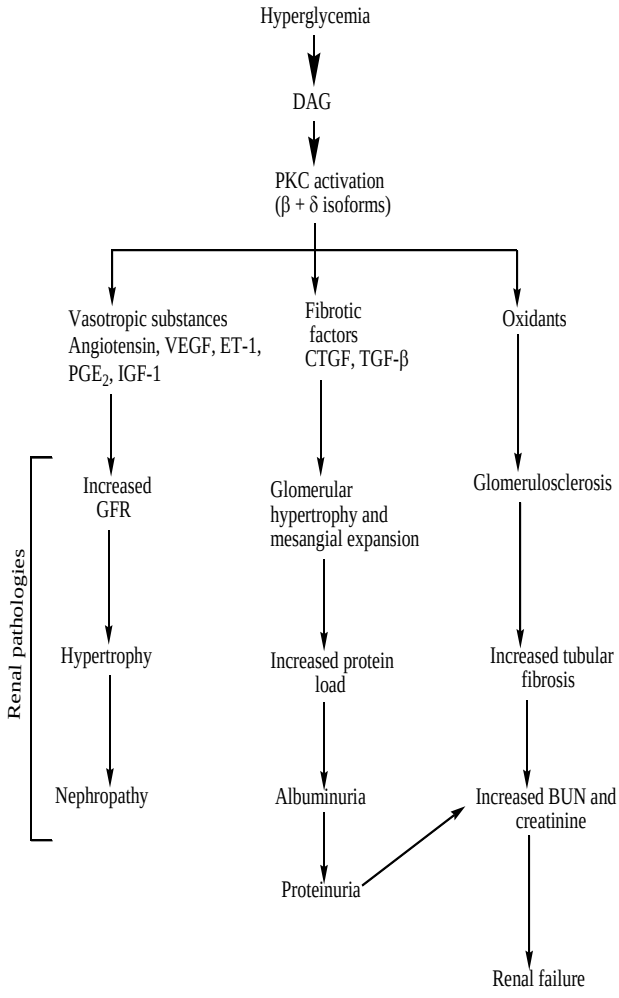


C. Protein kinase C pathway

Protein kinase-C is a family of serine threonine kinases that are multifunctional isoenzymes acting as an intracellular signal transduction system for many hormones and cytokines [10]. In diabetes mellitus, PKC can be activated by several mechanisms, including increased DAG levels by de novo synthesis or inhibition of DAG kinase. PKC α, β1, β2, δ, ε and ζ isoforms have been activated by high glucose levels in mesangial cells or glomeruli [11]. The PKC isoenzymes reside in the cytosol in their inactive state. However, upon cellular activation they are targeted to distinct subcellular locations, including the plasma membrane, nucleus and cytoskeleton suggesting isoform-specific biologic roles. Binding of activated PKC to receptor for activated C kinase (RACKs) is likely to be an important step for the signal transduction of PKC because the RACKs anchor multiple other enzymes and then provide a signal complex [12].

DAG, a physiologic activator of PKC, is synthesized by pathways, including phospholipase C, de novo synthesis from the glycolytic intermediates and metabolism of phosphotidylcholine by phospholipase D and glycerol-3-phosphate. DAG levels can be decreased bt hydrolysis (DAG lipase), phosphorylation (DAG kinase) and transacylation (sn-glycerol-3-phosphate acyltransferase) [13].

Activation of PKC has effects on various intracellular signal transduction systems, including the enhancement of $Erk1/2^{99}$ and p^{35} mitogen activated protein (MAP) kinase cascades and NADPH oxidase. PKC activation causes the enhancement of expression of vasotropic substances such as VEGF, ET-1, PGE_2, IGF-1 and fibrotic factors like CTGF and TGF-β that results in increase GFR, glomerular hypertrophy, mesangial expansion and results in nephromegaly. In addition to these substances, activation of oxidants causes glomerulosclerosis with increase in BUN and creatinine levels and leads to renal failure [14].



D. Reactive oxygen intermediate pathway

Oxidative stress occurs due to imbalance between generation of ROS (superoxide, hydrogen peroxide and hydroxyl radical) and the antioxidant mechanisms (for examples: superoxide dismutase, catalase and glutathione peroxidase) [15]. In physiological

conditions, ROS is continuously generated but effectively eliminated by the antioxidant system. However, when ROS production is more than the system's antioxidant defense capacity, the increased ROS will alter essential cellular proteins, causing cellular damage [16].

ROS is increased in diabetes mellitus and is the cause of neuronal and vascular complication, including diabetic nephropathy.

In diabetes mellitus, ROS generation may be increased through various mechanisms, including mitochondrial superoxide overproduction [17], increased flux through Polyol pathway [18], increased formation of AGEs and activation of PKC [19].

Also, PKC activation is interrelated to the ROS generation. The overexpression of PKC β_2 stimulates NADPH oxidase activity that causes increased ROS generation in GMCs. ROS, in turn, activates PKC through tyrosine phosphorylation [20].

NADPH oxidase is the major source of ROS in mesangial cells, smooth muscle cells and endothelial cells and activation of it requires phosphorylation of its components by various kinases, including PKC. Hyperglycemia associated with diabetes mellitus activates cellular NADPH oxidase, resulting in increased ROS generation. In the glomeruli of diabetic rats, increased 8-hydroxydeoxyguanosin (8-OHdG) and NADPH- driven superoxide synthesis are the markers of oxidative stress [19].

CONCLUSION

Diabetic nephropathy is a multifactorial disease which encompasses hemodynamic, metabolic and genetic factors which are the central to its development and progression. Hyperglycemia may exert its negative effect on the kidney by the generation of the toxic and reactive metabolites that alter intracellular signaling pathway. Understanding the interactions among these important signaling pathways is critical for unlocking the pathogenesis of DN and for designing innovative therapeutic interventions for complications from diabetes mellitus. AGE inhibitors or blocking the cellular signaling pathways involved in glucose toxicity by PKC-β isoform inhibitors such as RBX may offer a novel and beneficial approach to the treatment and prevention of diabetic nephropathy.

REFERENCES

[1] Zemin Cao and Mark E Cooper, ''Pathogenesis of diabetic nephropathy,'' Journal of Diabetes Investigation Volume 2, Issue 4, August 2011.

[2] K O Alsaad and A M Herzenberg, ''Distinguishing diabetic nephropathy from other causes of glomerulosclerosis: an update,'' J Clin Pathol, Volume: 60, pp: 18–26, 2007.

[3] Themis Zelmanovitz, Fernando Gerchman, Amely PS Balthazar, Fúlvio CS Thomazelli, Jorge D Matos and Luís H Canani, ''Diabetology & Metabolic,'' Bio Med Central, pp: 1;10, 2009.

[4] Atul Arya, Sahil Aggarwal and Harlokesh Naryan Yadav, ''Pathogenesis of diabetic nephropathy,'' International Journal of Pharmacy and Pharmaceutical Sciences, Vol 2, Suppl 4,pp: 24-29, 2010.

[5] Sheez Mj and King Gl, ''Molecular understanding of hyperglycemia's adverse effects for diabetic complications,'' JMMA., pp: 2579-2588, 2002.

[6] El- Kabbani O, Ruiz F, Darmanin C and Chung RP, ''Aldose reductase structures: implications for mechanism and inhibition,'' Cell Mol Life Sci, pp: 750-762, 2004.

[7] Sharma V and Sharma PL, '' Role of Different Molecular Pathways in the Development of Diabetes- Induced Nephropathy,'' J Diabetes Metab, pp: S9: 004, 2013.

[8] Alikhani, Z and M. Alikhani, "Advanced glycation end products enhance expression of pro-apoptotic genes and stimulate fibroblast apoptosis through cytoplasmic and mitochondrial pathways,'' J Biol Chem, pp: 12087-95, 2005.

[9] Thomas MC, Forbes JM and Cooper ME, ''Advanced glycation end products and diabetic nephropathy,''Am J Ther, pp: 562-572, 2005.

[10] Nishizuka Y, ''Protein kinase C and lipid signaling for sustained cellular responses,'' FASEB J, pp: 484-496, 1995.

[11] Way Kj, Chou E and King Gl, ''Identification of PKC-isoform-specific biological actions using pharmacological approaches,'' Trends Pharmacol Sci, pp: 181-187, 2000.

[12] Schechtman D and Mochly-Rosen D, ''Adaptor proteins in protein kinase C mediated signal transduction,'' Oncogene, pp: 6339-6347, 2001.

[13] Curtis TM and Scholfield CN, ''The role of lipids and protein kinase Cs in the pathogenesis of diabetic retinopathy,'' Diabetes Metab Res Rev, pp: 28-43 2004.

[14] Igarashi M, Wakasaki H and Takahara N, ''Glucose or diabetes activates p38 mitogen activated protein kinase via different pathways,'' J Clin Invest, pp: 185-195, 1999.

[15] Richter C, ''Oxidative damage to mitochondrial DNA and its relationship to ageing,'' Int J Biochem Cell Biol, pp: 647-653, 1995.

[16] Suzuki S, Hinokio V and Komatu K, ''Oxidative damage to mitochondrial DNA and its relationship to diabetic complications,'' Diabetes Res Clin Pract, pp: 161-168, 1999.

[17] Nishikawa T, Edelstein D and Du XL, ''Normalizing mitochondrial superoxide production blocks three pathways of hyperglycaemic damage,'' Nature, pp: 787-790, 2000.

[18] Dunlop M, ''Aldose reductase and the role of the polyol pathway in diabetic nephropathy,'' Kidney Int Suppl, pp: S3-S12, 2000.

[19] Baynes JW and Thorpe SR, ''Role of oxidative stress in diabetic complications: a new perspective on an old paradigm,'' Diabetes, pp: 1-9, 1999.

[20] Konishi H, Tanaka M and Takemura V, ‘’Activation of protein kinase C by tyrosine phosphorylation in response to H2O2,’’ Proc Natl Acad Sci U S A, pp: 11233-11237, 1997.

[21] Kitada M, Koya D and Sugimoto T, ‘’Translocation of glomerular p47 phox and p67 phox by protein kinase beta activation is required for oxidative stress in diabetic nephropathy,’’ Diabetes, pp: 2603-2614, 2003.

Management and Mechanism of Amikacin Induced Nephrotoxicity

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***Abstract*— Nephrotoxicity is one of the most common kidney problem. It occurs when the body is exposed to various agents like drugs like aminoglycoside, antimicrobial agents, NSAIDS etc or toxins such as mercury, lead, arsenic etc. Aminoglycosides are one of the oldest antibiotics used to treat serious infections caused by gram-negative and some gram-positive bacteria. Among aminoglycosides, Amikacin is often used for treating severe, hospital-acquired infections with multidrug-resistant gram-negative bacteria such as *Pseudomonas aeruginosa, Acinetobacter* etc. and also used to treat tuberculosis and non-tubercular mycobacterial infection. Kidney failure is the major side effect of amikacin. The risk of renal failure is greater in patients with impaired renal function and in those who receive high doses or prolonged therapy. The mechanism of renal toxicity of amikacin involves diverse range of pathophysiological mechanisms i.e. oxidative stress, inhibition of specific transporters, inflammation, vascular alterations. All major functional regions of the nephron i.e. glomerulus, proximal tubules, distal tubules and collecting ducts are affected. For the management of amikacin nephrotoxicity, various vitamins and antioxidants are used. In present study, we have mentioned an updated list of herbal plants and compounds that are used as nephroprotective agents in amikacin incuced nephrotoxicity.**

***Keywords- Nephrotoxicity, Amikacin, Nephroprotective, Oxidative stress, Management, Mechanism*.**

I. INTRODUCTION

Nephrotoxicity is one of the most common kidney problems and occurs when the body is exposed to a drug or toxin that causes damage to the kidneys. When kidney damage occurs, we are unable to rid our body of excess urine, and wastes [1]. Drug-induced renal failure is common and responsible for a variety of pathological effects on the kidney. Many medications like Aminoglycosides, NSAIDS, Anticancer drugs etc can cause renal dysfunction through various mechanisms including altered intraglomerular hemodynamics, tubular cell toxicity, inflammation, crystal nephropathy, rhabdomyolysis, and thrombotic microangiopathy , all these may lead to significant morbidity [2].

Aminoglycosides are most commonly used antibiotics worldwide because of certain properties like rapid concentration dependent bactericidal effects, clinical effectiveness, a low rate of true resistance, synergism with other beta lactum antibiotics and low cost of therapy. These are also considered to be very important against many life threatening infections especially against gram negative bacterial infections [26]. Aminoglycosides are polycationic, a property that is responsible for their poor oral absorption, a poor penetration into CSF, and a rapid renal clearance. The polycationic charge also appears to contribute to nephrotoxicity [27].

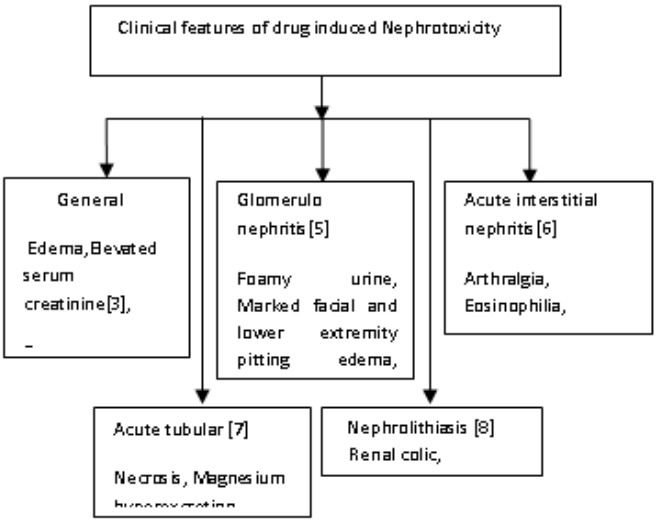


Table I: Drugs which can cause renal failure and their mechanism of toxic effect

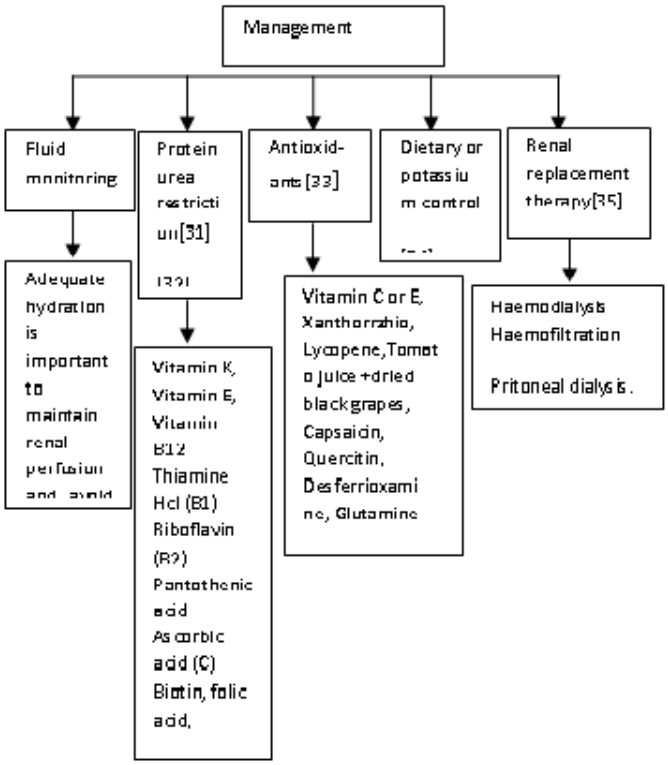
Mechanism of toxic effect	Drugs
Direct tubular effect Proximal tubule Distal tubule	NSAIDs[9], ACE inhibitors[10], Cyclosporine A[11], Lithium, Cyclophosphamide, Amphotericin B, Heavy metals[12], Aminoglycosides[13], Cisplatin[14],Radiocontrast media[15], Immune-globulin, Mannitol[16]
Tubular obstruction	Sulphonamides[17], Acyclovir[18], Poly ethylene Glycol
Acute interstitial nephritis	ß-lactams[19], Vancomycin[20], Rrifampicin[21], Ciprofloxacin, Ranitidine, Cimetidine[22], Furosemide[23], Thiazides, Phenytoin[24]
Acute glomerulonephritis	Penicillamine[25]

Amikacin is a semisynthetic derivative of the aminoglycoside antibiotic, kanamycin. It is used in the treatment of variousinfection resistance to bacterial aminoglycoside inactivating enzymes. However, aminoglycoside induced nephrotoxicity and ototoxicity is limiting factors for their clinical use and ROS have been found to be involved in these consequences [28].

The adverse effect of amikacin has been attributed to the development of an array of alterations in proximal tubule epithelium followed by its destruction, thereby causing kidney

dysfunction. Amikacin administration is also reported to induce apoptosis, free radical generation and another major adverse effect. Free radicals also play an important role in drug-induced damage to the kidney failure and other organs [29].

II. MANAGEMENT IN AMIKACIN INDUCED NEPHROTOXICITY



III. HERBAL TREATMENT FOR AMIKACIN INDUCED NEPHROTOXICITY

In the recent years many researchers had studied the effects of different plants used traditionally by indigenous healers and herbalists to support kidney function and treat renal disorders. Normally herbal plants are free from side effects and they are low cost medicines with different protective pathway, which will be beneficial for the people.

IV. MISCELLANEOUS COMPOUNDS FOR AMIKACIN INDUCED NEPHROTOXICITY

Table II: List of plants used in amikacin induced nephrotoxicity

S. No	Botanical name	Family	Plant part	Nephrotoxic Agent	Animal used	Reference
1.	Allium sativum	Amaryllidaceae	Whole	Amikacin (1.2g/kg i.p single dose for 7 days)	Wistar albino rat	**[36]**
2.	Nigella sativa	Ranunculaceae	Seed	Amikacin (1.2g/kg i.p single dose for 7 days)	Wistar albino rat	**[37]**
3.	Punica granatum	Lythraceae	Fruit	Amikacin (80mg/kg daily i.m for 15 days)	Rabbit	**[38]**
4.	Vitis venifera	Vitaceae	Seed	Amikacin (250 mg/kg i.p for 7 days)	Albino Swiss Mice	**[39]**

There are a various compounds like antioxidents agents etc are used as a protective agent in the amikacin induced nephrotoxicity.

Table III: List of compounds used in amikacin induced nephrotoxicity

S.No	**Compound**	**Nephrotoxic agent**	**Animal used**	**Reference**
1.	Ascorbic acid	Amikacin(15mg/kg i.m.)	White rabbit	[40]
2.	Caffeic acid phenethyl ester	Amikacin (i.p. 1.2g/kg at a single dose)	Albino wistar rat	[41]
3.	Carnosine	Amikacin (10 mg/kg for 2 weeks s c.**)**	Albino wistar rat	[42]
4.	Erythropoietin	Amikacin(1.2g/kg intraperitoneally at single dose)	Female Sprague Dawley rat	[43]
5.	Pentoxifylline	Amikacin (1.2 g/kg i.p. at a single dose)	Albino Wistar rat	[44]
6.	Alpha-lipoic acid	Amikacin (1.2 g/kg i.p. at a single dose) for 5 days	Female wistar rat	[45]
7.	Montelukast	Amikacin (single dose 1.2 mg/kg i.p.)	Wistar albino female rat	[46]

V. CONCLUSION

Now a day, Amikacin is mostly used for indoor and outdoor patients in the treatment of various infections. Nephrotoxicity is very common side effect produced by amikacin. We concluded that there are various herbal plants and compounds which are used in the treatment of amikacin nephrotoxicity. We suggested that herbal treatment is more benifial as campared to others.

REFERENCE

[1] S. J. Chaudhary and A.N Paranjape, "Phytoconstituents of trichosanthes dioica roxa.a harbel therapy for nephrotoxicity", would journal of pharmacy and pharmaceutical science, vol 3(2),pp.1521-1552, 2014.

[2] M. Leena, S. V. Kumar, A. Y. Rao, "Drug induced nephrotoxicity and its management",International Bulletin of Drug Research, vol 2(3), pp.50-65, 2014.

[3] A.S. Levey, J.P., Bosch, J.B. Lewis, T. Greene, T. Rogers and D. Roth, "A more accurate method to estimate glomerular filtration rate from serum creatinine: a new prediction equation. Modification of Diet in Renal Disease Study Group", Ann Intern Med, vol 130(6), pp.461-470, 1999.

[4] J. W. Graves, "Diagnosis and Management of Chronic Kidney Disease",Mayo Clin Proc, vol 83(9),pp.1064-1069, 2008.

[5] Kidney International Supplements vol 2, pp.259–274, 2008.

[6] D. N. Cruz and M. A. Perazella,"Drug-induced acute tubulointerstitial nephritis: the clinical spectrum", Hosp Pract,vol 33, pp.151–52,157–8,161–4. 1998.

[7] N. Gill, V. Joseph, J. Nally and A. F. Richard, "Renal Failure Secondary to Acute Tubular Necrosis", www.chestjournal.org,vol 128(4), pp. 2847–2863, 2005.

[8] J. W. Graves, "Diagnosis and Management of Chronic Kidney Disease", Mayo Clin Proc, vol 83(9), pp.1064-1069, 2008.

[9] M. Musu, G. Finco, R. Antonucci, E. Polati, D. Sanna, M. Evangelista And D. Ribuffo, "Acute nephrotoxicity of NSAID from the foetus to the

adult",European Review for Medical and Pharmacological Sciences, vol 15 pp.1461-1472,2011.

[10] E. H. Donald and J. D. Michael, "Angiotensin-Converting Enzyme Inhibitor-Induced Renal Failure: Causes, Consequences, and Diagnostic Uses", Journal of The American Society of Nephrology, vol 1(6), pp.845-858, 1999.

[11] B. Ryffel and M. J. Mihatsch, "Cyclosporine Nephrotoxicity", Toxicol Pathol, vol 14(1), pp.73-82, 2013.

[12] R. K. Zalups and G. L.Diamond, "Mercuric chloride-induced nephrotoxicity in the rat following unilateral nephrectomy and compensatory renal growth", the Toxicology Bibliographic Information, vol 53(6), pp.336-46, 2014.

[13] N. Ullah, M. A. Khan, T. Khan and W. Ahmad, "Bioactive traditional plant *Cinnamomum zeylanicum* successfully combat against nephrotoxic effects of aminoglycosides", Bangladesh J Pharmacol, vol 8, pp.15-21, 2013.

[14] M. Nematbakhsh, S. Ebrahimian, M. Tooyserkani, F. E. Jazi, A. Talebi and F. Ashrafi, "Gender Difference in Cisplatin-Induced Nephrotoxicity in a Rat Model: Greater Intensity of Damage in Male Than Female", Nephrourol Mon, vol 5(3), pp.818–821, 2013.

[15] W. Mary and N. Peter, "Contrast media-induced nephrotoxicity: identification of patients of patients at risk and algorithms for prevention", J Vase interv Radiol, vol 12, pp.3-9, 2001.

[16] G. S. Pazhayattil and C. S. Anushree, "Drug-induced impairment of renal function", International Journal of Nephrology and Renovascular Disease Dovepress,vol 7, pp.457–468, 2014.

[17] A. Schwarz and P.A. Canto "Nephrotoxicity of antiinfective drug", vol 36(3), pp.164-167, 1998.

[18] P. Gunness, K. Aleksa, G. Koren, "The effect of acyclovir on the tubular secretion of creatinine in vitro", Journal of Translational Medicine, vol 8 pp.139, 2010.

[19] B. M. Tune, "Nephrotoxicity of beta-lactam antibiotics: mechanisms and strategies for prevention", Pediatr Nephrol. Vol 11(6), pp.768-772, 1997.

[20] S. Elyasi, H. Khalini, D. S. Khavidaki and A. Mohammadpour, "Vancomycin induced nephrotoxicity: mechanism, incidence, risk factors and special populations", Eur J Clin Pharmacol, vol 68(9), pp.1243-1255.

[21] J. Rossert, "Drug-induced acute interstitial nephritis", Kidney Int., vol 60(2), pp.804-817, 2001.

[22] I. J. Simpson, M. R. Marshall and H. Pilmore, "Proton pump inhibitors and acute interstitial nephritis: report and analysis of 15 cases", Nephrology (Carlton), vol 11(5), pp.381-385, 2006.

[23] R. D. Adelman, W. L. Spangler, F. Beasom, G. Ishizaki and G. M. Conzelman, "Furosemide enhancement of experimental gentamicin nephrotoxicity: comparison of functional and morphological changes with activities of urinary enzymes", J Infect Dis, vol 140 (3), pp.342–352, 1979.

[24] X. Guo and C. Nzerue, "How to prevent, recognize, and treat drug-induced nephrotoxicity", Cleve Clin J Med, vol 69(4), pp.289-312, 2002.

[25] E. L. Rosenberg and J. P. Hayslett., "Nephrotoxic Effects of Penicillamine in Cystinuria",The journal of American medical association, vol 201(9), pp.698-699, 1967.

[26] M. Zahid, K. Farrukh, A. S. A. Batti and N. I. Ansari, "Morphological changes perduced by aminoglycoside induced nephrotoxicity- an experimental study", vol 23(6), pp.1-3, 2007.

[27] J. S. Sandhu, A. Sehgal, O. Gupta, and A. Singh, "Aminoglycoside Nephrotoxicity Revisited Journal, Indian Academy of Clinical Medicine", vol 8(4), pp.331-334, 2007.

[28] P. Devbhuti, C. Sengupta and A. Sana, "Amikacin induced lipid profile and peroxidise parameters and their control with ascorbic acid", International Journal of Current Pharmaceutical Research, vol 2(3), pp. 76-81, 2010.

[29] B. Prajapati and M. Singha, "Comparative evaluation of the toxicity of Amikacin and Cefepime on rat's kidney and liver", International Journal of PharmTech Research, vol 3(4), pp. 2149-2154, 2010.

[30] M. R. Pinsky, P. Brophy, J. Padilla, E. Paganini, and N. Pannu, "Fluid and volume monitoring" Int J Artif Organs, vol 31(2), pp. 111-126, 2008.

[31] S Heather. and D. John, "Is parentral nutrition therapy of value in acute renal failure patients?" American Journal of kidney Disease, vol 25, pp. 96-102, 1995.

[32] A. S. Y. Hounkpatin, R. C. Johnson, P. Guédénon, E. Domingo, C .G. Alimba, M. Boko and P. A. Edorh, Protective Effects of Vitamin C on Haematological Parameters in Intoxicated Wistar Rats with Cadmium, Mercury and Combined Cadmium and Mercury,Int. Res. J. Biological Sci, vol (8), pp. 76-81, 2012.

[33] M. Jun, V. Venkataraman, M. Razavian, B. Cooper, S. Zoungas, T. Ninomiya, A. C. Ninomiya and V. Perkovic, "Antioxidants for chronic kidney disease", Cochrane Database Syst Rev, vol 10, 2012.

[34] D. Wilfred, "Basics in Clinical Nutrition, Nutritional support in renal disease", The European Journal of Clinical Nutrition and metabolism, vol 5, pp. 54-7. 2010.

[35] J. Normal, E. William and J. Jhon, "Management of acute renal failure in the pediatric patient. Hemofiltration versus hemodialysis", American Journal Kidney disease, vol 30, pp. 84-88, 1997.

[36] I. Abdelaziz and M, Kandeel, "The Protective Effects of *Nigella sativa* oil and *Allium sativum* extract on Amikacin-induced Nephrotoxicity", International journal of pharmacology, vol 7(6), pp. 697-703, 2012.

[37] I. Hazim, Ahmad, K.A, Saba and Tai, "Protective role of Pomegranate juice in inhibit nephrotoxicity induced by amikacin in Rabbits", Journal of Advanced Biomedical & Pathobiology Research, vol 3(4), pp. 6-17, 2013.

[38] H. Kalantari, I. Rashidi, S. Bazgir and A. Dibaei, "protective effect of hydroalcolic extract of red grape seed (*vitis venifera*) in nephrotoxicity induced by amikacin in mice", Journal of Natural Pharmaceutical Products, vol 2(2), pp. 87-93, 2007.

[39] P. Devbhuti, C. Sengupta and A. Saha, "Studies on amikacin induced lipid profil and peroxidation parameter and their control with ascorbic acid", vol 2(3), 2010.

[40] H. Parlakpinar , M.K. Ozer, M. Ucar ,M. Gaffarogu, N. Vardi, M. Koe and A Acet, "Protective effects of caffeic acid phenethyl ester (CAPE) on amikacin-induced nephrotoxicity in rats", Cell biochem. funct., vol 24, pp. 363-367, 2006.

[41] A. M. K. Mohamed, S. G. Sherin and F. Mohamed and J. Mansoura, "protective effect of carocine on amikacin induced nephrotoxicity in rats", Forensic Med. Clin. Toxicol, Vol. 18(1), 2010.

[42] K. Kaynar, R. Aliyazioglu, S. Ersoz, S. Ulusoy, A. Sait, G. Ozkan and M. Cansiz, "Role of erythropoietin in prevention of amikacin-induced nephropathy", JN, vol (05), pp. 25744-74, 2012.

[43] M .K. Ozer, H. Asci, M. Oncu, M. yesilot, Savarn, D. Batrammmm and E. Cicek, "Effects of pentoxifylline on amikacin-induced nephrotoxicity in rats", Ren Fail, vol 31(2), pp. 134–139, 2009.

[44] H. Asci, M. Saygin, F.M. Cankara, D. Bayram, S. Yesilot, I. A. Candan, and I. Ilhan, "The impact of alpha-lipoic acid on amikacin-induced nephrotoxicity", Informa Healthcare USA, pp. 1525-6049, 2014.

[45] E. Kose, A. Beytur, Z. Dogan, Z. Ekincioglu, N. Vardi, K. Cinar, Y. Turkoz, H. Soysal and N. Ekinc, "The effects of montelukast against amikacin-induced acute renal", European Review for Medical and Pharmacological Sciences damage, vol 16, pp. 503-511, 2012.

[46] P. Gunness, K. Aleksa and G. Koren, "The effect of acyclovir on the tubular secretion of creatinine in vitro", Journal of Translational Medicine, vol 8:139, 2010.

Methotrexate Induced Hepatotoxicity and Its Management

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***Abstract*— Liver dysfunction is a major health problem that challenges not only health care professionals but also the pharmaceutical industry and drug regulatory agencies. Commonly used drugs such as anti cancer drugs, certain antibiotics, antituberculer agents, paracetamol and various other toxic chemicals such as carbon tetrachloride (CCL_4), thioacetamide (TAA), excessive alcohol consumption, arsenic and microbes reported to cause hepatotoxicity. In addition to this, genetics, metabolism and immunology also played important role in hepatotoxicity. Methotrexate is commonly used as anticancer and immunosuppressant drug. Its major side effects are bone marrow depression and hepatotoxicity. In the present review, we discuss about the mechanism of methotrexate induced hepatotoxicity and its herbal based treatment. Mechanism of methotrexate induced hepatotoxicity includes oxidative stress which increase the generation of reactive oxygen (ROS) and nitrogen species, inhibits cytosolic NADP-dependent dehydrogenase and NADP malic enzyme, which reduce the levels of glutathion, superoxide dismutase, catalase and ultimately reducing the effectivity of the antioxidant defence system protecting the cell against ROS. Herbal medicines may serve as a vital source of potentially useful for the development of effective therapy to combat a variety of liver problems. Developing a satisfactory herbal therapy to treat severe liver diseases requires systematic investigation of properties like anti-hepatotoxicity and stimulation of liver regeneration**.

Keywords*— *Hepatotoxicity; Methotrexate; Mechanism; Hepatoprotective Plants

I. INTRODUCTION

Liver is considered to be one of the most vital organs that functions as a centre of metabolism for nutrients such as proteins, carbohydrates and lipids with excretion of waste metabolites. It also carries out the metabolism, fight against disease, nutrient supply, energy provision and excretion of drugs and other xenobiotics from the body thereby providing protection against foreign substances by detoxifying and eliminating them [1]. As we know that, liver can metabolizes xenobiotics which can leads to the drug-induced liver injury (DILI) and is a potential complication of many drugs. DILI broadly classified into two types: intrinsic and idiosyncratic types; intrinsic DILI generally is dose-dependent and predictable (eg,acetaminophen toxicity), whereas idiosyncratic DILI is unpredictable and does not depend directly on dose [2]. Liver injury is a major health problem that challenges not only health care professionals but also the pharmaceutical industry and drug regulatory agencies [3]. The rate of hepatotoxicity has been reported to be much higher in developing countries like India (8% - 30%) compared to that in advanced countries (2% - 3%) with a similar dose schedule [4]. Drug induced liver injury is one of the main reason of withdrawal of many drugs from the market and most of the time severe case of liver dysfunction required liver transplant or some time death [5]. Mechanism of hepatotoxicity can be investigated through mitochondrial dysfunction and DNA damage [6]. This imperial function caused by drug itself or its cytochrome P450 mediated metabolite. Recent reports on hepatotoxicity suggest that suggest that oxidative stress, microvacular steatosis, imbalance energy storage are major outcome of mitochondrial dysfunction [7].

II. RISK FACTORS OF HEPATOTOXICITY

Different risk factors which lead to hepatotoxicity like genetic, non genetic or environmental etc [8]. In addition to this, there are number of drugs whose metabolites leads to liver injury i.e. anticancer drug, antiretroviral drug, alcohol and certain health condition such as age, sex, and diseases eg. TB, HIV are coupled with each other. Some recent research on hepatic injury shown that the risk of hepatotoxicity is increased in various diseased conditions like HIV,diabetic or tuberculosis, cancerous patients [9].

A. Genetic factors

Drug-induced liver injuries (DILI) with different genetic traits and studies conducted till date are hypothesis-driven only. Genetic variations in thioredoxin reductase 1 gene leads to DILI. Moreover, changes in the activity of drug metabolizing phase - I enzyme such as CYPS3A, CYP2C9 and CYP2C19 lead to pathogenesis of DILI [10].

In addition to this polymorphism of bioactivities pathway through phase II enzyme i.e. CYP450, detoxification reactions and excretion/transport reaction together with immunological factors i.e. HLA class II antigen, cytokines are major genetic factors which can leads to hepatotoxicity [11].

B) Non -genetic factors

Different environmental and others host factors like age, drug dose ,gender, alcohol abuse and some disease condition like cancer, HIV also associate with hepatotoxicity. Age is an important risk factor for hepatotoxicity such as use of aspirin in younger age increase risk to liver injury. Women and men have different susceptibility for drug induced hepatotoxicity.

For example according to Hyman and Zimmermanin in 1978 women are more susceptible for drugs like isoniazid, nitrofurantoin, chlorpromazine etc where as men are mostly affected azathioperine induced hepatotoxicity [9]. Obesity is also responsible for liver injury. Acute and chronic alcohol consumption is also one of the important causes of liver injury. Some disease condition like HIV tuberculosis, Hepatitis B and C associate disease always increase of liver injury [12].

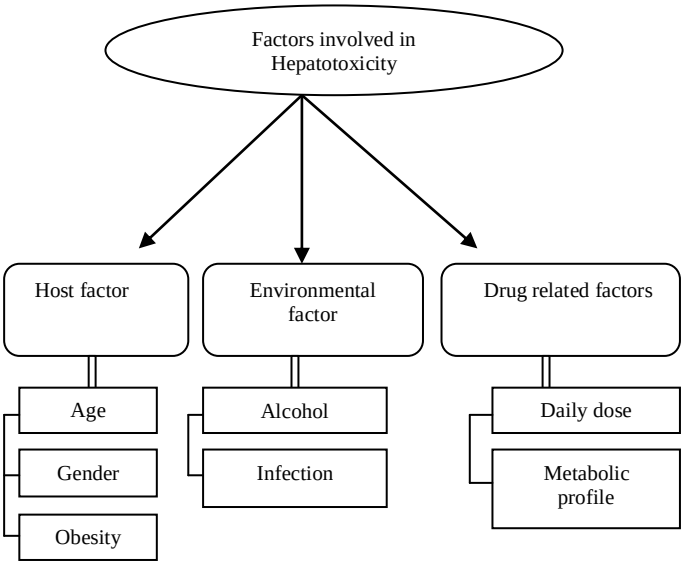

Fig . 1. Non genetic factors that involved in hepatotoxicity

III. METHOTREXATE INDUCED HEPATOTOXICITY

Methotrexate is a folic acid antagonist, widely used as a chemotherapeutic agent in the treatment of various cancerous stages such as acute lymphoblastic leukaemia and in the treatment of various inflammatory diseases [13]. It is also used for the treatment of multiple sclerosis, dermatomyositis, sarcoidosis, psoriasis, and rheumatoid arthritis, disorders causing inflammation. Its side effects include hypersensitivity pneumonia, central and peripheral nervous system toxicity, liver and gastrointestinal system dysfunctions, and hematologic failure [14]. MTX exerts its primary toxic effects against the rapidly replicating cells of the bone marrow and gastrointestinal epithelium producing leucopoenia and thrombocytopenia. Both low and high-dose therapy can cause hepatotoxicity. Methotrexate at very low dosage affects the liver and causes changes in histology of liver. Other frequently reported adverse toxic effects are malaise, nausea, vomiting, diarrhoea, headache, mild alopecia and fever. Low dose therapy produces a different type of hepatotoxicity which includes cirrhosis. Long term administration of the same causes anaemia. Kidney damage is a frequent complication of high-dose therapy. High-dose therapy results in elevated liver enzymes. However, the use of high-dose methotrexate (as in leukaemia) or prolonged use may result in hepatotoxicity that may lead to progressive fibrosis and cirrhosis. Methotrexate seems to be hepatotoxic, nephrotoxic and toxic to respiratory and reproductive system at very low doses for continuous therapy [15]. On the other hand, substantial evidence supports the concept that MTX was mutagenic and carcinogenic in animals, and the efficacy of this compound is often limited by its severe hepatotoxicity [16].Toxic side effects of methotrexate have been demonstrated in various animals including rat, mice, rabbit and dog. Clinically, hepatotoxicity, which occurs in long-term use of methotrexate, remains one of the significant restrictions on its use in the doses desired. The inhibition of tetrahydrofolate formation is responsible for both the therapeutic and toxic effects of methotrexate. Although these deleterious toxic effects of methotrexate can theoretically be reduced or prevented with the addition of folic acid to the treatment. On the contrary, there are studies showing that with the addition of folic acid, the therapeutic effectiveness of methotrexate decreases [17]. MTX induced toxicity appears to be a consequence of the interaction of many factors that includes the dosing schedule, length of treatment, patient risk factors, type of disease, and the presence of genetic and molecular apoptotic factors.

IV. MECHANISM OF METHOTREXATE INDUCED HEPATOTOXICITY

MTX has been shown to lead to a reduction in methionine synthesis, antioxidant enzymes such as catalase, glutathione peroxidase, superoxide dismutase and a decrease of SAM (S-adenosyl methionine) in cerebrospinal fluid of patients on MTX treatment. Due to its antioxidant effects, a deficiency of SAM caused by MTX may be a reason for increased reactive oxygen species (ROS). Effects of MTX are partly due to its direct toxicity by increasing ROS production. Altered balance between ROS production and antioxidant defenses leads to the “oxidative stress” and could be lead to various pathological conditions [13]. The mechanisms of MTX hepatotoxicity could be related to the cellular pathway of the drug [18].Methotrexate enters the stellate cell bound to folate trasporter 1 and is pumped out by the ATP-binding cassette (ABC) family of transporters.Methotrexate is retained within the cell as a polyglutamate that inhibits dihydrofolate reductase(DHFR T’ase, thymidylate synthase(TS) and AICAR (5-aminoimidazole-4-carboxamide ribonucleotide) transformylase, leading to impaired pyrimidine and purine synthesis.

Moreover, methotrexate indirectly affects MTHFR (methylene-tetrahydro folate reductase) and hence the generation of methionine from homocysteine. Excess homocysteine can generate oxidative stress or sensitize the cell to its cytotoxic effects. Homocysteine has been shown to induce endoplasmic reticulum (ER) stress, which when unresolved, leads to fatty infiltration of the liver. In addition to this, it can also activate proinflammatory cytokines. The combination of these insults could contribute to the activation of hepatic stellate cells, which leads to liver fibrosis [19, 20]. Lipid peroxidation plays an essential role in damage to the cell membrane through reactive oxygen radicals. In experimental studies, MTX toxicity has been shown to increase malondialdehyde (MDA), an important index of lipid peroxidation, and this increase has been shown to be suppressed by antioxidant therapies [21, 22].So it consider a good marker of free radical mediated damage and oxidative stress .This blocking in the synthesis of nucleic acids, certain amino acids and consequently proteins might lead to damage of organelles and plasma membranes of the hepatic parenchymal cells, interfering with their function and allowing leakage of enzymes. Studies have demonstrated that various

anti-oxidants are protective against methotrexate hepatotoxicity [23].

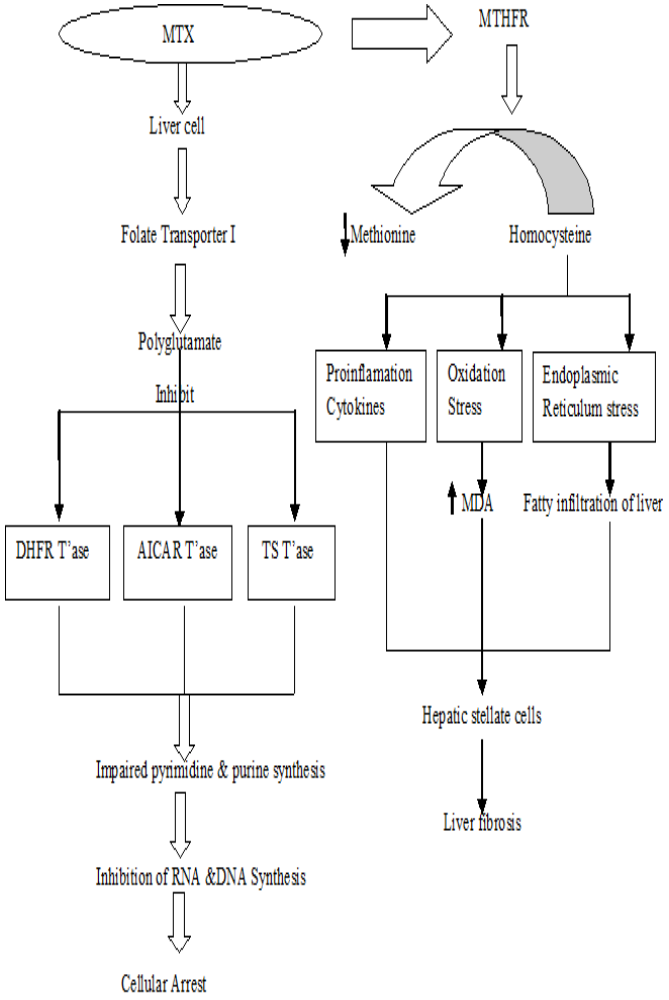

Fig. 2. Mechanism Of Mtx Induced Hepatotoxicity related to cellular Pathway; MTHFR:Methylenetetrahydro folate reductase, AICAR:5-aminoimidazole-4-caboxamide ribonucleotide, DHFR:dihydrofolate reductase; TS:thymidylate synthetase ; ABC:ATP-binding cassette; MDA: Malondialdehyde;

V. HERBAL TREATMENT FOR METHOTREXATE INDUCED HEPATOTOXICITY

A lot of medicinal plants, traditionally used for thousands of years are present in group of herbal preparation of the Indian traditional health care system. In India, millions of polyherbal commercial formulations reputed to have hepatoprotective action are being used. Scrutiny of the literature indicates that 160 phyto-constituents from 101 plant families have antihepatotoxic activity. Silymarin; a phytoconstituent from (*Silybum Marianum)* has been widely used from ancient times because of its excellent hepatoprotective action [24] .Clinical research has also shown that herbals have genuine utility in the treatment of liver diseases [1].There are many herbs, which have been proven to be as hepatoprotective agents while many more are claimed to be hepatoprotective but lack any such scientific evidence to support such claims. Developing a satisfactory herbal therapy to treat severe liver diseases requires systematic investigation of properties like anti-hepatotoxicity (antioxidants), stimulation of liver regeneration. Formulation of herbal drugs with standards of safety and efficacy can revitalize treatment of liver disorders [25] .There are some of the plants which have hepatoprotective activity against methotrexate induced hepatotoxicity.

Table 1: List of plants used as Hepatoprotective

Biological Name	**Common Name**	**Family**	**Dose Of MTX**	**Animal Used**	**Reference**
Curcuma longa	Turmeric	*Zingiberaceae*	20mg/kg/ip/single dose	Albino rats	[16]
Flacourtia indica	Batoka plum	*Flacourtiaceae*	1750mg/kg/1 days	Albino Mice	[26]
Thymus vulgaris	Thyme	*Lamiacea*	20mg/kg/ip/3 days	Rabbits	[27]
Silybum marianum	Milk thistle	*Compositae*	100µg/kg /45 days	Wistar rats	[28]
Camellia sinensis	Green tea	*Theaceae*	20mg/kg/single dose	Sprague-dawley rats	[29]
Olea europea	Olive	*Oleaceae*	20mg/kg/12 days	Wistar rats	[30]
Spinach oleracea	Spinach	*Chenopodiac*	20mg/kg/5 days	Wistar rats	[31]
Vitis vinifera L	Grape	*Vitaceae*	20mg/kg/single dose	Wistar rats	[32]
Opuntia ficus-indica	Cactus	*Cactaceae*	20mg/kg/10days	Wistar rats	[33]
Arachis hypogaea	Peanuts	*Fabaceae*	20mg/kg/5days	Wistar rats	[34]
Passiflora coerula	Chrysin	*Passifloraceae*	20mg/kg/7days	Wistar rats	[35]
Prunus armeniaca	apricot	*Rosaceae*	20mg/kg/10days	Wistar rats	[36]

REFERENCES

[1] S.D. Roy, S.Das, D. Shil, K.N. Dutta,"Herbal Hepatoprotective Agents: A Review," World J PHARM RES,vol.1(2), pp. 87-89, 2012.

[2] N.Chalasani and E. Björnsson, "Risk Factors for Idiosyncratic Drug-Induced Liver Injury," Gastroenterology, vol. 138(7), pp. 2246–2259, 2010.

[3] S.T.S. Mohamed, A.J.M. Christina, N. Chidambaranathan, Ravi V, Gauthaman K,"Hepatoprotective activity of *Annona squamosa* Linn.On experimental animal model," Int J App Res Nat Products, vol. 1(3), pp. 1-7, 2008.

[4] S.K.Sharma, "Antituberculosis drugs and hepatotoxicity" Infect Genet, vol.4, pp.167-170, 2004.

[5] Au JS, NavarroVJ, Rossi S. Review article, "Drug-induced liver injury--its pathophysiology and evolving diagnostic tools," Aliment Pharmacol The, vol. 34 (1),pp.11-20, 2011.

[6] B.Fromenty and D.Pessayre, "Inhibition of mitochondrial beta-oxidation as a mechanism of hepatotoxicity," Pharmacol Ther, vol.67, pp.101–154, 1995.

[7] G. Labbe, D. Pessayre, B.Fromenty, "Drug-induced liver injury through mitochondrial dysfunction, mechanisms and detection during preclinical safety studies," Fundam Clin Pharmacol, vol. 22, pp.335–353, 2008.

[8] L. DeLeve and N.Kaplowitz,"Prevention and therapy of drug-induced hepatic injury," In: Wolfe M, ed. Therapy of digestive disorders. Philadelphia: WB Saunders, Harcourt, Brace, pp.334–48, 2000.

[9] S.Mishra, V. Aeri and D.P. Katare, "Hepatoprotective medication for liver injury," World j pharm & pharmaceutical sci, vol.3(5), pp.891-932**,** 2014.

[10] S. Russmann, Y. Barguil, P. Cabalion, M. Kritsanida, D .Duhet, B.H.Lauterburg, "Hepatic injury due to traditional aqueous extracts of kava root in New Caledonia" Eur J Gastroenterol Hepatol,vol. 5, pp.1033-1036, 2003.

[11] R.J. Andrade, M. Robles, E .Ulzurrun, M.I. Lucena, "Drug-induced liver injury, insights from genetic studies," Pharmacogenomics, vol.10 (9), pp.1467-87, 2009.

[12] B. N. Dolores, "Drug-Induced Hepatotoxicity: Metabolic, Genetic and Immunological Basis" Int. J. Mol. Sci., vol.15, pp.6990-7003, 2014.

[13] C.L Coleshowers, O.O Oguntibeju, M Ukpong & E.J Truter , "Effects of methotrexate on antioxidant enzyme status in a rodent model" Medical Technology SA, Vol.24(1), pp.5-9, 2010.

[14] F. Celik, C. Gocmez, M. Bozkurt, I. Kaplan, K. Kamasak, E. Akil, E. Dogan, A. Guzel, E. Uzar , "Neuroprotective effects of carvacrol and pomegranate against methotrexate induced toxicity in rats," Eur Rev Med & Pharmacol Sci,vol.17: pp.2988-2993, 2013.

[15] N. N. Patel, D. J. Ghodasara, S. Pandey, P. D. Ghodasara, J. H. Khorajiya, B. P. Joshi and C. J. Dave, "Subacute toxicopathological studies of methotrexate in Wistar rats,"Veterinary World, vol. 7(7), pp.489-495, 2014.

[16] F. R .A.Ghaffar, I. A.Elaimy, K. A.Dougdoug , H. I. Nassar , "Protective and modulatory effects of Curcumin and L-Carnitine against Methotrexate-induced Oxidative stress in albino rats," Res J Pharm, Bio and Chem Sci ,vol. 4(1), pp.747-754,2013.

[17] S.L. Whittle, R.A. Hughes, " Folate supplementation and methotrexate treatment in rheumatoid arthritis: a review," Rheumatology,vol.43, pp.267–71,2004.

[18] J.M.Kremer,"Toward a better understanding of methotrexate," Arthritis Rheum,vol. 50: pp.1370–1382,2004.

[19] C. Desouza , M. Keebler, D.B.Namara, V. Fonseca, "Drugs affecting homocysteine metabolism: impact on cardiovascular risk," vol.62, pp.605–616, 2002 .

[20] A. Pandit, T. Sachdeva and P. Bafna, "Drug-Induced Hepatotoxicity: A Review," J Appl Pharm Sci, vol. 02 (05), pp. 233-243, 2012.

[21] A.Cetinkaya, E. Bulbuloglu, E. B. Kurutas and B. Kantarceken, "N-acetylcysteine ameliorates methotrexate induced oxidative liver damage in rats,"Med. Sci. Monit, vol.12, pp.274–278, 2006.

[22] N. Jahovic, H.Cevik, A.O. Sehirli, B.C.Yegen and G. Sener, "Melatonin prevents methotrexate- induced hepatorenal oxidative injury in rats," J. Pineal Res, vol. 34, pp.282–287, 2003.

[23] B. Ozogula, A. Kisaoglua, M. I. Turanb, D. Altunerc, E. Senerd, N.Cetine, C. Ozturkef, " The effect of mirtazapine on methotrexate-induced toxicity in rat liver," ScienceAsia, vol.93,pp.56–362, 2013.

[24] A.D. Kshirsagar, R. Mohite, A. S. Aggrawal And U.R. Suralkar, "Hepatoprotective Medicinal Plants Of Ayurveda– A Review," Asian J Pharm Clin Res.,vol.4(3), pp.1-18, 2011.

[25] A. Shaik, A. Elumalai, M. C. Eswaraiah, Usha," An Updated Review on Hepatoprotective Medicinal Plants," Journal of Drug Delivery & Therapeutics, JDDT, Vol.2(2), pp.2-3, 2012.

[26] J. Varkey and J. Thomas,"Protective effect of flacourtia indica (burm.f) merr. In methotrexate induced hepatotoxicity," PHARMANEST -An Inter J Advances in Pharm Sci, vol. 2 (2 - 3), pp.115-127, 2011.

[27] N. H. Swayeh, A. Raghif, B. J. Qasim, H.B. Sahib, "The Protective Effects of *Thymus vulgaris* Aqueous Extract against Methotrexate-Induced Hepatic Toxicity in Rabbits," Int. J. Pharm. Sci. Rev. Res, vol. 29(2) ,pp.187-193,2014.

[28] A.R. Ghaffari , H. Noshad , A. Ostadi , M. Ghojazadeh , P. Asadi, "The effects of milk thistle on hepatic fibrosis due to methotrexate in rat," Hepat Mon, vol.11(6), pp.464-468, 2011.

[29] A. H. Jwied, "Hepatoprotective Effect of the Aqueous Extract of *Camellia sinensis* Against Methotrexate-induced Liver Damage in Rats," Iraqi J Pharm Sci, vol. 18(2), pp.73-79, 2009.

[30] Amira O. Abd El-Azim, "Antioxidant effect of olive leaf extract on methotrexate–induced hepatic injury in rats," canad.J.Clin.Nutr, vol.01(02) ,2014.

[31] Farah K. Abdul-Wahab & Thukaa Z. Abdul Jalil.study of Iraqi spinach leaves (phytochemical and protective effects against methotrexate-Induced hepatotoxicity in rats). Iraqi J Pharm Sci.vol.21(2) PP.8-17,2012.

[32] C.Aysun, K.Leylagul, K.Ismail , K.H.Sibel, R. Saraymen, A.Ozturk, S.Ismail and S. Osman, "Role of Grape Seed Extract on Methotrexate Induced Oxidative Stress in Rat Liver," AM J CHIN MED,vol.36(5),pp.861–872,2008.

[33] A.Akacha,T.Rebai,M.Amri,L.Zourgui, "preventive role of cactus(opuntia ficus-indica)cladodes on methotrexate induced biochemical ,haematological and oxidative damage in rats liver,"INT J HOR SCI.

[34] Tunali-Akbay T, O.Sehirli , F. Ercan ,G. Sener, "Resveratrol protect against MTX induced hepatic injury in rats,"J Pharmacol Pharmaceut Sci ,vol.13(2), pp.303 – 310,2010.

[35] N.Ali, S.Rashid,S.Nafes,S.K.Hasan, " Beneficial effects of chrysin against MTX induced hepatotoxicity via attenuation of oxidative stress & apoptosis,"Mol.cell .biochem ,vol.385(1),pp.215-23,2014.

[36] N.vardi,H.parlakpinar,B.ATES,A.cetin,O.Ali, "The protective effect of prunus armeniaca against MTX induced oxidative damage and apoptosis in rats,"J PHY BIOCHEM,vol.69(3),pp.371-381,2013.

Nutraceuticals: Novel Neuroprotective Agents

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***Abstract:-*Oxidative stress and neuroinflammation resulting from neuroglia activation, at the level of neurons, microglial cells and astrocytes, are key factors in the etiopathogenesis of both neurodegenerative and neurological disorders. To be cured from these neurodisorders various neuroprotective are used in modern era. For normal functioning of the body a number of natural products which are considered as supplements such as vitamins, nutrients from the plants play a major role in our daily life. They are not only helpful in maintaining the health of the individual but also help in reducing the risk of various chronic diseases. Nutraceuticals are medicinal foods, enhancing health; modulating immunity by which it can prevents diseases without giving any side effects. As various allopathic drugs lead to swear side effects therefore various nutraceuticals are prescribed nowadays as they have high therapeutic efficacy and no side effects. The nutraceuticals used as neuroprotective agents are *Panax.ginseng*, *Ginkigo.biloba* and *Scutellaria.baicalensis* determine as dietary components these specific herbs have antioxidant activity.**

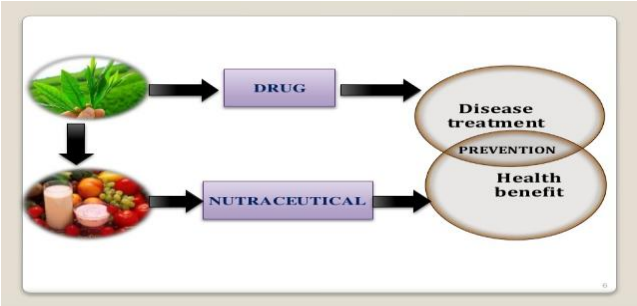
Keywords-Oxidativestress,neuroprotective,nutraceuticals, neurodegenerative

1. INTRODUCTION

Cognitive dysfunction is a major health problem in modern era, neuropsychiatric and neurodegenerative disorders, such as depression, schizophrenia, Alzheimer's disorder, dementia, cerebrovascular impairment, seizure disorders, head injury and Parkinsonism, can be severely functionally debilitating in nature. To be cured from these chronic disorders various allopathic drugs are used and that drugs have chronic side effects w.r.t the therapeutic effect because of these side effects nowadays nutraceuticals and herbal remedies are used which is considered to be the valuable resource with better remedy and for CNS disorders, as compare to the allopathic drugs. Neuroprotection refers to the relative mechanisms which is able to defend the central nervous system (CNS) against neuronal injury due to both acute (e.g. stroke or trauma) and chronic neurodegenerative disorders (e.g. Alzheimer's disease, AD, Depression, Parkinson's disease, PD) [1]. Neutraceuticals is also termed as dietary supplements and is considered as food or a food product that provide health and medical benefits. “Let food be the medicine and medicine be the food”. Referred to the functional foods, dietary supplements, and nutraceuticals, these products have been defined as “any substance that may be considered a food or part of a food. A nutraceuticals have a physiological benefit and provide protection against various chronic diseases [2]. The secondary metabolites of plants are used nowadays for the clinical or therapeutic benefits for the treatment of various chronic diseases and those secondary metabolites is further uses in the formation of various nutraceuticals. Such products may range from isolated nutrients, dietary supplements and specific diets to genetically engineered foods, herbal products, and processed foods such as cereals, soups, and beverages.

A. History with generation of nutraceuticals

Nutrition + Pharmaceuticals term is commonly used in marketing, synonymously for designer foods, med foods, health food, fortified food , vita food, functional food and dietary supplements. The term is coined by Dr. Stephen L De Felice founder and chairman of the foundation for innovation in medicine, New jersey in USA. Neutraceuticals industry is established in Rutgers. Mainly 6.1 billion people rely on the healing power of plant base material for many reasons-availability, affordability , safety or their belief in traditional; therapy. Medical benefits of food have been explored for thousands of years. Modern nutraceuticals industry began to develop in Japan.



B. Antioxidant property of nutraceuticals

There are many chemical classes of nutraceuticals found in all sorts of foods. Some nutraceuticals are well known, like epigallocatechin 3-gallate (EGCG) from green tea and resveratrol from grapes, while others are largely foreign to the lay consumer. EGCG significantly mitigates oxidative stress and neuronal death induced by hydrogen peroxide in motor neurons [3] it also protects human blastoma cells from amyloid precursor protein.

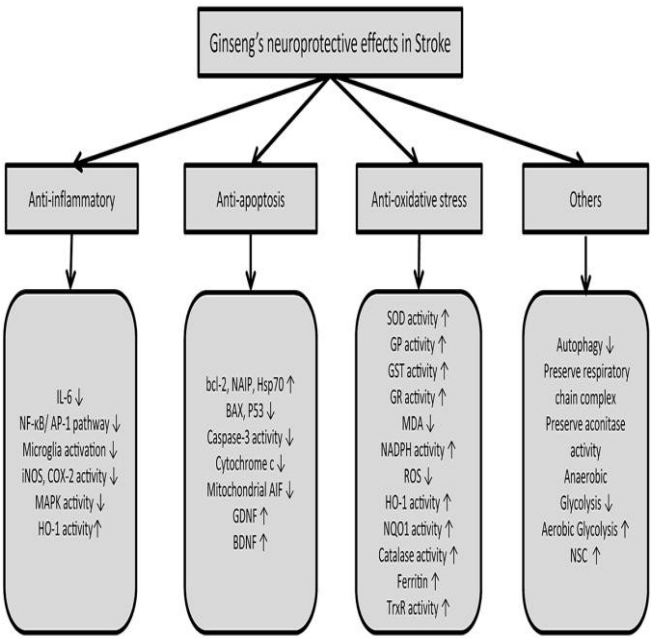
C. Traditional medicines for CNS disorders

Medicinal plants containing phytochemicals, secondary metabolites or primary metabolites that have a medicinal action in humans and animals. Nutraceuticals plants produce healthy phytochemical which are formulated and intake is in the form of capsules, tinctures or tablets. Functional foods are a component of nutraceuticals and are consumed as foods

Medicinal and nutraceutical plants offers a wide range of products utilized in the pharmaceutical and functional food industries. The following are the crops for their medicinal and nutraceutical attributes. The following plants, *Ginkgo biloba L.*, *Panax ginseng C.A.* Mayer and *Scutellaria baicalensis* Georgi, herbs mostly involved in neuroprotection.

- Panax Ginseng

The root of the Panax ginseng has been a popular and widely-used traditional herbal medicine in Korea, China, and Japan for thousands of years. Now it has become popular as a functional health food and is used globally as a natural medicine [4]. Panax ginseng Meyer is a perennial herb of the family Araliaceae. Its roots have been traditionally used to revitalize the body and mind, increase physical strength, prevent aging and increase vigour [5]. The main active pharmacological compounds in P. ginseng are ginsenosides, which are derivatives of triterpenoid dammarane. More than 31 ginsenosides has been isolated from natural and processed P. ginseng, and novel ginsenosides continue to be reported [6]



- Ginkigo Biloba

Extracts of *Ginkgo biloba* (Ginkgoaceae) such as EGb 761 are widely used for the treatment of progressive neurodegenerative disorders such as Alzheimer´s disease [7,8]. The standard *Ginkgo biloba* extract (EGb 761) contains two main active fractions, 24% flavonoids and 6% terpenoids, with a natural ratio approximately at 4:1 [9]. It has been revealed that EGb 761 provides neuroprotection during IR, which might be related to antioxidant and free radical scavenging activities of flavonoids [10,11] antagonism of platelet-activating factor (PAF), and ant apoptotic capacity of terpenoids [12,13]. Ginkgo extract EGb761, well known as a treatment for dementia, a disease of chronic neurodegeneration, has neuroprotective properties that may make it useful as a treatment for acute neurodegeneration e.g. after stroke.

- Scutellaria baicalensis

Scutellaria baicalensis (Labiatae family) is a plant sometimes referred to as Huang Qin or Scutellariae radix (root). *Scutellaria baicalensis* (Chinese skullcap) is a traditional Chinese medicine for the purposes of cardiovascular and cognitive health as well as longevity. The phytochemicals present in Scutellaria species have been reported to show a range of neuroprotective effects. S. baicalensis is one of the most popular medicinal plants in

traditional Korean medicine. It is used for the treatment of high fever, jaundice, ulcer, inflammation, cancer and various neurological disorders. The root of S. baicalensis has been reported to contain essential oils, diterpenoids, amino acids and flavonoids [14]. The main bioactive flavonoids in S. baicalensis are baicalein, baicalin (baicalein-7-glucuronide), wogonin, wogonoside (wogonin-7-glucuronide), oroxylin- A and oroxylin A-7-glucuronide, these flavonoids exhibit neuroprotective activity.

REFERENCES

[1] Shibamoto, Takayuki; Kanazawa, Kazuki; Shahidi, Fereidoon et al., eds. Functional Food and Health. ACS Symposium. (2008) p. 993

[2] EK Kalra (2003). "Nutraceutical-definition and introduction". AAPS pharm Sci 5 (3): E25.

[3] Koh, S.H.; Kwon, H.; Kim, K.S.; Kim, J.; Kim, M.H.; Yu, H.J.; Kim, M.; Lee, K.W.; Do, B.R.; Jung, H.K.; Yang, K.W.; Appel, S.H.; Kim, S.H. Epigallocatechin gallate prevents oxidative-stress-induced death of mutant Cu/Zn-superoxide dismutase (G93A) motoneuron cells by alteration of cell survival and death signals. Toxicology 2004, 202, 213-225.

[4] Baker JT, Borris RP, Carte B, Cordell GA, Soejarto DD, Cragg GM, Gupta MP, Iwu MM, Madulid DR, Tyler VE. Natural product drug discovery and development: new perspectives on international collaboration. J Nat Prod 1995;58:1325-1357.

[5] Choi KT. Botanical characteristics, pharmacological effects and medicinal components of Korean Panax ginseng C A Meyer. Acta Pharmacol Sin 2008;29:1109-1118.

[6] Kim MH, Lee YC, Choi SY, Cho CW, Rho J, Lee KW. The changes of ginsenoside patterns in red ginseng processed by organic acid impregnation pretreatment. J Ginseng Res 2011;35:497-503.

[7] Ramassamy C, Longpre F, Christen Y. Ginkgo biloba extract (EGb 761) in Alzheimer´s disease: is there any evidence ? Curr. Azheimer Res. 2007; 4: 253-262.

[8] Birks J, Grimley EJ. Ginkgo biloba for cognitive impairment and dementia. Cochrane Database Syst Rev 2009; CD003120.

[9] Van Beek TA (2002): Chemical analysis of Ginkgo biloba leaves and extracts. J Chromatogr A 967: 21–55.

[10] Bastianetto S, Zheng WH, Quirion R (2000): The Ginkgo biloba extract (EGb 761) protects and rescues hippocampal cells against nitric oxide-induced toxicity: Involvement of its flavonoid constituents and protein kinase C. J Neurochem 74: 2268–2277.

[11] Smith PF, Maclennan L, Darlington CL (1996): The neuroprotective properties of the Ginkgo biloba leaf: A review of the possible relationship to plateletactivating factor (PAF). J Ethnopharmacol 50: 131–139.

[12] Maclennan KM, Darlington CL, Smith PF (2002): The CNS effects of Ginkgo biloba extracts and ginkgolide B. Prog Neurobiol 67: 235–257.

[13] Li KL, Sheu SJ, Determination of flavonoids and alkaloids in the scute-coptis herb couple by capillary electrophoresis Anal Chim Acta 1995;313; 113-120.

[14] Zhang YY, Don HY, Guo YZ, Ageta H, harigaya Y, Onda M, Hashimoto K, Ikeya Y, Okada M, Maruno M. comparative study of Scutellaria planipes and Scutellaria baicalensis, Biomed Chromatogr 1998;12:31-33.

Hyper-Oxaluria and Surgical Treatment in Regulation of Urolithiasis

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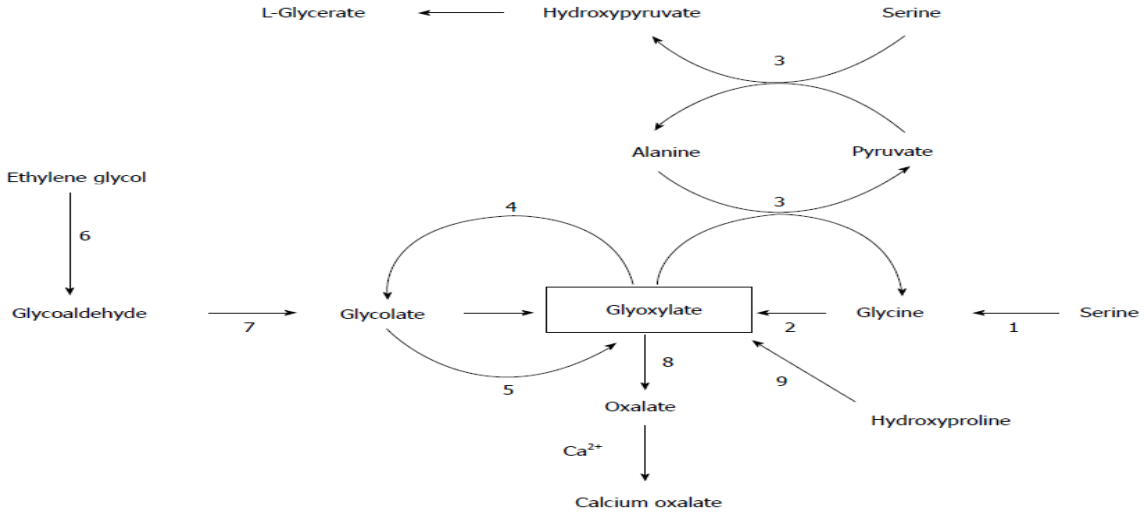
Abstract:- **As studies shows that the urolithiasis is a very serious urological disorder and its incidences are increased day by day. The oxalate along with calcium is an important factor of most of the stone cases. Hyper oxaluria is seen in oxalate urolithiasis. The surgical treatment approaches used in these days are listed in the review.**

Keywords: **oxalate, hyperoxaluria, surgical treatment.**

I. INTRODUCTION

Urolithiasis is one of the most common urological disorder. A large number of population in these days suffers from kidney stone disease. A survey suggest that about 5% of American women and 12% of men will develop a kidney stone at some time in their life, and prevalence has been rising in both sexes. Incidence of urinary stone disease in recent decades in all industrialized countries, increases as did the incidence of obesity, the metabolic syndrome, and type 2 diabetes [1]. Several hypothesis are given for the cause of kidney stone one of them is diet. Urolithiasis thought to be caused by diet, climate changes, and a concurrent rise in comorbidities like diabetes and obesity [2]. There is extensive epidemiological literature on dietary factors modulating urolithiasis risk. Majority of kidney stones are composed of calcium oxalate (CaOx) and phosphate (CaPh) crystals (~80%). Most of the rest are composed of uric acid (UA; 5-10%) and struvite (5-15%). Other rare constituents are cystine, xanthine, matrix, dihydroxy-adenosine and various drugs (e.g., indinavir, nelfinavir, efavirenz, amprenavir, triamterene) [3]

II. BIOSYNTHESIS OF OXALATE:



1. Serine hydroxymethyltransferase
2. D-amino acid oxidase
3. Alanine:glyoxylate aminotransferase (AGT)
4. Glyoxylate reductase-hydroxypyruvate reductase (GRHPR)
5. Glycolate oxidase
6. Alcohol dehydrogenase
7. Aldehyde dehydrogenase;
8. Lactate dehydrogenase; and
9. Five enzyme-catalyzed reactions.

- PH1 results from mutations in AGT which is a hepatic peroxisomal enzyme.
- PH2 results from mutations in GRHPR which is a cytosolic enzyme found in several tissues, but primarily the liver.
- PH3 results from defects in the hepatic mitochondrial enzyme 4-hydroxy-2-oxoglutarate (HOG) aldolase which converts HOG and glyoxylate to pyruvate (reaction not shown), the last step in hydroxyproline catabolism. The reason why a deficiency of HOG aldolase activity increases oxalate production is obscure.

Oxalate is one of the most common ion along with calcium is responsible for stone formation. [4]

III. TREATMENT

A. Surgical treatment:

The goal of kidney stone surgical treatment is to achieve maximal stone clearance with minimal morbidity to the patient. Multiple options are currently available including extracorporeal shock wave lithotripsy (ESWL), percutaneous nephrolithotomy (PCNL), retrograde intrarenal surgery (RIRS), and in rare cases, open or laparoscopic stone surgery. [5]

B. Extracorporeal shock wave lithotripsy

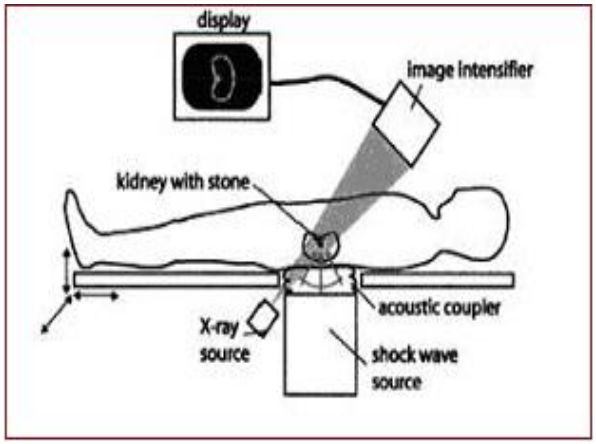
Extracorporeal shock wave lithotripsy (SWL) has revolutionized treatment for most patients with urolithiasis since its introduction in the early 1980s. It is one of the first-line treatments for urolithiasis for the past two decades, however, uric acid stones were once regarded as a relative contraindication for SWL with the Dornier HM3 lithotripter because of the difficulty in localizing the radiolucent stones with fluoroscopy. Today, the second generation ultrasound-guided lithotripters with alkali therapy are used which allow more accurate and harmless localization of radiolucent stones. Nowadays, this is the most frequently used treatment for Kidney stones. In ESWL, shock waves that are created outside the body travel through the skin and body tissues until they hit the denser stones. The stones break down into small particles and are easily passed through the urinary tract in the urine.

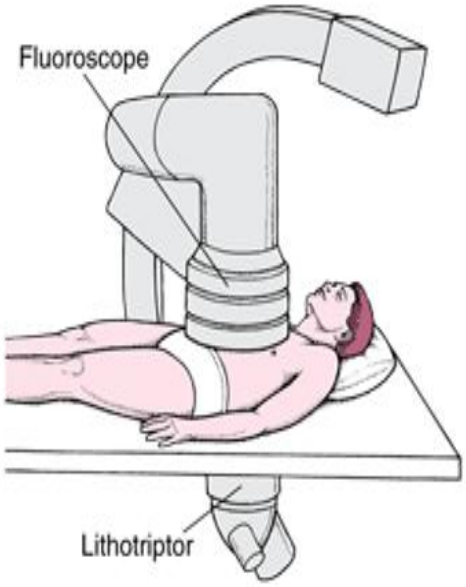
- Side effects of ESWL:

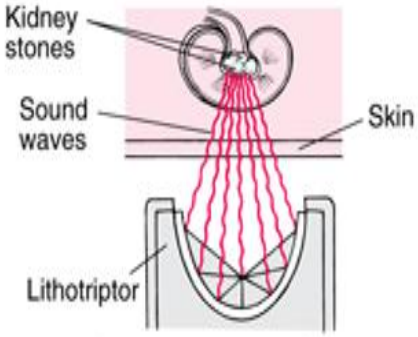
a) cardiac arrhythmia
b) Renal hematoma.
c) Also lack of disintegration may be regarded as a direct complication.

- Secondary complications such as: Hampered fragment passage, obstruction, colic, Hydro-nephrosis (partial/complete), Infection, Sepsis.

- Absolute contraindications for ESWL include uncontrolled urosepsis, uncontrolled hypertension, distal obstruction for stone passage and pregnancy. [6]







Shattering Kidney Stones

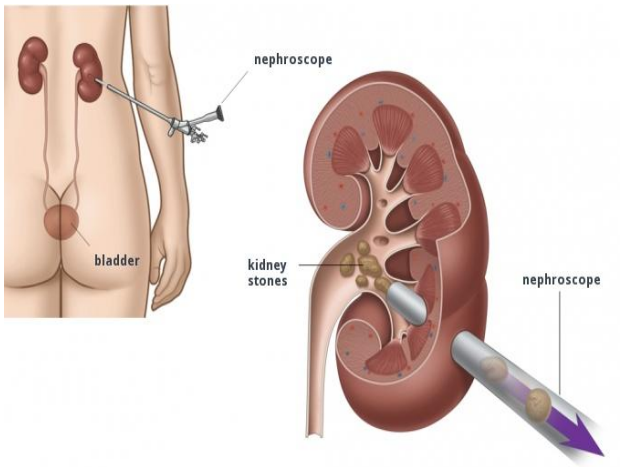
C. Percutaneous Nephrolithotomy

This treatment is often used when the stone is quite large or in a location that does not allow effective use of ESWL. In this procedure, the surgeon makes a tiny incision in the back and creates a tunnel directly into the kidney. Using an instrument called a **nephroscope**, the surgeon locates and removes the stone. For large stones, some type of energy probe—ultrasonic or electrohydraulic—may be needed to break the stone into small pieces. Often, patients stay in the hospital for several days and may have a small tube called a nephrostomy tube left in the kidney during the healing process. [7]

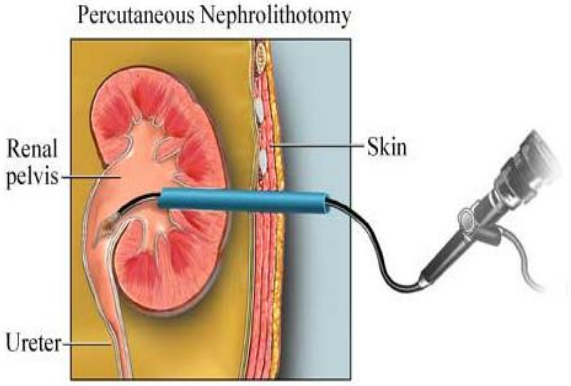
The entire procedure, is done with the patient under general anaesthesia. Prior to the procedure, a retrograde study is performed and a ureteral balloon catheter placed at the ureteropelvic junction. The collecting system is moderately filled with contrast dye (i.e., with addition of methylene blue). PNL is carried out with the patient placed in the prone position.

Complications during or, after PNL may be present with an overall high complication rate including extravasation, transfusion and fever whereas major

complications such as septicaemia and colonic or, pleural injury are rare.



A nephroscope is used to remove stones directly from the kidney and Stone fragments are removed in a single procedure with a nephroscope.



D. Ureteroscopic Stone Removal

This technique of ureteroscopy ("stone basketting") may be needed for mid- and lower ureter stones. No incision is required in this procedure. Instead, the surgeon passes a small fiberoptic instrument called an ureteroscope through the urethra and bladder into the ureter. The surgeon then locates the stone and either removes it with a cage-like device or shatters it with a special instrument that produces a form of shock wave. A small tube or stent may be left in the ureter for a few days to help urine flow. Patients received spinal or general anesthesia at the beginning of the procedure based on patient and anesthesiologist preference. All patients underwent rigid cystoscopy with placement of a guide wire into the renal collecting system under fluoroscopic guidance. Flexible or rigid ureteroscopes were used depending on stone location and patient gender. When the ureteroscope did not pass easily into the ureter, the ureteral orifice was balloon dilated to 15 mm. Calculi were extracted with graspers or baskets when feasible, or fragmented using a holmium:YAG laser or electrohydraulic lithotripter. A stent was placed postoperatively according to attending surgeon judgment. All ureteral perforations noted intraoperatively were treated with stent placement. Recently, the miniaturization of ureteroscopes, together with the introduction of the holmium laser, has improved stone-free rates and decreased the complication rates, widening the indications for ureteroscopy.

IV. CONCLUSION

In this paper we concluded that the incidences of urolithiasis are increased day by day and oxalate and calcium are main factors in most of the cases, and other causes are also there. Surgical treatment are efficient in the elimination of stone out of the body but they have some disadvantages like cost and other side effects.

REFERENCES

[1] Y T Chen. Urolithiasis update: Evaluation and management. Urological Science, vol.23, pp 5-8, 2012.

[2] J S Michelle, R M Brian. Management of urolithiasis in pregnancy. International Journal of Women's Health. Vol 5, pp. 599-604. September 2013.

[3] B R. Matlaga, O D Shah, D G Assimos. Drug-Induced Urinary Calculi. Rev Urol. Vol 5, issue 4, pp.227-231, 2003.

[4] R H Glew, Y Sun, B L Horowitz, K N Konstantinov, M Barry, J R Fair, L Massie, A H Tzamaloukas. Nephropathy in dietary hyperoxaluria: A potentially preventable acute or chronic kidney disease. World J Nephrol. Vol 3, issue 4, pp. 122-142, November 2014.

[5] V. A. Mezentsev. Extracorporeal Shock Wave Lithotripsy in The Treatment of Renal Pelvicalyceal Stones In Morbidly Obese Patients. Int Braz J Urol. Vol. 31, pp. 105-110, March - April, 2005.

[6] M Rajat, W Anu, G Sumeet. New Frontiers On Nephrolithiasis: Pathophysiology and management of kidney stones. IJRAP, vol 2 issue 3, pp.775-786, 2011.

[7] T C. Ngo, DG. Assimos, Uric Acid Nephrolithiasis: Recent Progress and Future Directions. Rev Urol. Vol. 9 issue 1, pp.17-27, 2007.

A Dmaic Approach for Process Capability Improvement of Omeprazole Capsules Manufacturing

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***Abstract*-This research article aims to demonstrate the improvement of the process capability of manufacturing of Omeprazole capsules in a pharmaceutical company which is subjected to critical quality problems related to this product. The present research work implements six sigma DMAIC methodology to reduce the variations, defects in the product and improve the capability level of manufacturing process. The study starts with defining the problem and selection of the critical to quality (CTQ) characteristics in the define phase, followed by collection of measurement data of CTQ characteristics identified. This is followed by the analysis of collected data to identify root cause of problem using various quality tools like Ishikawa diagram, scatter plots. After this improvement of identified problems is done, followed by monitoring of process continuously to check sustainability of improvement. By applying DMAIC approach, the process capability index of capsules is improved from cpk 0.85 to 1.57.**

Keywords: Process capability, Critical to quality (CTQ) characteristics, Process capability indices (PCIs), DMAIC, Six sigma.

I. INTRODUCTION

Quality of products is considered as fundamental part of any pharmaceutical industry [1]. Process capability studies play very important role in analysis of the quality and efficiency of pharmaceutical processes. Process capability is ability of the process to meet desired specifications. Process capability indices (PCIs) are the tools used to compare the process outputs (in control limits) to the predetermined specification limits, means these are statistical indicators of process capability. The most widely used PCIs are Cp and Cpk. Cp measure the two sided spread of specification relative to the six sigma spread (USL-LSL/6σ). Cpk is an index that measures how close a process is running to its specifications(single sided), relative to natural variability of process, calculated as Cpk= min (Cpu, Cpl), where Cpu= (USL-μ)/3σ and Cpl= (μ-LSL)/3σ, USL is upper specification limit, LSL is lower specification limit, μ is mean and σ shows process spread.[3,4] Six sigma(6σ) is an important measure of process capability to achieve defect free products.

Six sigma is a widely recognized, systematic, customer driven approach that uses statistical and non-statistical tools and techniques for continuous quality and process improvement by reducing process defects, variations and results in improving process capability [2,5]. DMAIC i.e. Define, Measure, Analyze, Improve and Control is the widely used six sigma methodology for quality and process capability improvement of existing processes[6,7].

The process capability improvement using DMAIC methodology is done on Omeprazole capsules, 20 mg being manufactured in a pharmaceutical company, having present Process capability index value (Cpk) value of 0.85,which shows poor quality performance.

Omeprazole gastro resistant capsules are used as proton pump inhibitors, for treating gastric ulcers, duodenal ulcers and gastroesophageal reflux disease (GERD).

II. MATERIAL AND METHOD

A. MATERIAL:

Instruments: HPLC, Electronic microbalance, pH meter, Sonicator, Syringe filters (0.45um), Statistical Software MINITAB, Chemicals and Reagents: Omeprazole IP(Working Standard), Potassium dihydrogen phosphate, Sodium hydroxide, Orthophosphoric acid, Acetonitrile (HPLC Grade) , Distilled water.

B. METHOD:

The DMAIC methodology is used to carry out the improvement project. The research work is carried out in 5 phases of DMAIC which are 1) Define phase 2) Measure phase 3) Analyze phase 4) Improve phase 5) Control phase [6-8].

- Define phase: The product having quality problem is first identified from historical data review and product health card. It was recognized that the Omeprazole capsules are having lower process capability index(Cpk) i.e.0.85(should be => 1.33 to get appropriate quality) as shown in fig.1 , for Assay of capsules as compared to Cpk of other quality characteristics like water content, dissolution, relative impurity test and Assay of Omeprazole enteric coated pellets(10%) getting filled in capsules(Cpk= 1.35) . Total 1 batch rejection, 9 OOT, 5 OOS and 11 Incidents for finished product were observed during the review year having 102 batches manufactured. After recognizing product with need of improvement, Project starts with designing the project charter that describes objectives, desired outputs, business and financial impact of project.

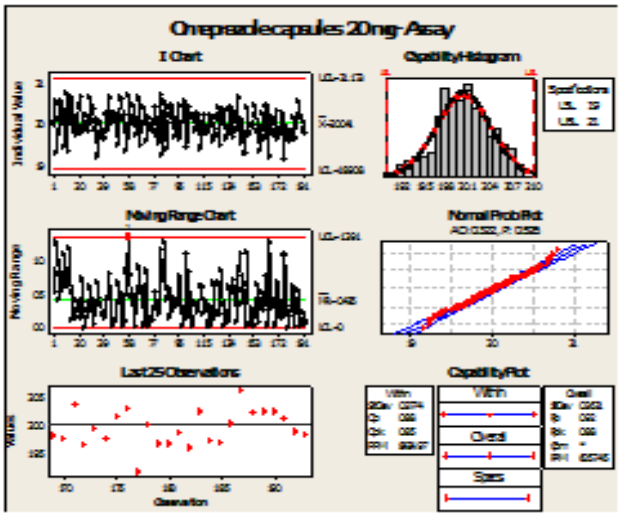

Fig 1: Process Capability six pack of Omeprazole capsules, 20 mg showing Cpk (0.85).

1. Process mapping: The process for manufacturing of capsules consists of 2 stages: 1) Pellets manufacturing 2) Filling of pellets in Capsules. The Pellets manufacturing consist of various stages of coating on sugar globules which are, Drug coating (10%w/w), Outer coating, Sub coating, Enteric coating, with drying and sifting after each coating stage.

In stage 2, the enteric coated Omeprazole pellets (10%w/w) are filled in hard gelatine capsules shells '3' size.

2. Identification of CTQ characteristics: From process map, the important CTQs affecting final product quality have been identified which are shown in table no.1.

Table 1: Manufacturing and Analysis steps of Omeprazole capsules with their identified CTQs

S.NO	Process Steps	Identified CTQ characteristics pertaining to the manufacturing and Analysis of Omeprazole capsules
1	Dispensing	Calibration status of weighing balance, Least count.
2	Drug Micronisation	Blending time to blend API with DSHP, Color of light in working area to which drug is being exposed.
3	Drug coating & Outer coating of pellets	Coating solution holding time, Inlet bed and exhaust temperature, Spray rate, Yield of drug coating, Assay value of drug coated pellets, Weight build up(35-40%), stirring.
4	Sub coating of pellets	Coating solution holding time, Inlet bed and exhaust temperature, Spray rate, Yield of sub coated pellets.
5	Enteric coating	Coating solution holding time, Inlet bed and exhaust temperature, Spray rate, Yield of enteric coating, Assay value of enteric coated pellets.
6	Capsulation	Assay of EC pellets (used in calculation of net fill weight of pellets to be filled in capsule), Weight variation.
7	Analysis of Enteric coated pellets	Water content, quantity of sample taken, Environment exposure time, Analyst variability
8	Analysis of Filled Omeprazole capsules	Pellets assay, Weight of sample and standard taken, dilution of test and standard.

- Measure phase: The measure phase involves collection of data for the CTQ characteristics of 30 batches manufactured in last year, selected on the basis of assay values as selected randomly 10 batches with average assay value, 10 with minimum and 10 with maximum from batches manufactured in review period. The data was tabulated and analyzed in next phase.

- Analyze phase: On the basis of Data collected for various CTQs, Cause and effect diagram(also known as Ishikawa diagram shown in fig.no.2) have been plotted in order to identify most critical parameters responsible for lower Cpk value of assay of capsules and know the main root cause of problem and investigation was done for root cause identification.

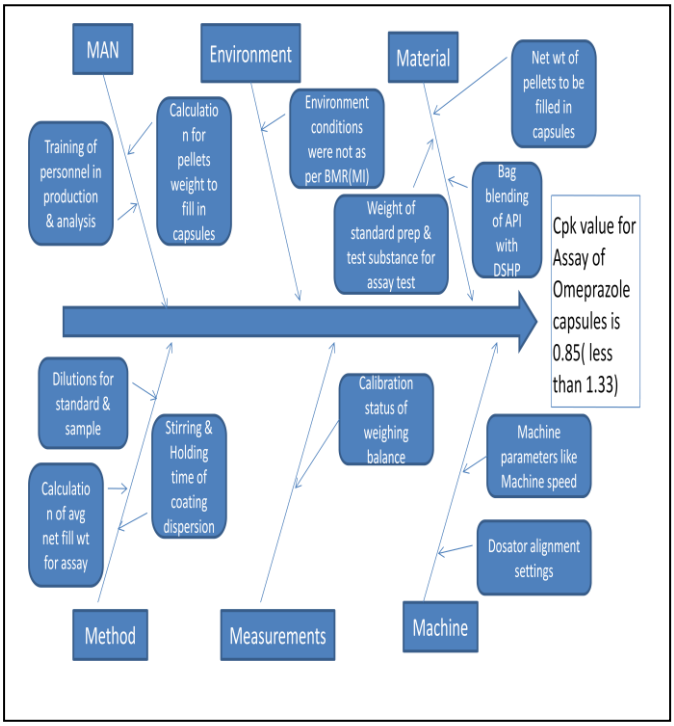

Fig.2: Cause and effect diagram for Omeprazole capsules manufacturing and analysis.

3. Identification of root cause from Ishikawa diagram:

a) Man: All the concerned personnel involved in capsule filling operation were trained , so this root cause was ruled out.

b) Measurement: Calibration status of Capsule filling machine: The calibration status of machine was observed and verified. So discrepancy w.r.t calibration was ruled out.

c) Machine parameters and Machine setting : During investigation, the critical in process parameters were checked for any discrepancy and it was found that parameters for capsule filling were within specification limit of Batch Manufacturing Record(BMR) as per validation parameters.

But there was so much variation observed for individual weight of filled capsules in data collected in measure phase (as shown in figure.3). The individual weight of capsules affect assay because the Assay of capsules is calculated on the basis of per average net fill weight as shown below in formula for Assay calculation of Omeprazole capsules:

Amount of Omeprazole present in mg per average net content
=At/As×Sw/100×5/100×100/100×50/5×P/100× average net fill weight(in mg)

Where, At = peak area due to sample preparation, As = peak area due to standard preparation, Sw = weight of Omeprazole working standard taken in mg, Tw = weight of sample taken in mg, P = % purity of Omeprazole working standard. Thus it is clear that variation in individual weight of capsules leads to batch to batch assay variation as shown in figure no.3 which will be the potential root cause for Omeprazole capsules assay variation.

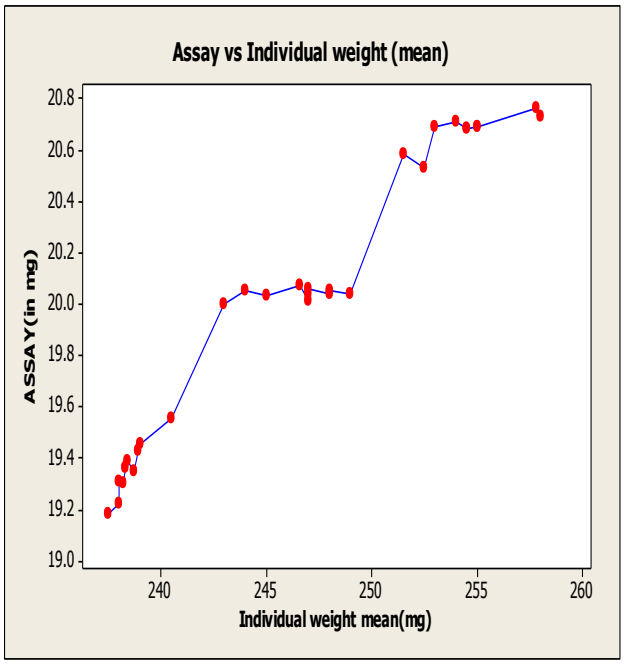

Fig.3: Showing effect of individual weight variation on assay

Reasons for individual weight variation: The critical machine parameters affecting individual weight variation of capsules were improper Dosator settings on capsule filling machine and Machine speed variation.

- The variation limit on Dosator for individual weight as per instructions was +/- 6% but this leads to higher variation in individual weight that have direct impact on assay of capsules.
- Another cause for variation of individual weight of capsules is capsule filling machine (AF 150T) speed variation. The machine speed limit as per validation parameters is 50-112 SPM but the recommended speed to get appropriate weight as per validation results is 108-110. Thus variation from this recommended speed value leads to higher variation in capsule net fill weight which impact on Assay(shown in fig.4).
- Assay of pellets: The variation in assay of pellets also leads to variation in capsules assay because assay of pellets is used for calculation of amount of pellets to be filled in capsules(theoretical net fill weight) as shown in given formula:

Amount of pellets to be filled in capsule(20 mg) means Theoretical average net fill weight = 20 ×100/ Assay of pellets (limit= 9.25 to 10.75%w/w)

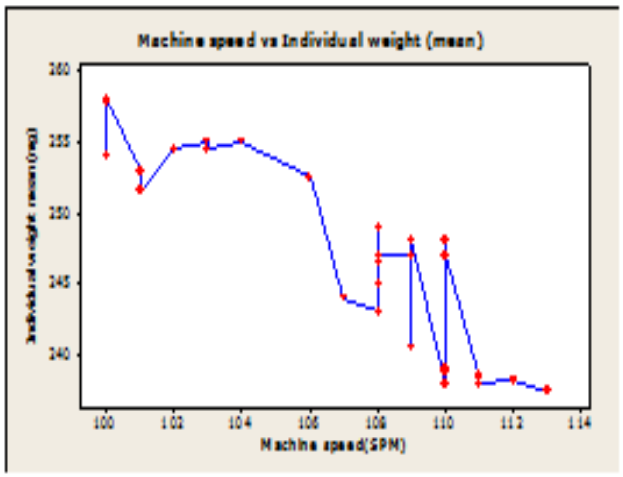

Fig.4: Effect of machine speed variation on individual weight of capsules.

d) Method: No discrepancy observed during investigation in the method used for capsule manufacturing. But in analytical testing of capsules, discrepancy was observed in dilutions preparation for assay test of capsules and calculation of average net fill weight of 20 capsules. It was observed that there was very much difference in net fill weight calculated in average net fill weight test and net fill weight taken for test of assay which may be due to analyst negligence and improper training. Thus this may also be one root cause for problem.

e) Material: The material used for capsule filling operation is Omeprazole enteric coated pellets (10%). The pellets manufactured in different stage undergone coating on sugar globules as Drug coating, sub coating and enteric coating.

C. Investigation of pellets:

In manufacturing, the in process critical parameters were checked and found within the specification limits.

Analysis of pellets: To check the variation in assay of pellets, a hypothesis testing was done on 5 successive batches, sampling was done from 7 different locations by taking 5g sample for analysis, assay test was performed on all samples and results shows acceptable assay amount(shown in table no.2). When these pellets were filled in capsules, they showed variation in 5 different batches(shown in table no.3). Thus the problem of capsules assay variation due to discrepancy in assay of pellets was ruled out.

- Improve phase: The potential root causes for problem of lower Cpk of assay of capsules were identified in analyze phase with the help of cause and effect diagram which are:

a) Individual weight variation of capsules during filling due to improper Dosator settings and variation in machine speed.

b) Improper analysis of capsules for assay by taking different average net fill weight for assay test and improper dilutions preparations. On the basis of these root causes, control plan was generated to remove these problems and have good quality product with least variations.

D. Control plan:

- Proper setting of Dosator alignment and changing the variation limit for weight from +/- 6% to +/- 4% to reduce the individual weight variation.
- Operating the capsule filling machine at speed of about 107-109 SPM to produce capsules having average individual net fill weight and provide training to the personnel to control the speed variation.
- During analysis, same capsules to be used for assay test which were used for average net fill weight test to avoid any variation in results.

E. Control:

The control plan generated was implemented and batches of capsules were manufactured as per the corrective actions. 3 successive batches of Omeprazole capsules were manufactured to check the improvement and new Cpk was calculated.

III. RESULTS AND DISCUSSION

Results: The root cause of the problem of lower Cpk of Omeprazole capsules assay were identified as Individual weight variation of capsules during filling operation and analyst errors during testing of capsules. The corrective actions were taken as:

1) Individual weight variation has been controlled by changing variation limit to +/-4% in Dosator and trained the personnel on machine about proper settings of Dosator and controlling the machine speed at 108SPM. 2) Training of Analysts has done to remove personnel error in calculations and weighing of capsules and preparation of dilutions.

The 3 successive batches of capsules manufactured as per the change control and results of these batches were improved showing Cpk of assay = 1.57 which is more than targeted value. Thus the quality of Omeprazole capsules has been improved by removing process defects and controlling the variations in manufacturing and testing. Thus as a result of improvement done in capsules processing, Cpk has been improved from 0.85 to 1.57, showing good quality product(as shown in fig.5). As a result of this improvement, defective products have been reduced that ultimately leads to financial benefit because of no batch rejections.

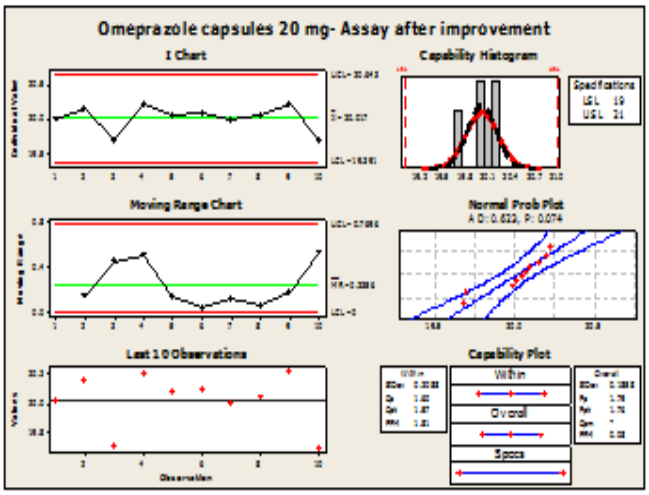

Fig.5: Process capability six pack of Omeprazole capsules after improvement showing Cpk1.57.

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REFERENCES

[1] U.S. Food and Drug Administration. Guidance for Industry: Q8(R2) Pharmaceutical Development. US Department of Health and Human Services, FDA. Rockville, MD Nov 2009.http://www.fda.gov/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/default.htm

[2] B. Greg, Six Sigma for Manager, McGrew Hill, New York: 2002, pp.10-25.

[3] Kane V.E.," Process capability indices," Journal of quality technology,vol.18(1),pp. 41-52, 1986.

[4] M.Sokovic*, D.Pavletic, K.Kern Pipan," Quality Improvement methodologies- PDCA cycle, RADAR matrix, DMAIC and DFSS" Journal of Achievements in Materials and manufacturing Engineering, vol. 43(1), pp. 476-483,2010.

[5] S. Kotz, Johnson, N.L., Process Capability Indices, Chapman and Hall, London :1993, pp. 37-78.

[6] Chakravorty, S.S., Atwater, J.B, " Implementing quality improvement programs using the focusing steps of the array of constraints" International Journal of Technology Management, vol.16(4/5/6), pp. 544-555,1986.

[7] Coleman, S., Six sigma: an opportunity for statistics and statisticians. Significance,vol5, issue2, 2008, pp. 94-96.

[8] Manning, E. et.al., "Applications of lean six sigma to optimize a legacy cleaning process," Pharmaceutical engineering, vol.34(6), pp,50-58, Nov/Dec 2014.

[9] Chowdary, B.V., Damian,G., "Improvement of manufacturing operations at a pharmaceutical company: a lean manufacturing approach," Journal of manufacturing technology management, vol. 23(1), pp.56-75, 2011.

A Review on Various Drug Delivery Systems for Colon Targeting

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Abstract- ***The absorption of most of the drugs takes place at small intestine but in some rare cases it is necessary to target the drug to thecolon due to some key factors i.e. to treat the colon disease, conditions relating to the degradation and to delay the release of the drug. Colon drug targeting has gained importance in the recent years because it helps in increasing the absorption of the drug as it provides neutral pH and long resistance time. The drugs that are poorly soluble for example Tinidazole the colon is an important site for the absorption. In order to design a successful dosage form for colon drug targeting the drug should be optimized in such a manner that the drug should be released in the region of the colon instead of releasing in upper GIT tract. The review article elaborate briefly on anatomy and physiology of colon, conditions prerequisite for colon targeting and various approaches for colon targeting.***

Keywords: Absorption, poorly soluble, approaches.

I. INTRODUCTION

A. Colon Specific Drug Delivery System

The local and systemic delivery of drugs both take place at the site of colon. Although the oral route for administration of drug is the most easiest and important route of administering drugs for systemic effect but from the last decade there has been interest in developing formulations which are site specific in order to target drug to the colon. From the therapeutic point of view when there is need for delayed drug absorption it is necessary to target the drug to the colon as colon has longer residence time for enhancing absorption. Colonic drug delivery has gained increased importance for not just delivering drugs for treating local diseases associated with the colon like Crohn's disease, ulcerative colitis but also for the systemic delivery of proteins, therapeutic peptides. In order to achieve the success in colon targeted drug delivery, there is a need to protect drug from degrading, releasing and absorbing in the upper portion of GIT so as to ensure the controlled release in the proximal colon [1].

1. Limitations of colon targeting drug delivery systems [1]

- Addition in number of manufacturing steps.
- The colonic performance via metabolic degradation of the drug could also be affected by resident microflora.
- Before absorption of drug it should be in a solution form and there for rate limiting step for poorly soluble drugs.
- A major drawback of the pH sensitive coating technique is the unpredictibility of the location and environment in which the coating may start to dissolve.
- The prodrug approach has limitations as it is not very versatile approach and it's formulation depends upon the functional group available on the drug moiety for chemical linkage.

2. Criteria for selection of drug for colon drug delivery system [2]

- Drug candidate: Drugs showing poor absorption from the stomach or intestine including peptide are most suitable for CDDS. The drugs which are suitable candidate for local colon delivery are used in the treatment of IBD, ulcerative colitis, colon cancer, diarrhea are categorized in table No 1
- Drug Carrier: The physiochemical nature of the drug as well as the disease for which system is used influences the selection of carrier for particular drug candidate.The factors which are to be considered in carrier selection includes chemical nature, stability and drugs partition cofficent. The selection of the drug carrier depends upon the functional groups of drug molecule. For.eg. Nitro or aniline groups on a drug can be used for linkage to another benzene group through an azo bond.

Criteria	**Pharmacological class**	**Non-peptide drugs**	**Peptide drugs**
Drugs used for local effects in colon against GIT diseases	Anti-inflammatory drugs	Metoprolol,Nifedipine	Amylin,Antisense oligonucleotide
Drugs poorly absorbed from upper GIT	Antihypertensive antiangial drugs	Ibuprofine,Theophyline	Cyclosporine, Desmopressin
Drugs to treat colon cancer	Antineoplastic drugs	Pseudoephedrine	Glucagon
Drugs that degrade in stomach and small intestine	Peptides and protiens	5-Flourouracil	Insulin, Interferons

B. Anatomy And Physiology Of Colon

The colon is situated in the abdomen forming the lower part of the GIT and extending from the ileocecal junction to the anus forms the colon. The colon is lined by four layers known as serosa, muscularisexterna, sub mucosa, mucosa. The colon consists of a cylindrical tube having a moist and soft pink lining known as mucosa and the pathway is known as lumen having approximate diameter of 2-3 inches. The lower right abdomen consists of junction of small intestine (ileum) and the colon. The first portion of the colon known as cecum is spherical in shape and the appendix hangs off the cecum. The next portion of the colon is the ascending (proximal) colon in which content flows in the order, just beneath the liver, the angle/bend is known as the hepatic flexure, located just beneath the rib cage where the colon then turns to a long horizontal segment, known as the transverse colon and beneath the left rib cage, the colon turns downwards at the splenic fixture, becoming descending(distal) colon. The left lower portion of the abdomen consists of S shaped curve from the hip over the midline known as the sigmoid colon. The blood supply in colon and rectum is anatomic in nature and along these blood vessels lymph nodes (structures found in bodies circulated lymphatic system producing and storing cells to fight against infection, inflammation and foreign proteins) are present [3]. The diagram below shows different segments of the colon:

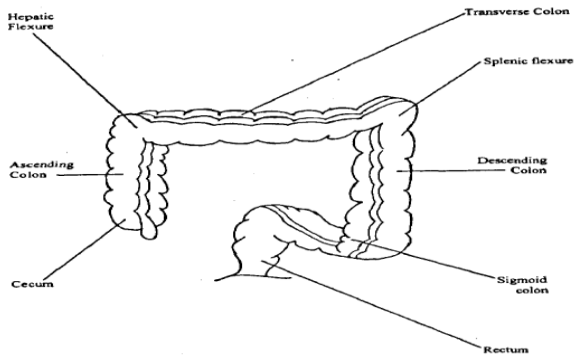

Figure 1: Different Segments of Colon

1) pH in the colon

The pH of the GI tract depends upon both inter and intra subject variations. The pH of gastrointestinal fluid is influenced by diet, diseased state, and food intake. For targeting the colon the changes in the pH along the GI tract is considered. There is variation in the pH of GIT of different individuals. There is different range of pH in the colon on entry into the colon the pH is 6.4±0.6. The pH of the mid colon is 6.6±0.8 and in the left colon is 7.0±0.7 [4].

2) Colonic micro flora and their enzymes

As the movement of material through the colon is slow this allow a large microbial population to thrive there. The most of distinct bacterial species found belongs to the Bacteroides and are anaerobic in nature. As the concentration of energy source is highest in proximal areas thus microbial concentration is also higher. In the proximal regions of the colon there is a predomination of carbohydrate fermentation resulting in relatively lower pH.

3) Transit of material in the colon [5]

There is high variability in the gastric emptying of dosage forms and is primarily dependent upon whether the subject is fed or fasted and on dosage form properties such as size and density. The gastric emptying and the small intestinal transit time helps in determining the arrival of oral dosage form at the colon. The transit times of oral dosage forms in GIT is given in Table No: 2

Table No: 2: Transit time of dosage form in GIT

Organ	**Transit time (hr)**
Stomach	<1(Fasting) >3(Fed)
Small intestine	3-4
Large intestine	20-30

4) Characterstics of Different Regions of Git

Different approaches for colon targeting:

a) Prodrug approaches:

- Azo bond conjugate:

Sulfasalazine [5- Amino Salicylic Acid (5-ASA)] is a special purpose sulfonamide used mainly for the treatment of inflammatory bowel diseases. Approximately about 85% of oral dose of sulfasalazine on reaching to the colon remains unabsorbed, on reaching the colon the anaerobic environment reduces sulfasalazine into 5- ASA and sulphapyridine respectively. It was revealed from the different studies that theprodrugs was formed from sulfapyridinei.e. Olsalazine, Balsalazine, 4-amino benzoyl-β- alanine. The microflora present in intestine produces glycosidase, a prominent enzyme group.By utilizing the azo-aromatic and pH sensitive polymers the colon specific formulation of flurbiprofen was evaluated and it was concluded that azoaromatic polymerand pH sensitive polymer eudragit S can be usedefficently for colonic drug delivery. The studies on the pulsincap drug delivery of salbutamol sulphate was conducted using an empty gelatin capsule. A coating of ethyl cellulose was done on empty gelatin capsule by keeping the cap portion as such followed by the coating of a hydrogel plug made of gelatin with cellulose acetate phthalate in such a manner that it was fixed to the body under the cap. Eudragit microspheres containing the salbutamol sulphate.

- Glycoside conjugated prodrug:

The various human microflora produces enzyme glycosidasesi.e β-D galactosidase, β-D-xylopyranosidase, and β-D glucosidase. The location of these enzymes is in the brush border of colon. The glycosides and andaglycon part in the structure of natural occurring drug constitutes natural occurring drug. On reaching the colon glycosidases releases a pharmacological active aglycon. The glycosides are used as the carrier for colon drug delivery as glycosides are hydrophilic in nature and have poor absorption in the GIT. The drugs such as lucosides, galactosides, and dexamethasone's cellobiosides,prednisolone, hydrocortisone

and fludrocortisone are targeted by such approaches. The two prodrugs (Daxamethasone-21-β-glucoside, prednisolone-21-β-glucoside and unmodified steroids dexamethasone and prednisolone) was used to carry out studies. It was concluded from the studies that only modified form of the steroids was able to rechead the cecum while the unmodified analog was absorbed in small intestine.

- Glucuronide conjugate

For the inactivation and the prepration for clearance of variety of drugs glucuronide and sulphate conjugation mechanisms plays a vital role. The bacteria present in the lower of GIT secrets glucuronidase that glucouronidate variety of drugs in the intestine. The glucuronideprodrug is considered to be superior approach for colon targeting because glucuronidation process results in the release of active drug enabling its reabsorption.

- Cyclodextrin conjugates

The cyclodextrins are cyclic oligosaccharide consisting of 6-8 glucopyranose units linked with α (1-4) glucosidic linkage having cyclic conformation. The hydrophilic and ionisablecyclodextrins are used as potent drug carriers in the formulations for both immediate as well as delayed release. The studies was carried out by synthesizing methotrexate prodrugs of α- and γ- cyclodextrins and it was concluded from the results that the primary aim was to mask the ulcerogenic potential of free drug by the use of 12-fold dose of the normal dose of methotrexate and equivalent doses of the esters.

b) Hydrogels

For the site specific delivery of peptide and protiens drugs through colon hydrogels are used. Hydrogels consists of acidic co-monomer and enzymatically degradable azo aromatic crosslinks.

The degradation of the drug in the stomach can be prevented as in the acidic pH gels shows less swelling. With the increase in the pH of the environment there is consequent increase in the swelling resulting in the easy acess of azoreductase enzymes which ultimately results in the release of drug.

c) Coating with pH dependent polymers:

The dosage form that disintegrates at higher pH range can be target into the region as th pH in the terminal ileum and colon is higher as compared to any other region of the GIT. As the pH range is higher in the terminal region of the ileum in comparison to the cecum resulting in the delay of dosage form at the ileocecal junction therefore careful selection of enteric coat composition and thickness is necessary in order to ensure that disintegration can't occur until the dosage form moves through the ileocecal junction from the terminal ileum into the cecum. The studies were conducted on the delayed released tablets containing mesalazine and coated with Eudragit S-100. The tablets were dissolved at a pH of 7 and >7 which leads to release of mesalazine at the terminal ileum site so as to achieve the topical inflammatory action in the colon. The most common pH dependent polymers are cellulose and acrylic acid. For the successful colonic drug delivery the drug core was coated with pH sensitive polymers. The different dosage form includes tablets, capsules, microparticles, nanoparticles. The chitosan nanoparticles were formulated.For the prepration of drug loaded chitosan nanoparticles ionic gelation was used using tinidazole as a drug. The chitosan solution with 0.1% w/v concentration was prepared and pH was adjusted to 5.5

followed by drop wise addition of tri-poly-phosphate solution. The tri-poly-phosphate was prepared by adding TPP to the deionized water and drug was added to the solution. There was spontaneous gel formation when multivalent polyanions of tri-poly-phosphate came in contact with chitosan. The resulted nanoparticles were further coated with eudragit solution prepared in ethanol:acetone (2:1) using solvent evaporation method. The aim of the above formulation was to improve the absorption of tinidazole.

II. NOVEL APPROACHES FOR COLON TARGETING [2]

Due to advancement in technology these days design of the dosage form is becoming complex. The few examples are given below:

A. Pulsincap

With the utilization of the time-release principle Pulsincap was the first developed formulation having similar appearance as that of hard gelatin capsule. It comprises of water insoluble body and having water soluble enteric coated cap. The contents were placed within body plugged with the help of hydrogel plug. After administering it after predetermined time the enteric coating gets dissolves leading to swelling of hydrogel plug.

B. Codes

The CODES system was formulated in order to eliminate the inherent problems associated with pH or systems that are time dependent. The system comprises of core tablets coated with triple layer of polymer coating. The first coating consists of the acid soluble polymer i.eEudragit and outer layeric is enteric with a layer consisting of HPMC, a barrier layer in between prevents interaction b/w the oppositely charged polymers. The core tablet consists of active ingredients with one or more polysaccharides. The enterobacteria degrades polysaccharides leading to generation of organic acid. There is no change in CODES during its transit through GIT because of enteric covering but as it reaches the small intestine the enteric covering starts dissolving as pH is above 6.0. And at last after entering the colon the bacteria degrades polysaccharide to organic acid.

C. Port System

It is comprised of a gelatin capsule having a coating of a semi-permeable membrane (e.g cellulose acetate) housing

an insoluble plug (e.g. lipidic) and an osmotically active agent along with the drug formulation. When the formulation comes in contact with the aqueous medium the water diffuses across the semi-permeable membrane leading to increase in the inner pressure thus ejecting the plug after a lag time.

D. Oros System

Till now the two OROS systems are designed for colon drug delivery:

- Osmet pump

The Osmet pump contains an enteric coated semi-permeable shell enclosing an osmotic layer having a central impermeable and collapsible reservoir filled with drug. The interior compartment is connected with an external environment with the help of delivery orficle at one end. After the dissolution of the gastric resistant film, water penetrates through the semi-permiable membrane which leads to rise in the pressure inside causing inner reservoir to shrink leading to release of drug formulation.

- Oros Ct

The hard gelatin capsule shell dissolves immediately after ingestion. The push and pull unit is shielded with enteric coating so as to prevent absorption of water. The osmotic pumping action takes place when the coating dissolved in the drug is delivered out of the orficle at a rate controlled by the rate of water transport across the membrane.Alza corporation californiadesigned OROS-CT an osmotically controlled dosage form used for colon drug targeting. It may comprise of single unit or can incorporate as many as 5-6 push pull units, each having 4mm diameter and is encapsulated within hard gelatin capsule. After reaching the small intestine the enteric coating starts to dissolve which allows entry of water through semipermeable membrane leading to swelling of osmogen which ultimately results in conversion of drug compartment into flow.

- Time Clock System

It comprises of solid dosage forms having lipidic barriers of *carnauba-wax/bee-wax* along with surfactants. In order to restrict the premature release of drug in small intestine the system was further coated with enteric polymer. The release of drug was mainly dependent on thickness of applied coat and was independent of pH and gut's digestive state. The moment the coat erodes in aqueous environment after predetermining lag time, the core gets exposed to the colonic environment leading to complete release of drug.

- Cronotropic System

It comprises of a drug having core coated by hydrophilic swellable HPMC, which is responsible for a lag phase in the onset of release. Apart from that, through the application of an outer gastric resistant enteric film, the variability in gastric emptying time can be overcomed, and a colon specific drug release can be obtained.

III. CONCLUSION

To formulate an efficient colon specific acting drug is still a challenge as its action is mainly at colon only. The some research work done in last two year were really appreciating especially in overcoming the side effects. In future by adding various new strategies, colon targeted drug delivery will find the central place in novel drug delivery.

REFERENCES

[1] RATNAPARKHI M, SOMVANSHI F, PAWAR S, CHAUDHARI S, GUPTA J, BUDHAVANT K. COLON TARGETED DRUG DELIVERY SYSTEM, IJPRR, 2013; 2(8): 33-42.

[2] Kolte B, Tele K, Mundhe V, Lahoti S. Colon targeted drug delivery system-A novel prospective, AJBPS, 2012; 2(14): 21-28.

[3] Sarasija S and Hota A. Colon-specific drug delivery systems, IJPS, 2000; 62(1): 1-8.

[4] Challa T, Vynala V, Allam K. Colon specific drug delivery systems: A review on primary and novel approaches, IJPSRR, 2011; 7: 171-181.

[5] Patel A, Bhatt N, Patel K, Patel N, Patel M. Colon targeted drug delivery system: A review system, JPSBR, 2011; 1: 37-49.

Method Development, Assay and Validation of Beclomethasone Metered Dose Inhaler, by HPLC

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Abstract: **HPLC assay method development and validated for Beclomethasone dipropionate in metered dose inhaler (MDI). Testosterone propionate used as an internal standard[1]. This drug was submitted to accelerated degradation studies under acidic, alkaline and oxidation condition exposure to light. The separation of beclomethasone dipropionate was achieved on Waters Spherisorb ODS-1,100X4.6mm, 5µm particle size with an isocratic mobile phase containing methanol:water (65:35v/v). The flow rate was 2.0mL/min injection volume 20 □l & detection wavelength was set 239nm, at 50^{0}C. The validation of the proposed method was carried out for specificity, linearity, accuracy, precision & system suitability test as per ICH guidelines. The RT time of beclomethasone dipropionate found to be 1.7 min. Calibration graph was found to be linear at range 0.15-0.26□ g. The regression coefficient (r2) was found to be 0.999. The proposed method was found to be rapid & stability indicating with adequate specificity, accuracy, ruggedness & robustness & hence be suitable for routine analysis of beclomethasone dipropionate in MDI & in bulk.**

Key Word(s): Meter dose inhaler (MDI), international conference on harmonization (ICH), Beclomethasone Dipropionate(BD).

I. INTRODUCTION

High performance/pressure liquid chromatography (HPLC) is the fastest growing analytical technique for analysis of drugs. Its simplicity, high specificity and wide range of sensitivity make it ideal for the analysis of many drugs in both dosage forms and biological fluids[2-4].

HPLC separation is based on the interaction and differential partition of the sample between the mobile liquid phase and the stationary phase[5].

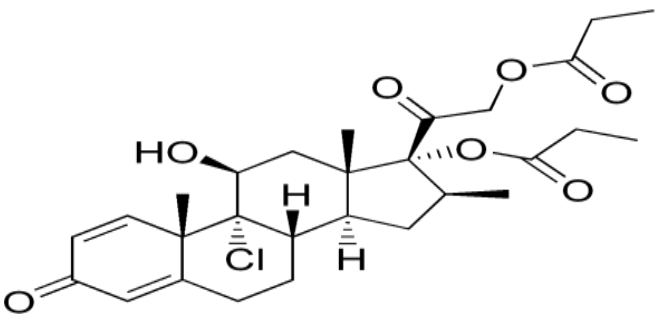


Fig.1:Chemical name: 9α-Chloro-11β hydroxy-16β methyl-3,20dioxopregna- 1,4 diene-17,21 diyldipropionate.

Beclomethasone Dipropionate is naturally occurring drug of class, corticosteroid. It is used as an anti-inflammatory agent to treat the variety of inflammatory condition and used in the form of ointments, cream, nasal spray and pressurized inhalation. Pressurized metered dose inhaler used to treat asthma. The anti-inflammatory action of beclomethasone dipropionate is due to inhibition of phospholipase A2, which control the biosynthesis of potent mediators of inflammation such as prostaglandins and leukotrienes.

II. MATERIALS AND METHODS

A. Apparatus and Instrument

- HPLC: Waters HPLC
- Pump: Pneumatic Pump
- Detector: PDA
- Electronic Micro Balance: Mettler Toledo
- pH Meter : Lab India
- Sonicator: Flexit Jour Lab Pvt Ltd.
- Filter: 0.45µ Nylon Filter
- Column: Waters spherisorb ODS1,100X4.6mm,.5□ □
- Chromatographic Software: Empower

B. Chemicals and Reagents

- Beclomethasone dipropionate (Glenmark pharmaceuticals Ltd.)
- Testosterone Propionate (Glenmark pharmaceuticals Ltd.)
- Hydrogen Peroxide, Concentrated Hydrochloric Acid, Sodium Hydroxide Pellets (ARgrade)
- Methanol, (HPLCgrade), Water (Mili Q or equivalent)

C. Formulation

Beclomethasone pressurized inhalation (250 µg/actuation)

Table 1: Chromatographic conditions:

PARAMETER	VALUE
Column	Waters Sphedrisorb ODS-1,100X4.6mm, 5□ m
Mobile Phase	Methanol:Water (65:35)v/v
Flow Rate	2.0 ml/min
Runtime	8 min
Column Temperature	50^{0}C
Volume of Injection	20 □ l
Detection wavelength	239 nm

III. METHOD DEVELOPMENT

In order to achieve the separation, different chromatographic conditions were attempted[6]. Well defined symmetrical peaks were obtained upon measuring the response of eluent under the optimized conditions after experimental trials that can be summarized. Stationary phase

like Waters spherisorb ODS-1(100 mm × 4.6 mm, 5 µm) column was most suitable one, since it produced symmetrical peaks with high resolution and a very good sensitivity and with good resolution. The flow rate was maintained 2.0mL min-1 shows good resolution. The PDA detector response of Beclomethasone dipropionate was studied and the best wavelength was found to be 239 nm showing highest sensitivity. The mobile phase consisting a combination of Water and Methanol in the ratio of 65:35% v/v was found to be an appropriate mobile phase for separation of Beclomethasone Dipropionate [7-9].

A. Preparation of the mobile phase:

Mix methanol and water in the ratio (65:35 v/v).

- Preparation of internal standard solution: (Sol. A)

Weighed accurately about 15 mg of Testosterone propionate working standard and transfer to 100 ml volumetric flask, add 10 ml Diluent and sonicate to dissolve it completely and then
dilute to 100 ml with diluent. 5 ml of the above solution to 200 ml with diluent and mix and filter out above mobile phase through the 0.45micron Teflon filter. (1.5µg/ml).

- Beclometasone Dipropionate std stock soln.(Sol. B)

Accurately wiegh about 20 mg of Beclometasone dipropionate Anhydrous WS and transfer to 200 ml volumetric flask add about 5 ml methanol and sonicate to dissolve the drug completely. Add about 70 ml of mobile phase and sonicate for 5-10 min. Dilute to mark with mobile phase.

- Preparation of Mixed Standard solution

Pipette out 5 ml of solution A and solution B in to 50 ml volumetric flask, dilute to volume with diluents and mix.

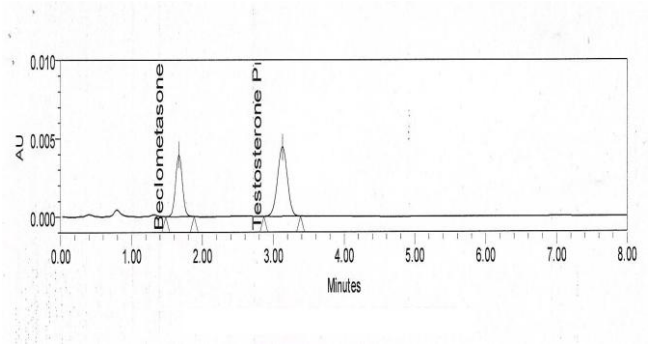


Fig. No: 1 Chromatogram for final method development

B. Method Validation

The newly developed method was validated according to the ICH guidelines with respect to specificity, linearity, accuracy, precision robustness and Ruggedness, System suitability was established by injecting standard solution[10]. The chromatograms were checked for the appearance of any extra peaks. No chromatographic interference from the Beclomethasone dipropionate excipients, were found. Method precision was determined using six-independent test solutions. The accuracy of the method was evaluated with the recovery of the standards from excipients. The mixtures were and analyzed using the developed HPLC method. Linearity test solutions were prepared. To determine the robustness of the method, the final experimental conditions were purposely altered and the results were examined. The flow rate was varied by ±0.2 mL min-1, the percentage of mobile phase was varied by ± 2%, column temperature was varied by ±50C [11-13].

- Precision

The repeatability was checked by repeatedly (n = 6) injecting BD (1.5 µg/ml) standard solution, and testosterone propionate internal standard (1.5 µg/ml) and recording the responses. The inter day precisions of the proposed method was determined by measuring the corresponding responses 3 times on the two different days[14]. The results were reported in terms of relative standard deviation.

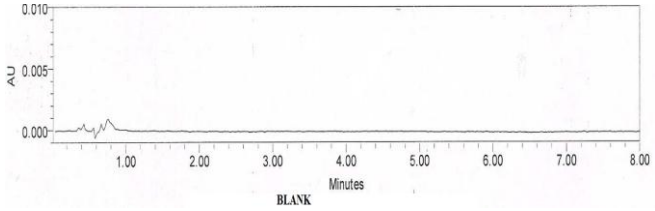


Fig. No: 2 Chromatograms for Precision

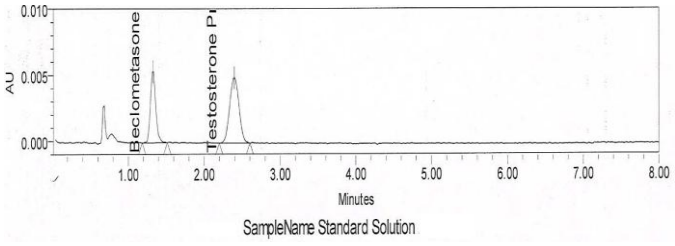


Fig. No: 3 Chromatograms for Precision

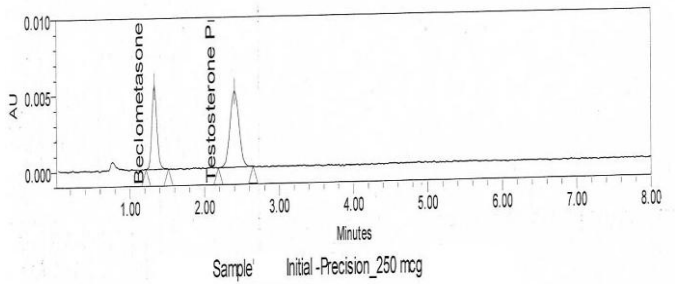


Fig. No: 4 Chromatograms for Precision

a) Observations

Table: 2

Sr No.	Sample identity	Area of beclometasone		Mcg /spray	% LC
		Injection 1	Injection 2		
1	Initial Set- 1	25352	25994	253.27	100.8
2	Initial Set- 2	25753	25959	250.22	99.6
3	Initial Set- 3	26861	26459	255.14	101.5
4	Initial Set-4	25721	25326	249.46	99.3
5	Initial Set- 5	25626	26273	255.53	101.7
6	Initial Set- 6	25919	25720	254.05	101.1
Average					100.7
Std Dev					0.997
%RSD					0.991

b) Inference

The %RSD of method precision within acceptance, Therefore, the HPLC method for the determination of

Beclomethasone dipropionate in metered dose inhaler is precise.

- Accuracy

The accuracy of the method was determined by calculating recoveries of BD by the standard addition method. Known amount of standard solution of BD (12, 15, 18 mcg/ml) were injected in triplicate, the percentage recovery was calculated by measuring the peak areas.

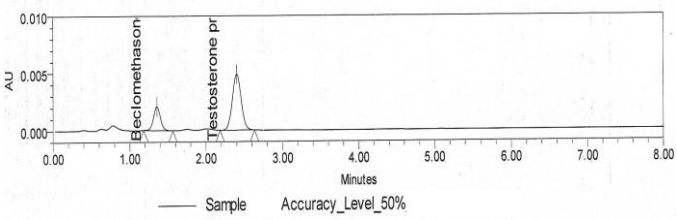


Fig. No: 5 Chromatograms for Accuracy

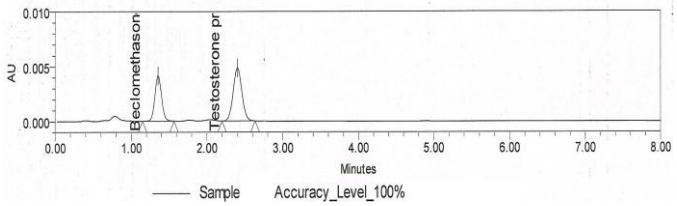


Fig. No: 6 Chromatograms for Accuracy

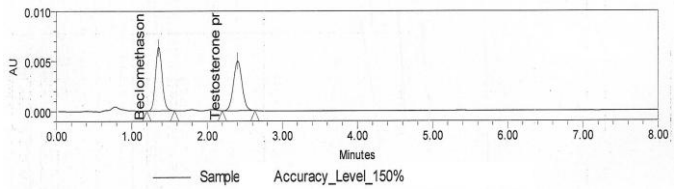


Fig. No: 7 Chromatograms for Accuracy

a) Observations

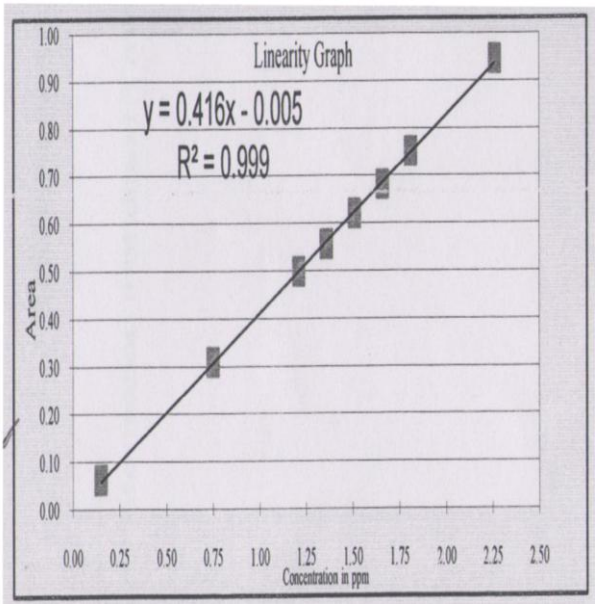
Table: 3

Sr No.	Sample Identity	Amount added in mg	Area of Beclometasone		Amount recovered in mg	% Recover
			Injection 1	Injection 2		
1	Acc.50% Set-1	1240.13	12681	12515	1233.74	99.4
2	Acc.50% Set-2	1240.13	12696	12680	1229.92	99.1
3	Acc.50% Set -3	1240.13	12997	13111	1266.94	102.1
4	Acc.80% Set-1	1984.20	20475	20416	1980.50	100
5	Acc.80 %Set-2	1984.20	20521	20482	1992.71	100.3
6	Acc.80% Set-3	1984.20	20713	20866	1992.91	100.4
7	Acc.100 %Set-1	2480.25	25538	25685	2503.18	100.8
8	Acc.100 %Set-2	2480.25	25664	25661	2502.91	100.8
9	Acc.100 %Set-3	2480.25	25530	25869	2516.37	101.4
10	Acc.120 %Set-1	2976.30	30392	30492	2998.95	100.7
11	Acc.120 %Set-2	2976.30	30685	30508	3006.26	100.9
12	Acc.120 %Set-3	2976.30	30831	30927	2811.58	94.4
13	Acc.150 %Set-1	3475.20	39147	39210	3744.52	100.6
14	Acc.150	3452.65	38327	38157	3752.64	100.8
	%Set-2					
15	Acc.150 %-3	3489.72	38444	38368	3735.75	100.3
Average						100.1
Sd						1.81
RSD						1.81

b) Inference

- %RSD is less than 2%.
- The % recovery was found to be 100.3.
- Linearity

The linearity of the method is a measured of how well a calibration plot of response vs. concentration approximately a straight line. Linearity can be assessed by the single measurement at several analyte concentrations. For the construction of calibration curves, eight standard solutions were prepared over the concentration range [15-17]. Linearity was determined for Beclomethasone dipropionate in the range of 0.15-2.26 ppm.



Linearity Graph

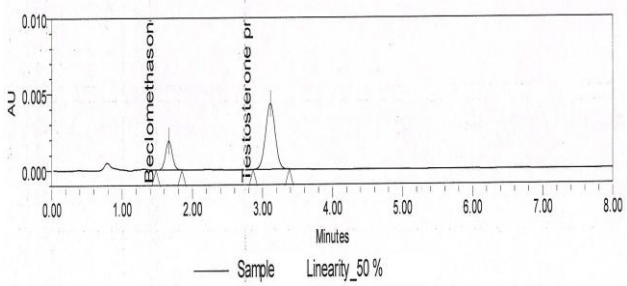


Fig. No: 9 Chromatograms for Linearity

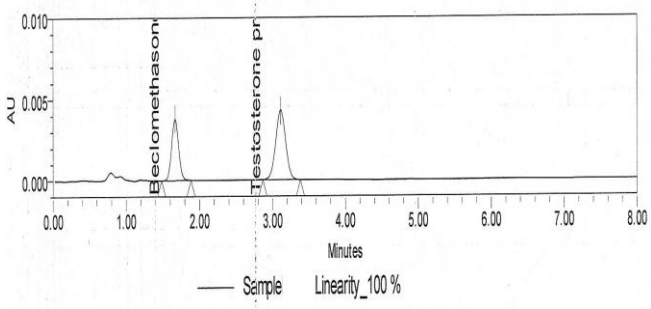


Fig. No: 10 Chromatograms for Linearity

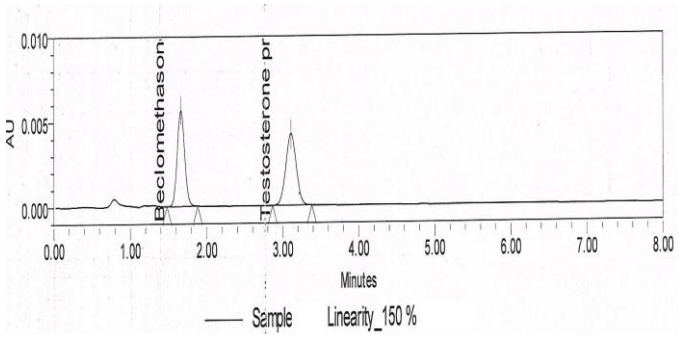


Fig. No: 11 Chromatograms for Linearity

a) Observations

Table 4

Sr No.	Sample Identity	Conc. of Std in PPM	Area of Beclometasone		SD	RSD
			Injection 1	Injection 2		
1	Linearity-10%	0.15	2505	2537	0.001	1.315
2	Linearity-50%	0.75	12692	12759	0.002	0.514
3	Linearity-80%	1.21	20429	20510	0.003	0.631
4	Linearity-90%	1.36	22878	22941	0.002	0.427
5	Linearity-100%	1.51	25567	25612	0.001	0.088
6	Linearity-110%	1.66	28162	28109	0.002	0.289
7	Linearity-120%	1.81	30392	30426	0.001	0.172
8	Linearity-150%	2.26	38330	38354	0.000	0.018
Slop						0.4168
Intercept						-0.0058
Correl						0.99983

b) Inference

As the result is within acceptance limits the proposed method is found to be linear.

- Ruggedness

The ruggedness of an analytical method is the degree of the reproducibility of the test results obtained by the same samples under variety of conditions [18-20]. One blank and six replicate injection of standard solution were injected and %RSD was calculated.

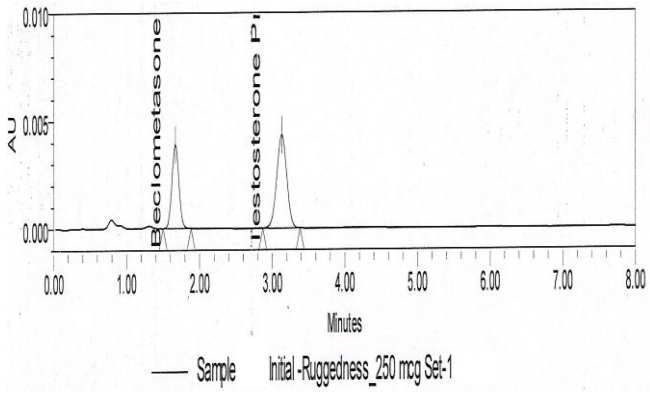


Fig. No: 12 Chromatograms for Ruggedness

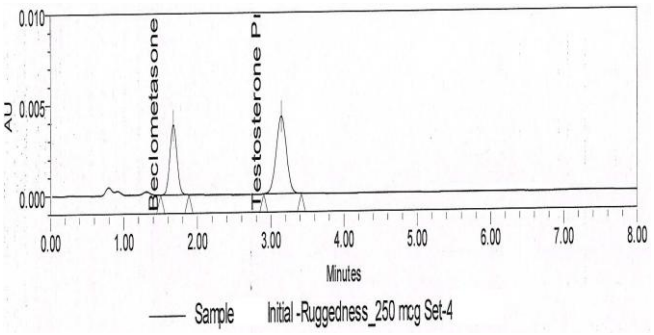


Fig. No: 13 Chromatograms for Ruggedness

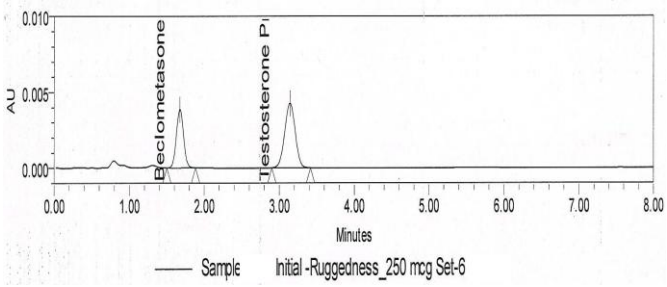


Fig. No: 14 Chromatograms for Ruggedness

a) Observations

Table 5

Sr No.	Sample Identity	Area of Beclometasone		Mcg/spray	% LC
		Injection 1	Injection 2		
1	Initial Set -1	26048	24224	243.57	97.4
2	Initial Set -2	26109	26156	253.87	101.5
3	Initial Set -3	26132	26181	253.24	101.3
4	Initial Set -4	26050	26065	253.22	101.3
5	Initial Set -5	26084	26094	253.12	101.2
6	Initial Set -6	26069	26168	253.62	101.4
Average					100.7
Std Dev					1.612
%RSD					1.601

b) Inference

Overall 1.601% RSD , results obtained from two different analysts are within limits. Therefore, the HPLC method for the determination of Beclomethasone dipropionate in metered dose inhaler is Rugged.

- Specificity

Specificity is the ability to measure accurately and specifically the analyte of interest in the presence of other components that may be expected to be present in the sample matrix[21]. It is a measure of the degree of interference from such things as other active ingredients, excipients, impurities, and degradation products, ensuring that a peak response is due to a single component only i.e. that no co-elution exist[22,23]. Specificity is measured and documented in a separation by the resolution, plate count (efficiency), and tailing factor. Specificity can also be evaluated with modern

photodiode array detectors that compare spectra collected across a peak mathematically as an indication of peak homogeneity. ICH also uses the term specificity, and divides it into two separate categories: identification, and assay/impurity tests [24].

For identification purposes, specificity is demonstrated by the ability to discriminate between compounds of closely related structures, or by comparison to known reference materials. For assay and impurity tests, specificity is demonstrated by the resolution of the two closest eluting compounds. These compounds are usually the major component or active ingredient and an impurity. If impurities are available, it must be demonstrated that the assay is unaffected by the presence of spiked materials (impurities and/or excipients). If the impurities are not available, the test results are compared to a second well-characterized procedure. For assay, the two results are compared. For impurity tests, the impurity profiles are compared head-to-head [25-29].

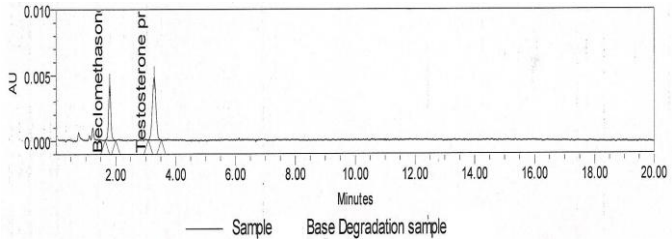


Fig. No: 15 Chromatograms for Specificity

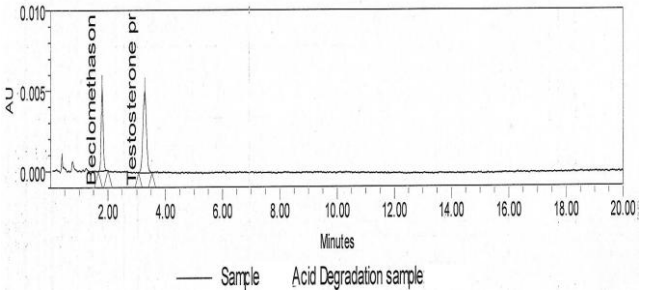


Fig. No: 16 Chromatograms for Specificity

c) Observations

Table 6

Sr No.	Name of Sample	Area of Beclomethasone Injection 1	Mcg/ Spray	% LC	Average Precetion	% Degradation
1	Control Sample	27037	256.76	102.7	100.4	--
2	Base Degradation (2ml 0.05M,25°C for 5 min.)	21987	209.75	83.9		16.5
3	Acid Degradation (3ml, 1M, 25°C for 5 Min.)	25309	223.95	89.6		10.8
4	H2O2 Degradation(3ml, 3%,70°C for 1 Hour)	26241	251.87	100.7		--
5	Thermal degradation (62°C for 12 Hours)	26985	254.93	102		--

c) Inference

The degradation in acid, base was within limit. Therefore, the HPLC method for the determination of Beclomethasone Dipropionate in metered dose inhaler is specific.

IV. CONCLUSION

The method provides selective quantification of Beclomethasone dipropionate without interference from blank affirming its stability-indicating nature. The proposed method is highly sensitive, reproducible, specific and rapid. The method was completely validated showing satisfactory data for all the method validation parameters. The developed method was robust in the separation and quantification of Beclomethasone Dipropionate in metered dose inhaler. This method can be used for the routine analysis of production samples. The information presented herein could be very useful for quality monitoring of bulk samples and as well employed to check the quality during stability studies. The current method is validated for the specificity parameter so that, it can be useful for forced degradation study of the formulation.

REFERENCES

[1] Skoog D.A.; Holler F.J.; Cruch S.R.; Instrumental Analysis; 8th edition, **2010**:145- 147,896-906

[2] Knowidas Stavros; HPLC Mode to measure A Practical Handbook of Optimization; Wiley-VCH Verlag Gmbh &co. KGaA; 2006:17-48.

[3] Sadek Paul C.; The Hplc solvent guide; A John Wiley & Son Inc. Publication; 2nd edition, 2002: 45-63.

[4] John A. Adamovics; Chromatographic analysis of pharmaceuticals; Marcel dekker Inc; 2nd edition, 1997:135-165.

[5] Micheal w. dong; Modern HPLC for practising scientist; A John wiley and sons Inc. Publications; 10th edition, 2006:15-40.

[6] Settle Frank A.; Handbook of Instrumental Technique for Analytical Chemistry; Practice Hall PTR; Upper Siddle River; 1997:152-154.

[7] Lindnolm Johan; Development & validation of HPLC Method for analytical and preparative purposes; Acta Universitatis Upsaliensis; Uppasala; 2004:34-39.

[8] Snyder L.R.; Kirkland J.J.; Glajch L.J.; Practical HPLC Method Development; John Wiley & sons; 2nd edition, 1997:643-644.

[9] Satinder Ahuja; Rasmuseen; HPLC methods for Pharmaceuticals analysis; Separation science and Technology; Vol-8, 2007:46-68.

[10] Willard H.H.; Merritt L.L.; Dean J.A.; Settle F.A.; Instrumental Methods of Analysis; CBS Publishers and Distributors; Delhi; 7th edition, 2001:2-5,500-600.

[11] United State Pharmacopoeia national formulary; the official compendia of standards ; may 1 2007:1487.

[12] Indian Pharmacopoeia; Government of India Ministry of Health & Family Welfare; Published by the Indian Pharmacopoeia Commission; Ghaziabad; Vol.2, 2007:772- 773.

[13] Ribeiro A.L. de Souza, Azevdo C.; Madeira K, Moreira s., Chorill M. Validation of a Satability Indicating HPLC Method with diode array Detection for the Determination of Beclomethasone dipropionate in aqueous Suspension for Nebulizer; Asian journal of Biological and Pharmaceutical Sciences;2013:3(9):1-9.

[14] Martis E.A.; Gangrade D.M.; Reverse phase isocratic HPLC Method for Simultaneous Estimation of Salbutamol sulphate and

Beclomethasone dipropionate in Rotacaps formulation dosage forms; International Journal of Pharmacy and Pharmaceutical science;2011; 3(1) :1-67.

[15] Prajapati N. B.; Dey S.S.; Dr. Upadhyay U.M.; Development and Validation of RP-HPLC Method for Simultaneous estimation of Salicylic acid and Beclomethasone dipropionate in their Bulk and Combined Dosage form;International journal of Pharmaceutical Research and Development; 2013:5(3):1-50.

[16] Dudhasia K.R.; Patel A.V.; Patel C.N.; Development and Validation of a Reversed phase

[17] HPLC Method for Simultaneous Estimation of Clotrimazole and Beclomethasone

[18] dipropionate in lotion and cream dosage form; Journal of Chronicle of Young Scientist

[19] ;2014:(3):1-107.

[20] Reddy U.M.; Reddy K.H.; BObbarala V.; Penumajji., Determination of Beclomethasone

[21] Dipropionate, Clotrimazole, Chloramphenocol, Lidocaine, in Pharmaceutical Formulations using a novel RP-HPLC method. International Journal Of Pharma and Biosciences;vol-2:2011:(3): 453-462.

[22] The Merck Index - an Encyclopedia of chemicals Drugs and biological; Published by

[23] Merck Research Laboratories; 13th edition, 2001:1019.

[24] Yuri kazakewich; Rosario lobrutto; HPLC for pharmaceuticals scientist; A John wiley and sons Inc. Publications; 10th edition, 2007:25-40.

[25] David C. Smith; Candace S. Johnson; Catherine C. Freeman; A phase one clinical trials in patients with advance Malignancy;Clinical cancer research; vol-5,1999:1339-1345.

[26] T. Hannai; A HPLC practical guide; Published by royal society of chemistry; 1999:96- 103.

[27] Stavros kromidas; Practical problem solving in HPLC; 2nd edition, 2004:123-130.

[28] Fifeld .F W.; Kealey D.; Principal and practice of analytical chemistry; USA Blackwell

[29] publishing; 5th edition, 2004: 2,5-7.

[30] Johan lindhlgm; Development and validation HPLC methods for Analytical and Preparative purposes; Acta Universities upsalieness; uppsala, 2004:34-39.

[31] ICH-Q1 A (R2); Stability Testing of New Substances and Products (Second Revision); FDA; Vol. 68 No. 225, 21 November 2003: 65717-18.

[32] ICH Q1 B; Photostability Testing of New Drug Substances and Products; FDA; Vol. 95 , 16 May 1997: 27115-27122

[33] Singh S.; Bakshi M.; Guidance on conduct of ,Stress tests to determine Inherent Stability of drugs; April 2000.

[34] USP-NF; Validation of Compendial Procedures; General Chapters; Vol.1;2010: 734-736.

[35] ICH –Q2 (R1); Validation of Analytical Procedures; Text and Methodology; FDA; Vol. 60 1 March 1995 :11260.

Drug Design, Catalytic Synthesis and Antimicrobial Investigation of Some Novel Imidazole Substituted Oxazole Derivatives

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*Abstract:-***Amongst different nitrogen heterocycles, the imidazole ring systems have been found medicinally useful as antimicrobial agents. Several Imidazole derivatives were synthesized by reaction of mixture of aromatic benzaldehyde, benzil, ammonium acetate using potassium dihydrogen phosphate as catalyst using absolute ethanol as solvent. Imidazole derivatives were further converted into imidazole substituted oxazole derivatives. The synthesized compounds were structurally characterized by IR, NMR and Mass spectroscopy. All of the tested compounds were investigated for their antimicrobial potential against gram-positive, gram-negative bacteria and fungal stains and compared with their respective standard drugs. Some compounds showed significant antimicrobial activities. This research work may be further explored for the drug design of potent anti-microbial drugs to solve the problem of microbial resistance.**

Keywords: Imidazole, oxazole, antibacterial, antifungal activity, drug design

I. INTRODUCTION

Heterocyclic compounds are of particular importance as they are associated with a wide variety of physiological activities. Amongst different nitrogen heterocycles, the imidazole and oxazole ring systems are very important since several of its derivatives have been found to be clinically useful [1]. With increase multi drug–resistant to Gram-positive and Gram-negative bacteria it becomes imperative to continuously search anti-infective agents. Imidazoles and oxazoles fit this requirement well since they have demonstrated a diverse set of biological activities that include antibacterial activity [2]. The incorporation of two moieties increases biological activity of both and thus it was of value to synthesize some new heterocyclic derivatives having two moieties in the same compound. The synthesized compounds were investigated for antibacterial and antifungal activities.

II. EXPERIMENTAL SECTION

Step I

- Synthesis of 2-(4-substituted-phenyl) 4,5-diphenyl-1*H*-imidazole:

A mixture of benzil (10mmol), substituted benzaldehyde (10mmol), ammonium acetate (20mmol) and potassium dihydrogen phosphate (5 mol %) were refluxed with stirring in ethanol for 40 min. The completion of reaction was checked by TLC. The reaction medium was cooled to room temperature and poured into 50 ml of cold water. Precipitate obtained was filtered and recrystallized from ethanol. The % yield, melting point and R_f values of the synthesized compound were noted.

- Synthesis of 2-(4-substituted-phenyl)4,5-diphenyl-1*H*-imidazole-1-carbonyl chloride:

Accurately weighed, (0.01mole) 2-(4-substituted-phenyl)4,5-diphenyl-1H-imidazolewas dissolved in 20ml of acetone in conical flask. To this solution (0.02mol) of anhydrous potassium carbonate was added. A dropping funnel was fitted to the conical flask and in the dropping funnel a solution of (0.01mol) of chloro acetylchloride was taken. A very slow dropwise addition of chloro acetylchloride solution was done. The reaction mixture was stirred for 5-6 hours at cold condition. After 5-6 hours, excess of solvent and chloroacetyl chloride was removed by distillation under reduced pressure and the residue was washed with aqueous sodium bicarbonate (5%w/v, 30ml) and subsequently with cold water (50ml). The crude product was dried and on recrystallization from ethanol afforded white crystalline solid. The % yield, melting point and R_f values of the synthesized compound were noted.

Step II

- Synthesis of 4-(4-substituted-phenyl) oxazol-2-amine:

A mixture of urea (0.05 mole) and substituted phenacyl bromide (0.05 mole) in absolute ethanol medium was refluxed for 2 hours at 80°C. The completion of reaction was checked by TLC by using silica gel G as stationary phase, solvent systems of varying polarity petroleum ether:ethyl acetate 1:1 were used to run the chromatograms. The plates were visualized in iodine chamber. The reaction medium was cooled to room tempreture and poured into 50 ml of cold water and neutralized with 5% aqueous sodium acetate solution. Precipitate obtained was filtered and recrystallized from ethanol. The % age yield, melting point and R_f values of the synthesized compounds were noted.

Step III

- Synthesis of final product

In a conical flask, 2-(4-substituted-phenyl)4,5-diphenyl-1H-imidazole-1-carbonyl chloride (0.001 mole) was taken in acetone (10 ml) and 4-(4-substituted-

phenyl)oxazol-2-amine (0.001 mole) was added to it. To this mixture,(0.001mole) of anhydrous potassium carbonate was added. The solution was stirred for 4 h. The reaction mixture was poured onto crushed ice with constantstirring. The solution was neutralized with dil. HCl. The solid was filtered and washed with water. The product was recrystallized from acetone. The % age yield, melting point and R_f values of the synthesized compounds were noted.

General Scheme of Chemical Reactions (Figure 1-3):

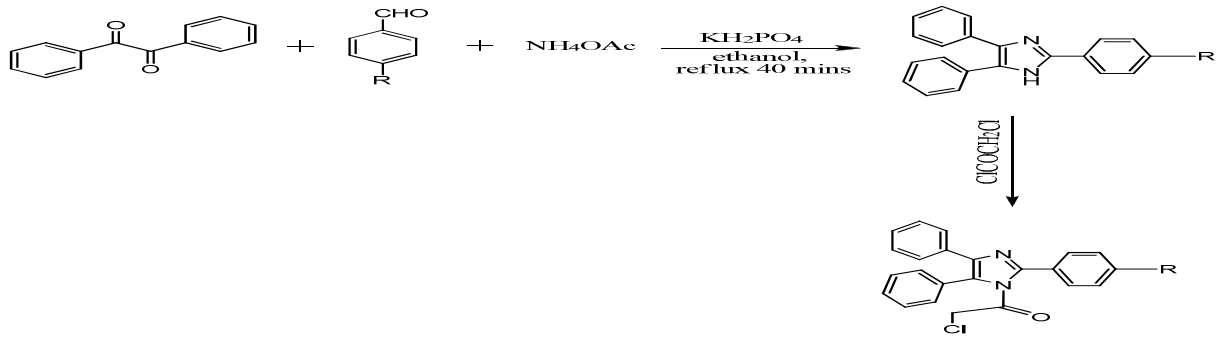

Fig. 1: Synthesis of 2-(4-substituted-phenyl)4,5-diphenyl-1*H*-imidazole-1-carbonyl chloride

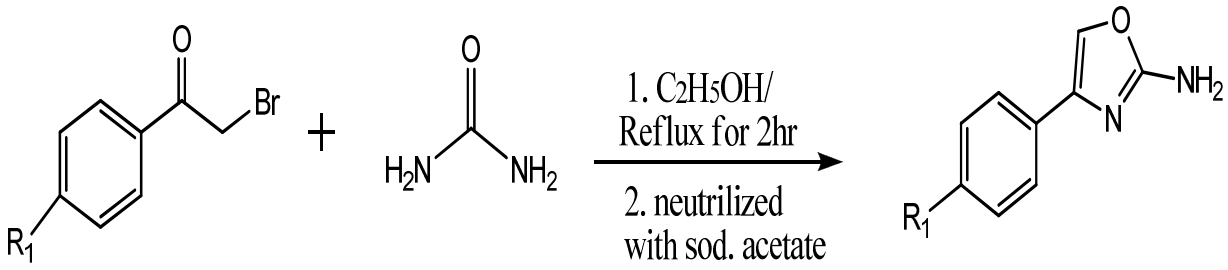

Fig. 2: Synthesis of 4-(4-substituted-phenyl)oxazol-2-amine

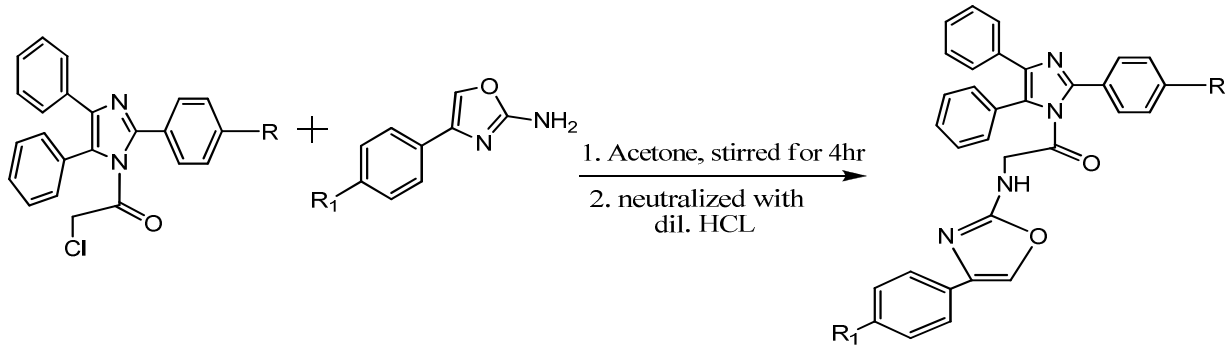

Fig. 3: Synthesis of 2-(4-(4-substitutedphenyl)oxazole-2-ylamino)-1-(2-(4-substitutedphenyl)-4,5-diphenyl-1*H*-imidazole-1-yl)etanone

A. Spectral Characterization of Compounds

- Infra Red Spectra (IR):

The infrared spectra of final compounds were recorded on BRUKER FTIR spectrophotometer. IR region ranges between 4000-400 cm-[1]

- ^{1}H-NMR spectra:

Proton NMR was recorded on BRUKER Avance-II, 400 MHz instrument. For NMR, solutions were made in deuterated chloroform containing tetramethylsilane as internal reference.

- Mass spectra:

For mass spectra, solutions were made in HPLC grade methanol and spectra were recorded on WATERS, Q-TOF MICROMASS (LC-MS).

B. Pharmacological Screening of Test Compounds:

- Antimicrobial activity *(in-vitro)*:-

Antimicrobial activities like antibacterial and antifungal were performed by using agar well diffusion method against Gram-negative bacteria i.e. *E. coli* (MTCC 614), Gram positive strains i.e. *S. aureus* (MTCC 96) and fungal strains i.e. *C. albicans*(MTCC 227) by comparison against standard drugs like Ciprofloxacin and ketoconazole respectively [3]. The antimicrobial activity was performed in ITC, Panchkula.

III. RESULTS AND DISCUSSION

A. *Physico-Chemical Data of Titled Compounds*:

Melting points were taken in open capillaries and are uncorrected. The solubility checked by DMSO and $CDCl_3$ and R_f values were calculated by TLC metho

Table No. 1: Physical properties data of synthesized compounds (RK1-RK10)

Compound code	R	R^1	Molecular formula	Molecular weight (g/mol)	% yield
RK1	H	H	$C_{32}H_{24}N_4O_2$	497	46.73
RK2	H	OCH_3	$C_{33}H_{26}N_4O_3$	527	48.21
RK3	4-Cl	H	$C_{32}H_{23}ClN_4O_2$	531	52.27
RK4	4-Cl	OCH_3	$C_{33}H_{25}ClN_4O_3$	561	52.70
RK5	4-F	H	$C_{32}H_{23}FN_4O_2$	515	55.61
RK6	4-F	OCH_3	$C_{33}H_{25}FN_4O_3$	545	61.71
RK7	4-OH	H	$C_{32}H_{24}N_4O_3$	513	33.08
RK8	4-OH	OCH_3	$C_{33}H_{26}N_4O_4$	543	37.0
RK9	4-NO_2	H	$C_{32}H_{23}N_5O_4$	542	36.60
RK10	4-NO_2	OCH_3	$C_{33}H_{25}N_5O_5$	572	40.08

Table No. 2: Physiochemical data of synthesized compounds (RK1-RK10):

Compound code	M.P. °C	Solubility	Solvent system	R_f value
RK1	172-174	DMSO	Tolene: ethyl acetate: formic acid (2:6:2)	0.63
RK2	160-162	DMSO	Tolene: ethyl acetate: formic acid (2:6:2)	0.77
RK3	180-182	DMSO	Tolene: ethyl acetate: formic acid (2:6:2)	0.58
RK4	168-170	DMSO	Tolene: ethyl acetate: formic acid (2:6:2)	0.8
RK5	176-178	DMSO	Tolene: ethyl acetate: formic acid (2:6:2)	0.73
RK6	152-154	DMSO	Tolene: ethyl acetate: formic acid (2:6:2)	0.56
RK7	142-145	DMSO	Tolene: ethyl acetate: formic acid (2:6:2)	0.85
RK8	134-136	DMSO	Tolene: ethyl acetate: formic acid (2:6:2)	0.61
RK9	192-194	DMSO	Tolene: ethyl acetate: formic acid (2:6:2)	0.52
RK10	176-178	DMSO	Tolene: ethyl acetate: formic acid (2:6:2)	0.66

Table No. 3: Antibacterial activity of test compounds

Compound code	R	R^1	Zone of inhibition (mm) ± SEM	
			SA	EC
RK1	H	H	12.57±0.051	12.36±0.043
RK2	H	OCH_3	12.8±0.037	13.13±0.029
RK3	4-Cl	H	17.47±0.037	16.29±0.033
RK4	4-Cl	OCH_3	19.07±0.046	17.81±0.046
RK5	4-F	H	22.81±0.027	18.44±0.052
RK6	4-F	OCH_3	23.28±0.054	18.81±0.056
RK7	4-OH	H	15.23±0.041	13.44±0.037
RK8	4-OH	OCH_3	16.78±0.035	14.29±0.043
RK9	4-NO_2	H	26.66±0.035	20.98±0.017
RK10	4-NO_2	OCH_3	28.57±0.029	23.31±0.037
Control	-	-	-	-
Ciprofloxacin	-	-	31.24±0.013	25.77±0.045

Table No. 4: Antifungal activity of test compounds

Compound code	R	R^1	Zone of inhibition (mm) ± SEM
			Candida Albicans
RK1	H	H	9.89±0.054
RK2	H	OCH_3	19.25±0.040
RK3	4-Cl	H	13.43±0.029
RK4	4-Cl	OCH_3	15.76±0.037
RK5	4-F	H	10.80±0.031
RK6	4-F	OCH_3	14.46±0.034
RK7	4-OH	H	19.80±0.037
RK8	4-OH	OCH_3	20.31±0.040
RK9	4-NO_2	H	12.24±0.049
RK10	4-NO_2	OCH_3	17.46±0.034
Control	-	-	-
Ketoconazole	-	-	22.62±0.031

B. Spectral Analysis of Compound Rk1

- IR (cm^{-1}): IR spectrum of the compound RK1 showed various absorption peaks at 3395.16 (NH), 3000.10 (Ar-CH), 1593.87 (C=N), 1467.47 (C=C), 1285.96 (C-N), 1029.94 (C-O).
- ^{1}H-NMR (ð, 400 MHz, DMSO-d6): ^{1}H-NMR spectra of compound RK1 showed peaks at 7.43-8.22 (21H, Ar), 3.38 (1H, NH) and 2.52-2.53 (2H, CH_2).
- MS (m/z, M^+): Mass spectra of compound RK1 displayed molecular ion peak at m/z value of 496 which corresponds to molecular formula $C_{32}H_{24}N_4O_2$of the compound.

C. Spectral Analysis of Compound Rk2

- IR (cm^{-1}): IR spectrum of the compound RK2 showed various absorption peaks at 3396.09 (NH), 3010.10 (Ar-CH), 1582.97 (C=N), 1468.32 (C=C), 1285.04 (C-N), 1031.76 (C-O).
- ^{1}H-NMR (ð, 400 MHz, DMSO-d6): ^{1}H-NMR spectra of compound RK2 showed peaks at 7.52-7.85 (20H, Ar), 3.33 (1H, NH) and 2.53-2.57 (2H, CH_2), 3.73 (3H, OCH_3).
- MS (m/z, M^+): Mass spectra of compound RK2 displayed molecular ion peak at m/z value of 526 which corresponds to molecular formula $C_{33}H_{26}N_4O_3$of the compound.

D. Spectral Analysis of Compound Rk3

- IR (cm^{-1}): IR spectrum of the compound RK3 showed various absorption peaks at 3382.16 (NH),

3057.10 (Ar-CH), 1584.67 (C=N), 1466.62 (C=C), 1281.90 (C-N), 1078.19 (C-Cl), 1030.79 (C-O).

- ^{1}H-NMR (ð, 400 MHz, DMSO-d6): ^{1}H-NMR spectra of compound RK3 showed peaks at 7.82-8.15 (20H, Ar), 2.69 (1H, NH) and 2.52-2.57 (2H, CH_2).
- MS (m/z, M^+): Mass spectra of compound RK3 displayed molecular ion peak at m/z value of 532 which corresponds to molecular formula $C_{32}H_{23}ClN_4O_2$of the compound.

E. Spectral Analysis of Compound Rk4

- IR (cm^{-1}): IR spectrum of the compound RK4 showed various absorption peaks at 3397.98 (NH), 3000.10 (Ar-CH), 1582.04 (C=N), 1466.81 (C=C), 1285.90 (C-N), 1079.97 (C-Cl), 1030.98 (C-O).
- ^{1}H-NMR (ð, 400 MHz, DMSO-d6): ^{1}H-NMR spectra of compound RK4 showed peaks at 7.43-7.88 (19H, Ar), 3.33 (1H, NH) and 2.52-2.53 (2H, CH_2), 3.32-3.35 (3H, OCH_3).
- MS (m/z, M^+): Mass spectra of compound RK4 displayed molecular ion peak at m/z value of 562 which corresponds to molecular formula $C_{33}H_{25}ClN_4O_3$of the compound.

F. Spectral Analysis of Compound Rk5

- IR (cm^{-1}): IR spectrum of the compound RK5 showed various absorption peaks at 3400.03 (NH), 3032.10 (Ar-CH), 1583.75 (C=N), 1471.38 (C=C), 1284.85 (C-N), 1170.00 (C-F), 1032.54 (C-O).
- ^{1}H-NMR (ð, 400 MHz, DMSO-d6): ^{1}H-NMR spectra of compound RK5 showed peaks at 7.23-7.42 (20H, Ar), 3.43 (1H, NH) and 2.57-2.61 (2H, CH_2).
- MS (m/z, M^+): Mass spectra of compound RK5 displayed molecular ion peak at m/z value of 514 which corresponds to molecular formula $C_{32}H_{23}FN_4O_2$of the compound.

G. Spectral Analysis of Compound Rk6

- IR (cm^{-1}): IR spectrum of the compound RK6 showed various absorption peaks at 3441.69 (NH), 3056.98 (Ar-CH), 1594.03 (C=N), 1467.10 (C=C), 1284.10 (C-N), 1166.82 (C-F), 1029.92 (C-O).
- ^{1}H-NMR (ð, 400 MHz, DMSO-d6): ^{1}H-NMR spectra of compound RK6 showed peaks at 7.18-7.92 (19H, Ar), 3.43 (1H, NH) and 2.53-2.57 (2H, CH_2), 3.34-3.37 (3H, OCH_3).
- MS (m/z, M^+): Mass spectra of compound RK6 displayed molecular ion peak at m/z value of 544 which corresponds to molecular formula $C_{33}H_{25}FN_4O_3$of the compound.

H. Spectral Analysis of Compound Rk7

- IR (cm^{-1}): IR spectrum of the compound RK7 showed various absorption peaks at 3394.86 (NH), 3035.92 (Ar-CH), 1582.87 (C=N), 1467.90 (C=C), 1286.10 (C-N), 1031.98 (C-O).
- ^{1}H-NMR (ð, 400 MHz, DMSO-d6): ^{1}H-NMR spectra of compound RK7 showed peaks at 7.23-7.42 (20H, Ar), 3.43 (1H, NH) and 2.57-2.61 (2H, CH_2), 1.12-1.14 (1H, OH)
- MS (m/z, M^+): Mass spectra of compound RK7 displayed molecular ion peak at m/z value of 512 which corresponds to molecular formula $C_{32}H_{24}N_4O_3$ of the compound.

I. Spectral Analysis of Compound Rk8

- IR (cm^{-1}): IR spectrum of the compound RK8 showed various absorption peaks at 3395.16 (NH), 3000.10 (Ar-CH), 1593.87 (C=N), 1467.47 (C=C), 1285.96 (C-N), 1029.94 (C-O).
- ^{1}H-NMR (ð, 400 MHz, DMSO-d6): ^{1}H-NMR spectra of compound RK8 showed peaks at 7.21-7.42 (19H, Ar), 3.29 (1H, NH) and 2.53-2.55 (2H, CH_2), 1.13 (1H, OH), 3.32-3.35 (3H, OCH_3).
- MS (m/z, M^+): Mass spectra of compound RK8 displayed molecular ion peak at m/z value of 542 which corresponds to molecular formula $C_{33}H_{26}N_4O_4$of the compound.

J. Spectral Analysis of Compound Rk9

- IR (cm^{-1}): IR spectrum of the compound RK9 showed various absorption peaks at 3380.53 (NH), 3015.18 (Ar-CH), 1583.62 (C=N), 1465.95 (C=C), 1282.72 (C-N),1514.45 (NO_2), 1032.40 (C-O).
- ^{1}H-NMR (ð, 400 MHz, DMSO-d6): ^{1}H-NMR spectra of compound RK9 showed peaks at 6.82-7.12 (20H, Ar), 3.32 (1H, NH) and 2.57-2.61 (2H, CH_2),
- MS (m/z, M^+): Mass spectra of compound RK9 displayed molecular ion peak at m/z value of 541 which corresponds to molecular formula $C_{32}H_{23}N_5O_4$of the compound.

K. Spectral Analysis of Compound Rk10

- IR (cm^{-1}): IR spectrum of the compound RK10 showed various absorption peaks at 3391.23 (NH), 3050.10 (Ar-CH), 1598.29 (C=N), 1465.95 (C=C), 1288.96 (C-N), 1029.54 (C-O), 1514.45 (NO_2).
- ^{1}H-NMR (ð, 400 MHz, DMSO-d6): ^{1}H-NMR spectra of compound RK10 showed peaks at 7.42-8.15 (19H, Ar), 3.33 (1H, NH) and 2.53-2.55 (2H, CH_2), 3.31-3.34 (3H, OCH_3).
- MS (m/z, M^+): Mass spectra of compound RK10 displayed molecular ion peak at m/z value of 571 which corresponds to molecular formula $C_{33}H_{25}N_5O_5$of the compound.

IV. CONCLUSION

Some synthesized compounds of this novel series of substituted imidazole incorporated oxazole derivatives contaning electron withdrawing groups showed potent antibacterial and antifungal activities when compared with their respective standard drugs. Research outcomes of this research work ensure that combination oftwo heterocyclic nuclei like imidazole and oxazole in a single drug molecule results in synergistic effect on pharmacological activities such as antibacterial and antifungal activities.

REFERENCES

[1] M. Suresh, P. Lavanya, C.V. Rao, "Synthesis, antibacterial, antifungal and antioxidant activity studies on 2-benzylthio- and 2-benzylsulfonyl-1*H*-imidazoles," Der Pharmacia Lettre, vol. 2, pp. 393-402, 2010.

[2] J. Fernandes, P. Kumar, A. Kumar, "Synt'hesis of Some Novel Oxazolidinones Having BenzoThiazinen Derivatives as Antimicrobial and Anti-Inflammatory Agents," International Journal of Pharmaceutical Sciences and Drug Research vol. 5, pp. 101-104, 2013.

[3] K. Sztanke, T. Tuzimski, J. Rzymowska, "Synthesis, determination of the lipophilicity, anticancer and antimicrobial properties of some fused 1,2,4-triazole derivatives," Eur. J. Med. Chem., vol. 43, pp. 404-419, 2008.

Microwave Assisted one Pot Synthesis and Spectral Analysis of Some New 2-(4-(3-Substitutedphenyl)Piperazin-1-Yl)-1-(6-Substitutedquinolin-4-Yl)Ethanone Derivatives

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Abstract: **Microbes are unique creatures that adapt to varying lifestyles and environment resistance in extreme or adverse conditions. It becomes a challenge for the medicinal chemists to find new chemical entities which can treat microbial infections. Heterocyclic compounds are of keen interest for them as they possess different pharmacological activities. There are many quinolone derivatives which show antibacterial, antifungal, antimalaria, antipsychotic activities. On the other hand, heterocyclic containing substituted piperazine nucleus also exhibit various biological activities. On keeping in mind these activities, we make an attempt to synthesize2-(4-(3substitutedphenyl) piperazin-1-yl)-1-(6-substituted quinolin-4-yl)ethanone derivatives by one pot synthesis in microwave. The two nucleus were fused via Maanich reaction using formaldehyde Microwave reactions are very inexpensive, operational simplicity, eco-friendly method and give good yield in a very short reaction time. The resulted piperazine substituted derivatives were characterized by elemental analysis by IR, NMR, MS and TLC. Physicochemical properties were also determined (melting point, solubility). Then the compounds were analysed for their activity against gram+ve and gram–ve bacteria. The aim of the present communication is to report the microwave assisted synthesis as well as spectral analysis of novel substituted phenylquinolone carboxylic acid derivatives. Biological data has revealed that the synthesized compounds have great potential for activity and this research work can be further explored for search of better antimicrobial agents.**

Keywords: ***Quinoline, piperazine, antioxidant and antibacterial activity, microwave synthesis***

I. INTRODUCTION

To overcome the problem of microbial resistance, medicinal chemists are showing their keen interest in developing new antimicrobial reagents[1]. From the literature review of quinoline and piperazine nucleus it is revealed that they can act as promising lead molecule for the synthesis of novel antimicrobials[2,3].In this present communication we have amalagamate substituted quinolines and piperazine using "Maanich reaction" by microwave irradiation, resulting in formation of a library of novel molecules having synergistically increasing antimicrobial portfolios.

II. EXPERIMENTAL

All the chemicals were purchased from Hi-Media Laboratories Ltd., Mumbai and Sigma Aldrich Co, St Louis, USA. Microwave oven used (model no.17 PM-MEC-1) with maximum power of 700 W. Melting points reported were recorded in open capillaries.IR spectra were recorded on Bruker FT-IR spectrometer. 1H-NMR were recorded on Bruker Avance 11 400 spectrophotometer operating at 400.00 MHz. Mass spectra were recorded on Bruker.

A. general procedure for the synthesis of titled compounds (4_{a-j}):

Step 1: synthesis of 6-substituted-2-substituted phenylquinoline-4-sodium carboxylate derivatives (1)

Benzaldehyde derivatives (0.125 mol), sodium pyruvate (0.125 mol) in DMF and substituted aniline (0.124 mol) in 100ml of absolute ethanol was irradiated at 300 watts. Reaction completion was monitored by TLC after every minute. The products obtained were dried and recrystallized from methanol.

Step 2: Synthesis of bis (βchloro- ethyl)amine :

To a solution of diethanolamine (50g) in chloroform (150cc), thionyl chloride (130cc) in chloroform (130cc) is added at first cautiously and more than more rapidly, during about 10 mins and boiled vigorously with shaking till clear solution formed. Within few minutes crystallization rapidly occurs. The flask is at once chilled by immersion in ice water, and after standing for one hr., the semisolid product is filtered off, washed thrice with chloroform and then with ether, and dried. Product is obtained as white crystals and recrystallized from acetone.

Step3: Synthesis of 1-(3-chloro phenyl) piperazine:

m-chloro aniline (0.1 mole) was taken along with bis-(2-chloro-ethyl)-amine (2) (0.14 mole) in water methanol (1:1) and carefully 40%NaOH was added until pH-6, then irradiated in microwave until pH-7 is achieved. Then it was made alkaline using *conc.* NaOH (pH-12). The contents then extracted with toluene. The toluene layer was distilled and pale colored liquid was obtained.

Step4: Synthesis of 2-(4-(3-substituted phenyl)piperazin-1-yl)-1-(6-substituted quinolin-4-yl)ethanone derivatives (4a-j):

Compound (1) (0.01mol), compound(3) (0.005mol), and formaldehyde (0.01mol) irradiated in microwave oven at 125 C for five minutes. Then insoluble products were sonicated in cold ethanol, filtered and air dried.

Analytical and spectroscopic characterization data of the synthesized compound 4a–j are given below:

- ***2-(4-(3-chlorophenyl)piperazin-1-yl)-1-(6-nitro-2-phenylquinolin-4-yl)ethanone 4a :*** Light Yellow solid, m.p.210C, yield 73%,Mol. formula $C_{27}H_{23}ClN_4O_3$, Mol.wt. 486.85, IR= 1596.63cm^{-1}(-C=O), 1466.96cm^{-1}(-CH_2-), 1528.20 & 1292.31cm^{-1}(-NO_2-), 750.20cm^{-1}(-Cl-),3362.47cm^{-1}(-C-OH-), ^{1}HNMR(DMSO-$_{d6}$) δ = 7.21-7.51(13H, ArH), 4.08-4.16(10H, -CH_2), MS = m/z : 486$(M)^+$, 488$(M+2)^+$

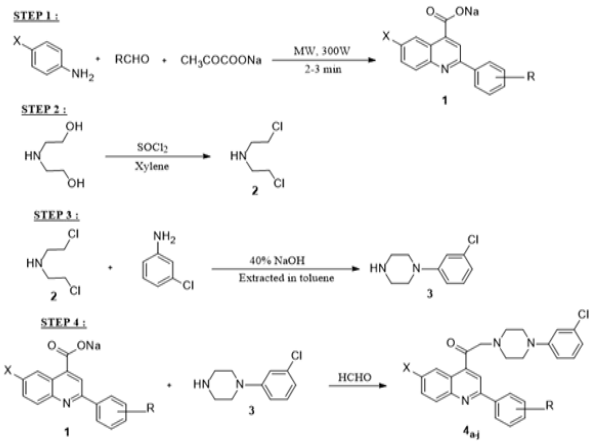
- ***2-(4-(3-chlorophenyl)piperazin-1-yl)-1-(6-nitro-2-(4-nitrophenyl)quinolin-4yl)ethan-one 4b :*** Yellowish-brown solid, m.p.212C, yield 77%, Mol.formula $C_{27}H_{22}ClN_5O_5$,Mol.wt. 531.95, IR= 1591.15cm^{-1}(-C=O), 1464.81cm^{-1}(-CH_2-), 1526.04 & 1290.56cm^{-1}(-NO_2-), 748.21cm^{-1}(-Cl-),3360.74cm^{-1}(-C-OH-), ^{1}HNMR(DMSO-$_{d6}$) δ = 7.26-7.49(12H, ArH), 4.11-4.19(10H, -CH_2); MS = m/z : 531$(M)^+$, 533$(M+2)^+$

- ***2-(4-(3-chlorophenyl)piperazin-1-yl)-1-(2-(4-methoxyphenyl)-6-nitroquinolin-4-yl)ethano- ne 4c:*** Dark yellow solid, m.p.211C, Mol.formula $C_{28}H_{25}ClN_4O_4$, Mol.wt. 516.98,IR = 1598.83cm^{-1}(-C=O), 1470.08cm^{-1}(-CH_2-), 1530.21 & 1296.66cm^{-1}(-NO_2-), 752.76cm^{-1}(-Cl-),3366.02cm^{-1}(-C-OH-),1248.23cm^{-1} & 976.06cm^{-1}(-OCH_3-), ^{1}HNMR(DMSO-$_{d6}$) δ = = 7.29-7.52(12H, ArH), 4.25-4.32(10H, -CH_2), 3.75(3H, OCH_3); MS = m/z : 516$(M)^+$, 518$(M+2)^+$

- ***2-(4-(3-chlorophenyl)piperazin-1-yl)-1-(2-(4-hydroxyphenyl)-6-nitroquinolin-4-yl)ethano- ne 4d:*** Brownish yellow solid, m.p. 216C, Mol.formula $C_{27}H_{23}ClN_4O_4$, Mol.wt. 502.95, IR = 1598.05cm^{-1}(-C=O), 1468.66cm^{-1}(-CH_2-), 1530.20 cm^{-1} & 1295.37cm^{-1} (-NO_2-), 758.20cm^{-1}(-Cl-), 3360.76cm^{-1}(-C-OH-), ^{1}HNMR(DMSO-$_{d6}$) δ = = 7.35-7.51(12H, ArH), 4.12-4.28(10H, -CH_2), 9.82(1H, -OH); MS = m/z : 503$(M)^+$, 505$(M+2)^+$

- ***2-(4-(3-chlorophenyl)piperazin-1-yl)-1-(2-(4-hydroxyphenyl)-6-chloroquinolin-4-yl)ethano -ne 4e:*** Light brown solid, m.p. 208 C, yield 76 %, Mol.formula $C_{27}H_{23}Cl_2N_3O_2$, Mol.wt. 475.95, 1594.26cm^{-1}(-C=O), 1460.96cm^{-1}(-CH_2-),747.26cm^{-1}(-Cl-),3362.47cm^{-1}(-C-OH-), ^{1}HNMR(DMSO-$_{d6}$) δ = = 7.43-7.59(12H, ArH), 4.81-4.96(10H, -CH_2), 9.74(1H, -OH); MS = m/z : 478$(M)^+$, 480$(M+2)^+$

- ***1-(6-chloro-2-p-tolylquinolin-4-yl)-2-(4-(3-chlorophenyl)piperazin-1-yl)ethanone 4f:*** Yellowish solid, m.p 212C,yield-69%,Mol.formula $C_{28}H_{25}Cl_2N_3O$,Mol.wt.490.42, IR values at 1600.05cm^{-1}(-C=O),1471.06cm^{-1}(-CH_2-),756.29cm^{-1}(-Cl-),3362.47cm^{-1}(-C-OH-),2880cm^{-1}(-CH_3), ^{1}HNMR(DMSO-$_{d6}$) = 7.14-7.19(12H, ArH), 4.69-4.72(10H, -CH_2), 1.31-1.37(3H, CH_3); MS = m/z : 490$(M)^+$, 492(M+2)



Scheme: Synthetic route for the synthesis of titled compounds 4_{a-j}

- ***1-(6-chloro-2-(4-chlorophenyl)quinolin-4-yl)-2-(4-(3-chlorophenyl)piperazin-1-yl)ethano- ne 4g :*** Brownish solid, m.p. 217C, yield 71 %, Mol.formula $C_{27}H_{22}Cl_3N_3O$, Mol.wt. 510.84, 1594.79cm^{-1}(-C=O), 1459.76cm^{-1}(-CH_2-), 759.16cm^{-1}(-Cl-),3362.47cm^{-1}(-C-OH-), ^{1}HNMR(DMSO-$_{d6}$) δ = 7.13-7.29(12H, ArH), 4.76-4.86(10H, -CH_2); MS = m/z : 511$(M)^+$, 513$(M+2)^+$

- ***1-(6-chloro-2-(4(dimethylamino)phenyl) quinolin-4-yl)-2-(4-(3-chlorophenyl)pipe- razin-1-yl)ethanone 4h :*** Yellowish brown solid, 209C, m.p 206C, yield 67%, Mol.formula $C_{29}H_{28}Cl_2N_4O$, Mol.wt. 519.46, IR = 1599.73cm^{-1}(-C=O), 1469.97cm^{-1}(-CH_2-),752.28cm^{-1}(-Cl-),3362.47cm^{-1}(-C-OH-), 2866.65cm^{-1}(-CH_3-), ^{1}HNMR(DMSO-$_{d6}$) δ = 7.43-7.59(12H, ArH), 4.81-4.56(10H, -CH_2), 8.14(1H, -NH), 1.41-1.56(6H, -CH_3); MS = m/z : 519$(M)^+$, 521 $(M+2)^{+.}$

- ***1-(6-chloro-2-(3,4,5-trimethoxyphenyl)quinolin-4-yl)-2-(4-(3-chlorophenyl)piperazin-1-yl)ethanone 4i :***Yellow solid,m.p. 213C, yield 70%, Mol.formula $C_{30}H_{29}Cl_2N_3O_4$, Mol.wt. 566.47, IR = 1598.13cm^{-1}(-C=O), 1467.86cm^{-1}(-CH_2-), 752.20cm^{-1}(-Cl-),3365.46cm^{-1}(-C-OH-), 1245.13cm^{-1} & 972.06cm^{-1}(-OCH_3-),^{1}HNMR(DMSO-$_{d6}$) δ = 7.63-7.69(10H, ArH), 4.51-4.66(10H, -CH_2), 3.74(9H, -OCH_3); MS = m/z : 566$(M)^+$, 568$(M+2)^+$

- ***1-(2-(4-chlorophenyl)-6-nitroquinolin-4-yl)-2-(4-(3-chlorophenyl)piperazin-1-yl)ethanone 4j:*** Dark yellow solid, m.p.219C, yield 76%, Mol.formula $C_{27}H_{22}Cl_2N_4O_3$, Mol.wt. 521.39, IR= 1596.15cm^{-1}(-C=O), 1462.81cm^{-1}(-CH_2-), 1526.04 & 1289.56cm^{-1}(-NO_2-), 746.22cm^{-1}(-Cl-),3360.74cm^{-1}(-C-OH-),^{1}HNMR(DMSO-$_{d6}$) δ = 7.33-7.60(12H, ArH), 4.21-4.46(10H, -CH_2); MS = m/z : 521$(M)^+$, 523$(M+2)^+$

III. RESULTS AND DISCUSSION:

The reaction between 6-substituted-2-substituted-phenyl-quinoline-4-sodium carboxylate 1(a-j), 1-(3-chlorophenyl)piperazine (3) and formaldehyde gave piperazine substituted quinolone derivatives. Characterization of newly synthesized compounds of this series was accomplished by IR, NMR and mass spectral data. Titled compound ***4a***(mol. formula $C_{27}H_{23}ClN_4O_3$, m.w. 486.85) shows stretching and vibrational bands like 1596.63cm^{-1}(-C=O), 1466.96cm^{-1}(-CH_2-), 1528.20 & 1292.31cm^{-1}(-NO_2-), 750.20cm^{-1}(-Cl-),3362.47cm^{-1}(-C-OH-). In 1H NMR spectra, it has been observed from the chemical structure of compound (4a) that different pairs of carbons are attached to chemically equivalent protons having δ values as 7.21-7.51(13H, ArH), 4.08-4.16(10H, -CH_2). Mass spectra of 4a gives ionisation peaks at m/z : 486$(M)^+$ and 488$(M+2)^+$ for chlorine.

A. *Antimicrobial screening*:-

Antibacterial screening was done by using agar well diffusion method against Gram negative strain *E. coli*, Gram-positive strain *S. aureus* by comparing against standard drug Ciprofloxacin. at conc. 100 µg/ml. Antifungal activity was checked against *Candida albicans* at conc. 100 µg/ml using Fluconazole as standard drug. All compounds exhibited significant antimicrobial and antifungal activity. They were evaluated by determining the zone of inhibition (mm).

Table 1: Results of antibacterial and antifungal screening of compounds 4_{a-j}:

Sr.No.	X	R	Zone of Inhibition(mm)		
			SA	EC	CA
4a	-NO_2	-C_6H_5	18	19	19
4b	-NO_2	-4-NO_2-C_6H_4	25	27	17
4c	-NO_2	-4-OCH_3-C_6H_4	20	23	21
4d	-NO_2	-4-OH-C_6H_4	22	24	25
4e	-Cl	-4-OH-C_6H_4	21	23	22
4f	-Cl	-4-CH_3-C_6H_4	20	22	24
4g	-Cl	-4-Cl-C_6H_4	19	21	20
4h	-Cl	-4-$N(CH_3)_2$-C_6H_4	17	19	27
4i	-Cl	-3,4,5-$(OCH_3)_3$-C_6H_2	15	17	22
4j	-NO_2	-4-Cl-C_6H_4	21	23	19
		Ciprofloxacin	24	25	-
		Fluconazole	-	-	26

SA = *Staphylococcus aureus* ; EC = *Eschericia coli;* CA = *Candida albicans*

IV. CONCLUSION

The present work given in this paper gives valuable information about the antimicrobial profile of some novel piperazine substituted quinoline derivatives and it has been observed in this research work that compounds contaning electron withdrawing groups like nitro and fluoro showed most potent antibacterial activity whereas derivatives containing electron donating groups like dimethyl amine group showed most potent antifungal activity. These findings are supportive for researchers in search of better antimicrobial agents

REFERENCES

[1] N.C. Desai et al," Synthesis and antimicrobial activity of novel quinazolinone–thiazolidine–quinoline compounds" Journal of Saudi Chemical Society (2013) 17, 259–267.

[2] Avnish A. Patel et al," Synthesis and characterization of some pyrimidine–quinoline clubbed molecules and their microbicidal efficacy" Journal of Saudi Chemical Society (2010) 14, 203–208.

D.M. Suyoga Vardhan et al," Synthesis and evaluation of novel ureido/thioureido derivatives of amino acid conjugated 2,3-dichlorophenyl piperazine as highly potent antiglycating agents" Journal of Saudi Chemical Society (2014).

Assessing and Improving Potential Causes of Quality Defects of Amlodipine Tablet by Six Sigma Approach

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Abstract:-**The purpose of presenting these well-known and widely accepted six sigma study and process capability is to change the entire mindset and culture of the organization to create systems and processes that are near to perfect as achievable which assure that they are functioning at best performance levels. The objectives are achieved by implementing Six Sigma strategy to quality improvement project in tablet manufacturing. DMAIC is the main sub type of Six sigma strategy which includes team work through its five phases which are 1) define phase 2) measure phase 3) analyze phase 4) improve phase 5) control phase. Systematic application of DMAIC tools and techniques within the tablet production results with reduction of process variations/ deviations, defect rate and cost of poor quality which are the several achievements gained through this approach. It was shown that Six sigma is the most effective way to find out which are the critical factors of the process affecting quality and also provide adequate data for analytical analysis. High-level process mapping, Ishikawa diagram, process capability six pack chart using Minitab software and analysis of variation and capability studies are the potential of application of several six sigma tools. This Six Sigma approach is world widely accepted in a wider range of manufacturer activities and improvements through process capability indices have been yield significant financial. The paper researches the opportunity of very useful six sigma approach application within the various manufacturing processes and also depicts that six sigma is a simplest and worth method in the field of quality management and continuous improvement and also for the professionals in the pharmaceutical industry, wherever the quality improvement is an issue within the manufacturing processes.**

Key words: Six sigma, quality improvement, DMAIC.

I. INTRODUCTION

The most challenging question that tackle business leaders and managers in the new millennium is not that how do we succeed but rather it is the how do we stay successful in this competitive and emerging business environment. Six sigma offers nowadays the sight of a success of companies and can be seemed like hot new answer and as a flexible system for improving business process performance. It is built on many essential managing ideas and practices of the past century which creates a new formula for 21st-century business success. It is to be noted that :-

"Six sigma is not about theory, it is all about action" [1]

Sigma plays very vital role in building up of new structures and practices to support sustained success and it is a strategic methodology which decides the best approach for improvement of given situation or process. Sigma is an efficient manner to measure quality by measuring process performance and the improvement efforts results as it is considered as a standard which reflects control on the processes to meet their pre intended specifications.[2] Sigma is a universal scale like yardstick which is used to measure inches thus sigma scale helps us to compare dissimilar processes in the form of capability of that process to be within the quality limits which are proposed for that process and also it is used to measure the DPMO which is defects per million opportunities.[3]

Fig 1:- Sigma scale:-

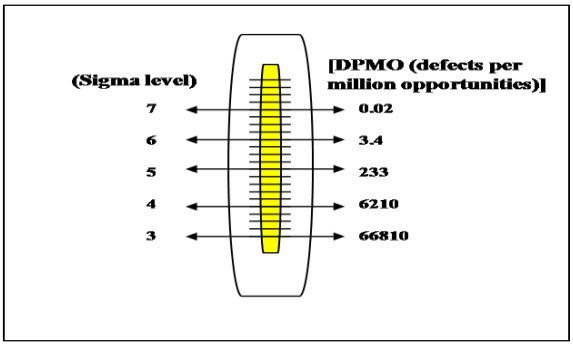


Fig. illustrating sigma metric comparing dissimilar processes in terms of defects produced by process in one million opportunities.

In order to understand Six Sigma definition it is required first to know the meaning of sigma: For a pharmaceutical production process the metric is the sigma capability which gives idea about how much

defects are generated during process and how effectively our process is performing. A defect is anything that results in unsatisfied customer's expectation.[4] The Six sigma quality scale determines the number of sigma between the interval defined by the predetermined specification limits which states that the greater the number of Sigma between the pre intended specification limits the smaller will be the value of Sigma and the lower the number of defects will be produced. The sigma level (z) is obtained by the difference between the USL which is Upper Specification Limit and the LSL which is Lower Specification Limit divided by the standard deviation. [5]

Most of the people think that the 99% quality is quite enough and 1% defectives are very high level to obtain but that 1% can mean the failure to the company thus implementation of six sigma strategy for the reduction of variations and defects and to increase the customer satisfaction is required. [6] PCIs which stands for process capability indices is the influential tool for determining the ability of a process to produce a pharmaceutical product meeting the required specification limits. Various capability indices have been used providing quantitative measures on process performance and its potential which are as follows:- a) Cp b) Cpu c) Cpl d) Cpk.[7] The interpretation of process capability analysis assesses the capabilities of multi-process products and also offers the chances to achieve continuous improvement on the pharmaceutical manufacturing process. Higher cpk value indicates higher process yield and lower process expected loss due to which cpk can be seen as an most efficient and excellent tool to determine the product quality and performance .[8]

II. MATERIALS AND METHODOLOGY

The methodology employed for reducing variations and deviations produced in the process and to reduce the waste and cycle time of the Amlodipine 5mg tablet is the statistical study i.e. Six sigma as it is an project-driven approach that enhances profitability and employs a well established DMAIC methodology that consists of five phases:[5]

- Define
- Measure
- Analyze
- Improve
- Control.

All the five phases of DMAIC approach which are implemented in Amlodipine tablet manufacturing are explained briefly as follows:-

Fig illustrating six sigma strategy (DMAIC) phases.

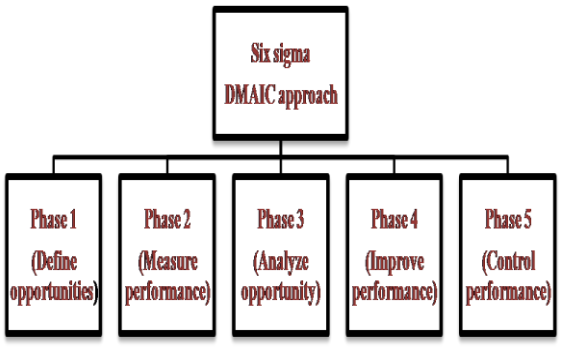


Fig 2:- The 5 step problem solving model (DMAIC)

A. *Define Phase*

This is the first phase of the six sigma approach which defines the goals, objectives and boundaries of the improvement study in terms of the requirements of the customer or business. The main activities carried out under define phase are defining of the project boundaries with the help of SIPOC analysis which stands for supplier, input, process, output, customer and identifying CTQ's which is critical to quality attributes and the problem is defined in this phase in an efficient manner.

B. *Measure phase:-*

After defining the problem statement and conducting the define phase there is measure phase which includes data collection plan and collecting data from historical source like from BMR(batch manufacturing record) and APQR (annual product quality review) and then interpreting that data with the help of Minitab software and identifying the critical factors along with the estimation of the current process capability sigma level. Review of manufacturing process is also conducted in this phase to know whole of the process determining critical factors responsible for the variation.

C. *Analysis Phase:-*

In this phase of six sigma approach analysis of the measured data collected in the measure phase is carried out which is essential for estimating the main root causes responsible for the huge time and expenses for closure of complaints in the manufacturing pharmaceutical industries. Cause and effect analysis is the main action performed in this phase to find out the probable root causes affecting the process which leads to process variation. According to the causes identified hypothesis testing is carried out to solve the problems and to assure that these were the main causes which needs improvement.

D. *Improve Phase:-*

After the analyze phase improve phase is carried out which took into account the essential corrective actions required for the validation purpose. Then the possible solutions are implemented in this phase for the overall improvement of the process rather than solution for a

particular problem or complaint. Further new validated data is interpreted using Minitab for determining the improved cpk value.

E. Control Phase:-

Then in the control phase complaints and improvements are modified with control plans ensuring gains are sustained and overall process improvement is achieved by reducing the variations in the process.

III. RESULTS AND DISCUSSION

The results are discussed as follows:-

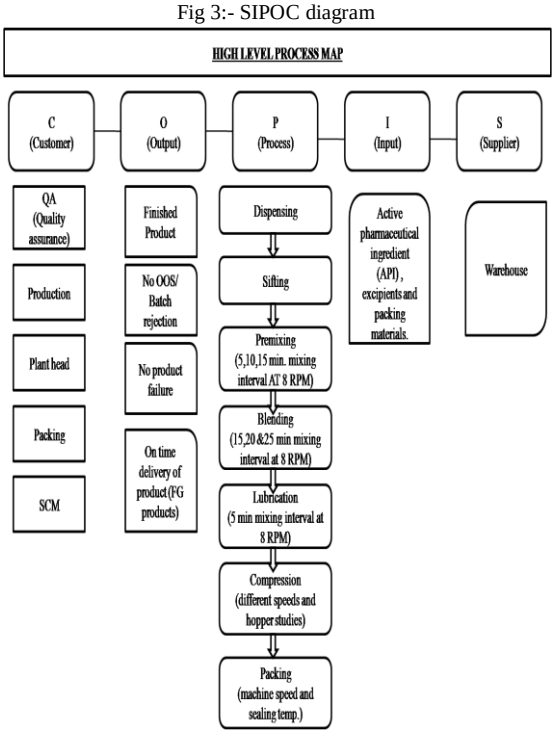
A. Define phase:-

- Problem Statement:-

During product quality review significant variation observed in blend assay value and finished product assay value against the pre intended specification limit of 4.80-5.20 mg and 4.70-5.30 for blend and finished product respectively leading to batch rejection. This variation in assay leads to lower Cpk value as 0.63 at finished stage and 0.56 at blend stage against targeted Cpk value of $\geq$ 1.33.

Total four batches rejected, five OOT (one OOT confirmed as OOS), five OOS and five incidents observed during this review period.

Fig 3:- SIPOC diagram



SIPOC diagram demonstrates whole of the process, who is the customer and what are the inputs and outputs.

B. Measure phase:-

Historical data was collected from the batch manufacturing record for 30 batches of blend and finshed product stages and it was interpreted on Minitab's six pack chart which shows the cpk value with corresponding charts and value of process capability indices is found to be less which leads to batch failure. The six packs charts for the blend assay values and the finished dosage form of Amlodipine tablet-5mg is as follows:-

Fig 4:- Blend assay chart

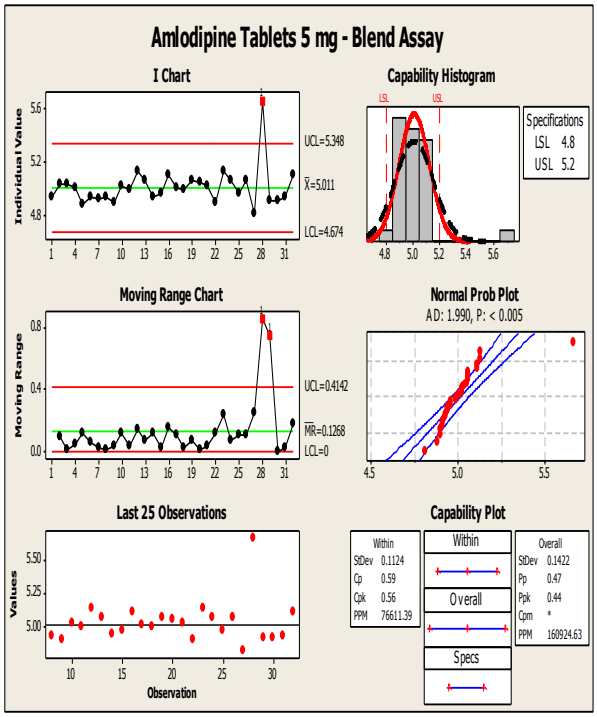
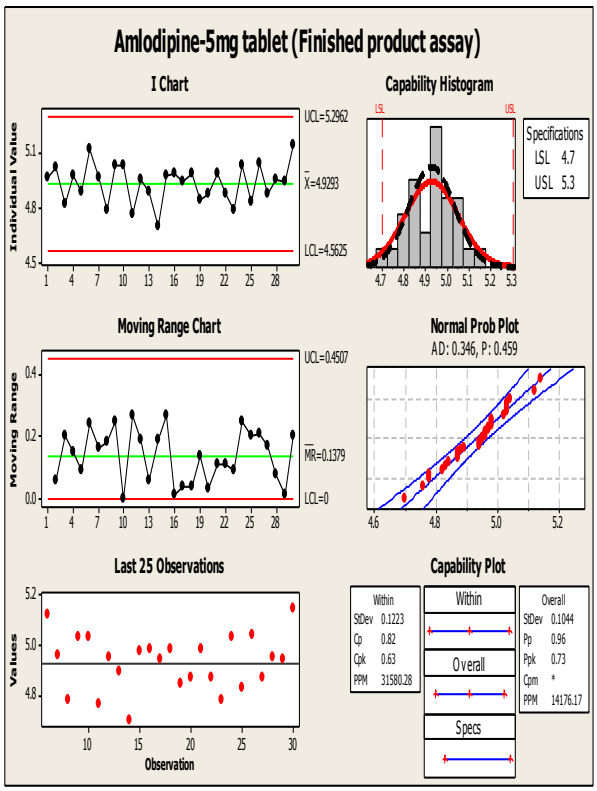
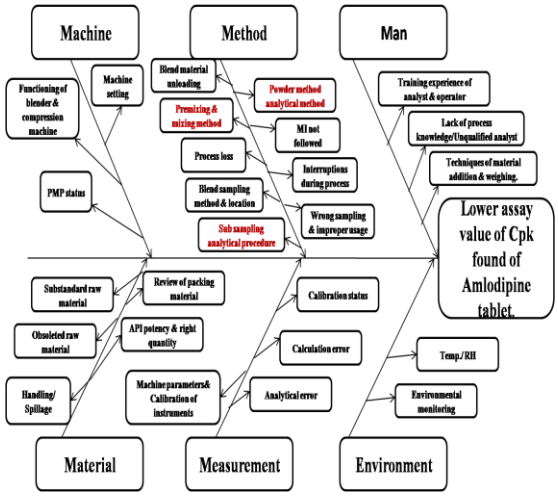


Fig 5:- Finished product assay chart



C. Analyze phase:-

Fig 6:- Cause and effect diagram:-



Cause and effect diagram shows all the probable factors affecting the process which can be the root cause for the variations produced in the process. From above diagram conclusion drawn is that there are three main causes that leads to the lower cpk value which are 1) Premixing and mixing method 2) Sub sampling analytical procedure 3) Powder method analytical procedure. Hence hypothesis testing is carried out for the both sub sampling and the powder method and the results obtained showed that sub sampling method does not greatly impacts the cpk value but the powder method do impacts the process to a large extent so the powder method is replaced by the drop method and the premixing ang mixing method is also changed with the introduction of portable blender of capacity 250kg.

D. Improve phase:-

In this phase of improvement validation of the batches are conducted to show that the improvements made leads to the enhancing the cpk value at the both blend and finished product stage and the charts showing improvement are given below:-

Fig 7:- Validation batches blend assay chart

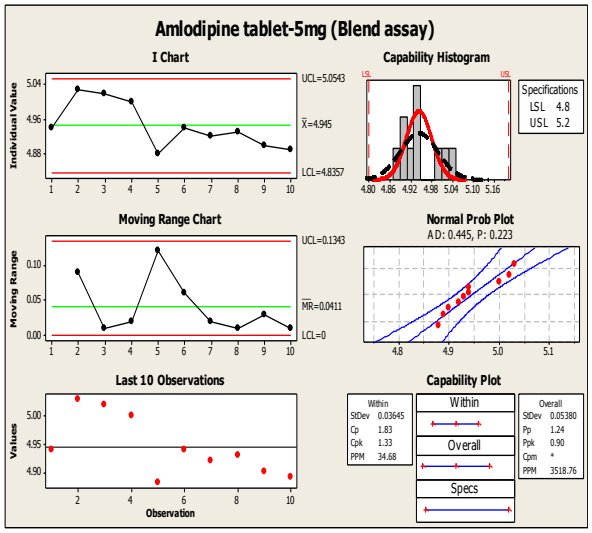
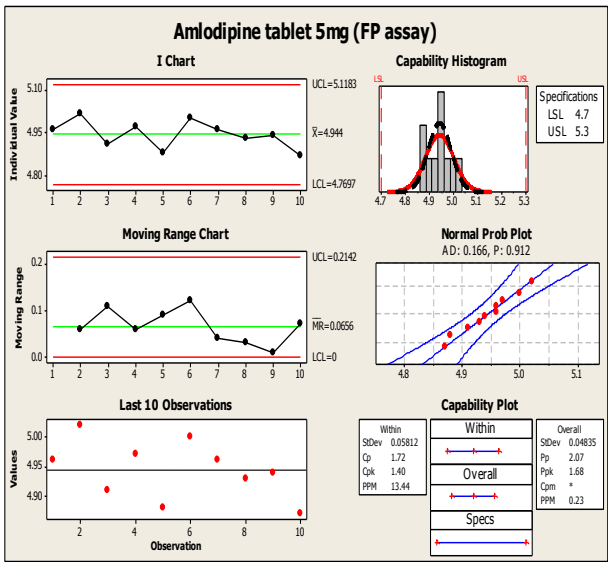


Fig 8:- Validated finished product assay chart:-



Hence the above charts of Minitab's six pack process capability shows that the cpk value is increased by implementing six sigma methodology against the targeted value .

E. Control phase:-

This control phase ensures that gains are sustained by continuous monitoring of the process with the improved method thus eliminate errors which leads to defect free product and enhanced customer satisfaction.

IV. CONCLUSION

The six sigma DMAIC approach is proved to be an most efficient way for the continuous improvement of the processes as implementation of this approach solve the problem of lower cpk value in the Amlodipine 5mg tablet that leads to product failure so new methods are developed in alternate to the methods causing problems like Drop method is employed in place of the Powder method and Portable blender is introduced for the premixing of the materials in place of bag blending due to which process quality and performance is improved to a greater extent and it ultimately leads to the increased cpk value against the targeted value and hence required sigma level is achieved with reduced variations in the process and reduced process losses. Thus six sigma is considered to be a foundation stone for the process improvement in the pharmaceutical manufacturing industries.

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REFERENCES

[1] T.N. Desai and R.L. Shrivastava, "Six Sigma – A new direction to quality and productivity management" Proceedings of the World Cong. on Engi. and Comp. Sci. vol. 2, 2008, pp. 1-6

[2] D. Pokharkar, V. Jadhav, S. Gholve and V. Kadam, “Six Sigma: golden opportunity for Pharmaceutical Industry” Int.J. PharmTech Res. vol. 2(2), 2010, pp. 1160-1164.

[3] O.P. Sharma, V. Gupta, G.S. Rathore, N.K. Saini and K. Sachdeva , “Six Sigma in Pharmaceutical industry and Regulatory Affairs: A Review” J. of Nat. Consci. vol. 2(1), 2011, pp. 273-293.

[4] K. Pavlovic and V. Božanic, “Lean and six sigma concepts and application in pharmaceutical industry” Int. J. for Quality Res. vol. 6(1), 2012,pp. 23-28.

[5] H.S.Kothawade A. B. Kuckekar and P.D. Lokhande, “Six Sigma: Process of Understanding the Control and Capability of Ranitidine Hydrochloride Tablet” J.Young Pharm. vol. 3(1), 2011, pp. 15-25.

[6] J.H. Shinde and R.S. Katikar, “ Importance of process capability and process performance indices in a machine tool” Int. J. of Res. in Eng. & App. Sci. vol. 2(2), 2012, pp. 1211- 1217.

[7] M.R. Chowdhury, “Process capability analysis in pharmaceutical production” Int. J. of Phar. & Life Sci. vol. 2(2), 2013, pp. 85-89.

[8] L. K. Chan, S. W. Cheng and F. A. Spiring, “A new measure of process capability” J. of Qual. Tech. vol. 20, 1988, pp. 162-175.

Recent Methods of Synthesis, Structural Characterization and Antimicrobial Screening of Some Novel Pyridine Substituted Thiazole Derivatives

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***Abstract*: Microbial resistance is global health concern disease because it leads to deactivation of currently used antibiotics. Heterocyclic nucleus is utilized for the synthesis of various antimicrobials as it contains the pharmacophoric group. It has been observed by the literature survey that pyridine and thiazole nucleus show significant antimicrobial activity. In view of these facts, some novel pyridine substituted thiazole derivatives (SR1-SR10) were synthesized by utilising different steps of reactions. The synthesized compounds were structurally characterized by instrumental methods of analysis like IR, NMR and Mass spectroscopy. All the tested compounds were screened for their antimicrobial potential against gram-positive bacteria, gram–negative bacteria and fungal stains and compared with their respective standard drugs. Biological experimentation data has revealed that pyridine and thiazole have great potential for antimicrobial activity. Therefore this manuscript is an attempt in search of better antimicrobial agents for future.**

Keywords: Pyridine, thiazole, antifungal, antibacterial activity, drug design

I. INTRODUTION

Infections can be caused by a wide range of bacteria, virus, and fungus resulting in mild to life-threatening illnesses that require treatment [1]. A recent World Health Organization report indicated that infectious diseases are responsible for more than 17 million deaths worldwide each year [2]. Now a days, the infectious diseases caused by multidrug resistant bacteria are increased and treatment for them with antimicrobial agents are limited [3].

Recently, it is reported that the antimicrobial agents are synthesized on the basis of their resistance towards the bacterial resistance and efforts are made to minimize the transmission and spread of resistant bacteria through appropriate infection control, would be the first step in resolving the issue of resistant organisms [4].

Heterocyclic nucleus plays a vital role in the development of different medicinal agents. Pyridine and thiazole derivatives exhibit antimicrobial, antioxidant and anti-inflammatory activities [5]. In the current research work, main strategy focuses on achieving a synergistic effect on antimicrobial profile by synthesizing novel Pyridine incorporated Thiazole derivatives. This concept leads to reduce the numbers of drugs to be taken at a time and the toxicity due to multi drug therapy for better treatment of microbial infections.

II. EXPERIMENTAL SECTION

A. General Prodecure for Synthesis of Titled Compounds (SR1-SR10):

Step 1:

- To Synthesize Substituted Chalcone Derivatives (compound 1)

Firstly, placed a solution of sodium hydroxide (4.4g, 0.01 mole) in distilled water (40 ml) and added rectified spirit (24.4 ml) in 500 ml of stoppered flask, provided with mechanical stirrer for 4-6 hr. Immersed the flask in a crushed ice bath and slowly added substituted acetophenone (0.43 mole, 10.1 ml). Then substituted benzaldehyde (0.43 mole, 9.12 ml) was add. Kept the temperature of mixture at about 25ºC and stirred vigourously until the mixturewas so thick. Kept the mixture over night. Then the mixture was filtered and recrystallized by using ethanol. The percentage yield was calculated as 80%.

Step 2

- To Synthesize The Disubstituted Pyridine Derivatives:

A mixture of compound (1) (2.7g, 0.05 mol) , malononitrile (3.30g, 0.05 mol) , and ammonium acetate (7.7g, 0.4 mol) in ethanol (80 ml) was refluxed on a water bath for 14-16 hr. The substituted pyridine(compound 2) was obtained, washed with water. After cooling, the contents of the flask were poured onto crushed ice with constant stirring. The solid mass, thus obtained, was washed with water followed by cold ethanol. The residue was recrystallized from ethanol. The percenatage yield was calculated as 75%.

Step-3

- To Synthesize Thiazole:

Thiazole (compound 3) was prepared by a mixture of thiosemicarbazide (0.9g, 0.002mol), mono chloroacetic acid (0.9g, 0.002 mol) and anhydrous sodium acetate (0.7g, 0.002 mol) in a glacial acetic acid (200 ml) was refluxed on a heating mantle for 6 hr. The reaction mixture was cooled to room temperature. The solid thus obtained was filtered, washed with water, dried and purified by recrystallization from methanol. The percentage yield was calculated as 60%.

Step 4

- Synthesis Of Pyridine Incorporated intoThiazole Derivatives:

Schiff's base reaction was used to incorporated pyridine into thiazole nucleus. In this reaction, a mixture of pyridine (2g, 1 mmole) and thiazole (2g, 1mmole) was added into the ethanol (25ml) and refluxed the mixture for 2 hr. After completion of reaction, the crude product was cooled at room temperature. The solid thus obtained was filtered, washed with water, dried and purified by recrystallization from ethanol. The percentage yield was calculated as 65%. The scheme of chemical reactions for synthesis of titled compounds is presented in Figure: 1.

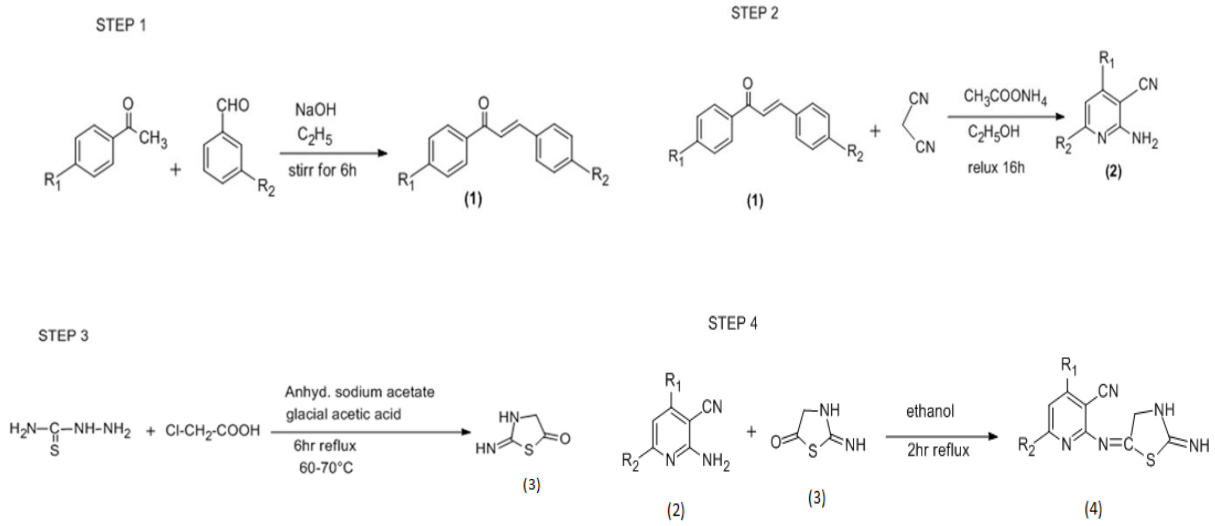

Fig. 1: Reaction Scheme for the Synthesis of Titled Compounds (SR1-SR10)

III. RESULTS AND DISCUSSION

The structures of all the new compounds were characterised by their elemental analysis, IR, ^{1}H-NMR, Mass spectroscopy studies. IR spectra were recorded on Bruker FT-IR spectrometer. ^{1}H-NMR spectra were recorded on BrukerAvance 11400 spectrophotometer operating at 400.00 MHz. Data are presented in chemical shift-values (δ).

Mass values were recorded on Bruker. All these compounds were characterized on the basis of spectral studies. All the compounds were screened for their antibacterial and antifungal activity. Physicochemical properties and analytical data of the synthesized compounds **SR1–SR10** is given below.

2-(3-amino-2-iminothiazolidin-5-ylideneamino)-6-methylnitronicotinonitrile SR1: Brown powder; yield 73%: m.p. 140ºCMol formula ($C_{10}H_9N_6O_2$), Molwt (291.5); IR; (NH)3238cm^{-1}, (C=O) 1668.01 cm^{-1}, (C=N) 1595.09cm^{-1},(C=S) 1091.01 cm^{-1}, (CH) 1450.02cm^{-1}; ^{1}HNMR ($CDCl_3$) δ1.31-1.37(3H,CH_3), 4.08-4.16(2H,CH_2), 7.21-7.51(1H,ArH), 8.14(1H,NH), 6.93(2H,NH_2); MS=m/z 291.5(M)$^+$

2-(3-amino-2-iminothiazolidin-5-ylideneamino)-4-chloro-6-hydroxynicotinonitrile SR2: Brown powder; yield 68%; m.p. 139ºC molecular formula($C_9H_{17}ClN_6OS$), molwt(282.01); IR;(NH) 3038.04cm^{-1}, (C=O) 1694.33 cm^{-1}, (C=N) 1597.87cm^{-1}, (C=S) 1099.90 cm^{-1}, (CH) 1450.01cm^{-1}, (C-Cl) 763.35cm^{-1}, (-OH) 3659.90 cm^{-1}; ^{1}HNMR ($CDCl_3$) δ1.01-1.35(3H,CH_3), 4.05-4.12 (2H,CH_2), 7.20-7.52(1H,ArH), 8.13(1H,NH), 6.92(2H,NH_2),9.82(OH); MS=m/z 282.01(M)$^+$, (M+2) 282.03.

*2-(3-amino-2-iminothiazolidin-5-ylideneamino)-4-hydroxynicotinonitrile SR3:*Brown powder; yield73%; m.p. 136C; IR(NH) 3196.12cm^{-1}, (C=O) 1651.06cm^{-1}, (C=N) 1606.04cm^{-1}, (C=S) 1096.70cm cm^{-1}, (CH) 1450.55cm^{-1}, (OH) 3300.04cm^{-1}; molecularformula($C_9H_8N_6O$), molwt(248.05);1HNMR ($CDCl_3$) δ1.30-1.35(3H,CH_3), 4.06-4.14 (2H,CH_2), 7.20-7.41(1H,ArH), 8.31(1H,NH), 6.92(2H,NH_2), 9.83(OH): MS=m/z 248.05(M)$^+$

2-(3-amino-2-iminothiazolidin-5-ylideneamino)-6-hydroxy-4-nitronicotinonitrile SR4: Brown powder;brown powder; yield 73%: m.p. 140ºC; IR (NH) 3216.61cm^{-1}, (C=O) 1664.01 cm^{-1}, (C=N) 1591.09cm^{-1},(

C=S) 1101.09 cm^{-1}, (OH) 3329.03cm^{-1}molecular formula ($C_9H_7N_7O_3S$), molwt (293.2); ^{1}HNMR ($CDCl_3$) δ1.33-1.35(3H,CH_3), 4.01-4.16 (2H,CH_2), 7.22-7.50(1H,ArH),8.13(1H,NH),6.80(2H,NH_2),9.79(OH), 8.14 (1H,NH);MS=m/z 293.2$(M)^+$

2-(3-amino-2-iminothiazolidin-5-ylideneamino)-4,6-dinitronicotinonitrile SR5: Brown powderbrown powder; yield 75%: m.p. 140ºC; IR (NH) 3399cm^{-1}, (C=O) 1654.05 cm^{-1}, (C=N) 1597.31cm^{-1}, (C=S) 1096.07 cm^{-1}, (NO_2) 1550.34cm^{-1}, ^{1}HNMR ($CDCl_3$) δ1.31-1.37(3H,CH_3), 4.08-4.16 (2H,CH_2), 7.21-7.51(1H,ArH), 8.14(1H,NH), 6.93(2H,NH_2); MS=m/z 283.29$(M)^+$

2-(3-amino-2-iminothiazolidin-5-ylideneamino)-4-methoxy-6-nitronicotinonitrile SR6: Brown powder; yield 71%: m.p. 142ºC;molecular formula($C_9H_6N_8O_4S$), molwt(283.29); IR(NH) 3394.11cm^{-1}, (C=O) 1702.15 cm^{-1}, (C=N) 1594.90cm^{-1}, (C=S) 1091.02 cm^{-1}, (CH) 1448.06cm^{-1}, (C-O) 1100.01cm^{-1}, (NO_2) 1548.67cm^{-1}($C_{10}H_9N_7O_3S$) molwt (266.28); ^{1}HNMR ($CDCl_3$) δ1.31-1.37(3H,CH_3), 4.08-4.16 (2H,CH_2), 7.21-7.51(1H,ArH), 8.14(1H,NH), 6.93(2H,NH_2), 9.17 (H,OH), 1.31-1.37(3H,CH_3) ,3.75 (3H,OCH_3)MS=m/z 266.28$(M)^+$

*2-(3-amino-2-iminothiazolidin-5-ylideneamino)nicotinonitrile SR7:*Brown powder; yield 66%: m.p. 135ºC; IR (NH) 3238.04cm^{-1}, (C=O) 1668.07 cm^{-1}, (C=N) 1595cm^{-1}, (C=S) 1093 cm^{-1}, (CH) 1450.08cm^{-1}molecular formula($C_9H_{10}N_6OS$) molwt(277.26); ^{1}HNMR ($CDCl_3$) δ1.31-1.37(3H,CH_3), 4.08-4.16 (2H,CH_2), 7.21-7.51(1H,ArH), 8.14(1H,NH), 6.93(2H,NH_2), 9.17 (H,OH), 1.31-1.37(3H,CH_3);MS=m/z 277.26$(M)^+$

*2-(3-amino-2-iminothiazolidin-5-ylideneamino)-4-methoxynicotinonitrile SR8:*Brown powder; yield 68%: m.p. 140ºC;molecular formula($C_{10}H_{10}N_6OS$) molwt(246.29) IR (NH) 3358.08cm^{-1}, (C=O) 1678.08 cm^{-1}, (C=N) 1628.16cm^{-1}, (C=S) 1091.01 cm^{-1}, (CH) 3050.03cm^{-1}, (C-O) 1102.01cm^{-1}; ^{1}HNMR ($CDCl_3$) δ1.31-1.37(3H,CH_3), 4.08-4.16 (2H,CH_2), 7.21-7.51(1H,ArH), 8.14(1H,NH), 6.93(2H,NH_2), 3.74(3H,CH_3); MS=m/z 246.29$(M)^+$

*2-(3-amino-2-iminothiazolidin-5-ylideneamino)-6-hydroxy-4-methylnicotinonitrile SR9:*Brown powder; yield 74%: m.p. 141ºC; IR (NH) 3402.02cm^{-1}, (C=O) 1682.08 cm^{-1}, (C=N) 15961.05cm-1, (C=S) 1091.09 cm^{-1} (OH)3200.00cm,$^{-1}$ (CH) 2998.08cm^{-1}molecular formula($C_{10}H_{10}N_6OS$) molwt (266.71); ^{1}HNMR ($CDCl_3$) δ1.31-1.37(3H,CH_3), 4.08-4.16 (2H,CH_2), 7.21-7.51(1H,ArH), 8.14(1H,NH), 6.93(2H,NH_2), 9.17 (H,OH), 1.31-1.37(3H,CH_3); MS=m/z266.71$(M)^+$

*2-(3-amino-2-iminothiazolidin-5-ylideneamino)-4-(dimethylamino)nicotinonitrile SR10:*Brown powder; yield 73%: m.p. 139ºC; Molecular formula($C_{11}H_{13}N_7S$),molwt(264.26); IR;(NH) 3238.04cm^{-1}, (C=O) 1668.07 cm^{-1}, (C=N) 1595.90cm^{-1}, (C=S) 1093.33 cm^{-1}, (CH_3) 1450.08cm^{-1} ^{1}HNMR ($CDCl_3$) δ1.31-1.37(3H,CH_3), 4.08-4.16 (2H,CH_2), 7.21-7.51(1H,ArH), 8.14(1H,NH), 6.93(2H,NH_2), 8.15(1H,NH), 3.74(6H,OCH_3); MS=m/z: 264.26$(M)^+$

A. Evaluation of Antimicrobial Activity:

- Antibacterial activity:

The *in-vivo* antibacterial activity was carried out against *E.coli* and *S.aureus*. These strains were streaked on nutrient agar plates separately and grown overnight.single well isolated colonies of eah type of bacteria were incubated in separate nutrient medium for 16hr at 37ºC. To determine the zone of inhibition as agar well diffusion method was used. Solution of 100µg/ml of each compound was prepared in DMF. Standard antibiotic Ciprofloxacin was screened under similar conditions,100µg/ml of these solutions were added to each well and incubated at 37ºC. one of the wells was used as control by adding 100µg/ml of DMF. According to SAR and major findings indicated that the compounds having electron withdrawing groups like p-nitro, p-chloro, p-bromo and p-fluoro substitution were observed more potent activity. Zone of inhibition was measured in mm after 24 hr and compared with standard drug. Results of antibacterial screening are reported in Table 1.

Table 1: Antibacterial Activity of Tested Compounds

Compd. Code	**R_1**	**R_2**	**Zone of Inhibition (mm) ± SEM**	
			SA	**EC**
SR-1	NO_2	CH_3	22.77±0.055	20.50±0.039
SR-2	Cl	OH	20.74±0.06	18.79±0.053
SR-3	OH	H	19.48±0.053	17.56±0.060
SR-4	NO_2	OH	26.81±0.063	24.10±0.053
SR-5	NO_2	NO_2	27.68±0.033	25.58±0.060
SR-6	OCH_3	NO_2	23.18±0.019	21.42±0.046
SR-7	H	H	12.46±0.054	11.85±0.063
SR-8	OCH_3	H	17.71±0.043	15.25±0.046
SR-9	CH_3	OH	17.88±0.011	16.31±0.041
SR-10	$N(CH_3)_2$	H	16.9±0.048	14.81±0.011
Control	-	-	-	-
Ciprofloxacin	-	-	29.52±0.057	27.56±0.068

Keys: SA – Staphylococcus aureus; EC – Escherichia Coli.

- Antifungal Activity:

The compounds were screened for antifungal activity against *C. albicans*. The zone of inhibition values are shown below in Table 2.

Table 2: Antifungal Activity of Tested Compounds

Compound Code	**R_1**	**R_2**	**Zone of inhibition (mm) ± SEM**
			Candida Albicans
SR-1	NO_2	CH_3	23.40±0.023
SR-2	Cl	OH	17.40±0.052
SR-3	OH	H	21.03±0.053
SR-4	NO_2	OH	20.81±0.042
SR-5	NO_2	NO_2	16.59±0.067
SR-6	OCH_3	NO_2	25.14±0.060
SR-7	H	H	15.12±0.065
SR-8	OCH_3	H	22.05±0.035
SR-9	CH_3	OH	25.31±0.058
SR-10	$N(CH_3)_2$	H	25.32±0.042
Control	-	-	-
Fluconazole	-	-	30.46±0.056

IV. CONCLUSION

The present communication gives valuable information about the antimicrobial profile of some novel pyridine substituted thiazole derivatives and it has been observed in this research work that compounds contaning electron withdrawing groups like nitro and fluoro showed most potent antibacterial activity whereas derivatives containing electron donating groups like dimethyl amine group showed most potent antifungal activity. These findings are supportive for researchers in search of better antimicrobial agents.

REFERENCES

[1] S. Tomoo *et al*, "History of Antimicrobial Agents and Resistant Bacteria", J.M.A.J., vol. 52(2), pp. 103–108, 2009.

[2] J.H. Powers *et al*, "Antimicrobial drug development—the past, the present, and the future", Clin. Microbiol. Infect. vol. 10, pp. 23–31, 2004.

[3] Hashimoto *et al*, "Why Antimicrobial Agents Become Ineffective: Disease-causing Bacteria Are Evolving", Tokyo: Chuokoron-Shinsha, Inc.; 2000.

[4] R.K. Mali *et al*, "Synthesis of some Antifungal and Anti-tubercular 1,2,4-Triazol Analogues", International Journal of ChemTech Research , vol.1, no.2, pp 168-173, 2009.

[5] J.S. Clark, "Heterocyclic Chemistry", Oxford Primer Series, pp 14-15, 2012.

Identification of Various Types of Bacteria From Patients Suffering from Skin Infections

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Abstract: **Out of 30 wound swabs samples taken from hospitalized patients in Guru Nanak Dev Hospital, Amritsar, 25 samples were found positive by bacterial infection who presented invasive wound infection from both sex and average age of 10 - 55 years. Different types of bacterial species were isolated from the collected wound samples and identified by selective culture medium and standard biochemical tests. Each wound samples showed one or more bacterial isolate, primarily Pseudomonas aeruginosa was found to be the most common isolate, followed by Staphylococcus aureus, then E. coli and Klebsiella spp.**

Keywords: ***Wound swabs, bacterial infection, P. aeruginosa, S. aureus***

I. INTRODUCTION

Wound infection causes morbidity and mortality in the patients hospitalized for the treatment of injuries. Injuries contribute 75% of mortality among the wound infected individuals in the developing countries. Wounds facilitate a favorable habitat for the growth and multiplication of bacteria. Patients with diminished immunity are highly susceptible to invasion of microbes and are at an increased risk of developing a wound infection. There are several factors which contribute to this condition. Virulence, quantity and antibiotic resistance of bacteria are some important reasons that lead to contamination and result in wound infection. Bacteria such as *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *E. coli*, *Klebsiella* spp., are more common invaders found in wounds . In view of the above facts, this study was aimed to isolate bacterial species from collected wound samples and identifying them by selective culture medium and standard biochemical tests.

II. MATERIAL AND METHOD*:*

A. Sample collection:

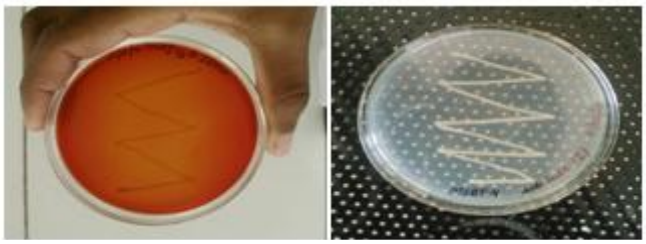
The specimens were collected and transported in sterile, leak- proof container to the laboratry. The swab sticks used for the collection of the samples were streaked directly on the labeled agar plates and incubated at 37°C for 24 h. After incubation, cultures were examined for significant growth. Subcultures were then made into plates of nutrient agar and incubated for another 24 hours.

B. Culture media:

For culturing of different bacteria,Basal Media as well as Selective medias like nutrient agar,manitol agar, cetramide and Mac-conkey agar were prepared.Subculturing was done atleast three to four times in order to obtain pure cultures. Morphology of the isolated organisms was studied along with gram staining,cultural characheristics and biochemical tests were performed.

Culturing on nutrient agar plate

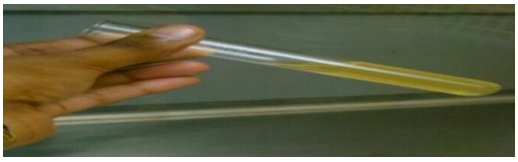
Culturing on nutrient agar plate

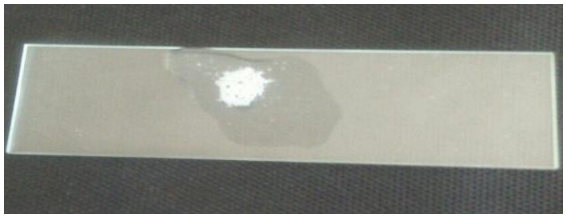


III. BIOCHEMICAL TESTS

The primary identification of the bacterial isolates was made based on colonial appearance and pigmentation. Biochemical tests were performed to

identify the isolates.Biochemical tests applied were standard catalase test, citrate utilization, coagulase, oxidase test,carbohydrate fermentation test using glucose, sucrose, maltose.





IV. RESULT AND DISCUSION

A total of 30 patients with different types of wounds samples were selected for sample collection during the study period. Four types of bacterial species were isolated and identified by selective culture medium and standard biochemical tests. Each wound samples showed one or more bacterial isolate, totally 78.9% of samples exhibited 24 isolates. Among them, *Pseudomonas aeruginosa* was the predominant species isolated, followed by *Staphylococcus aureus* and lowest percentage was recorded by *Escherichia coli* . Bacterial isolates were identified using biochemical tests and cultural characteristics. There was almost equal prevalence of gram positive and gram negative bacteria in hospitalized patients. *P.aeruginosa* and *Staphylococcus aureus* were commonly found in wound infections. Moreover enterococci are less comonlyfound in skin or wound infections.

ACKNOWLEDGMENT

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REFERENCES

[1] McManus AT, Mason AD, McManus WF, Prutt BA (1994). A decade of reduced Gram-negative infections and mortality associated with improved isolation of burned patients. Arch. Surg. 129:1306-1309.

[2] Vindences H and Bjerknes R (1995). Microbial colonization of large wounds. Burns.21: 575-579.

[3] Pruitt BA, McManus AT, Kim SH and Goodwin CW (1998).Burn wound infections: current status. World J Surg.

[4] Pruitt BA, Colonel MC and McManus AD (1984). Opportunistic infections in severely burnt patients. Am J Med.

[5] Order SE, Mason AD, Switzer WF and Moncrief JA (1965). Arterial vascular occlusion and devitalization of burn wounds. Ann Surg. 161: 502-508.

[6] Gupta M, Gupta OK, Yaduvansh RK and Upadhyahy J (1993). Burn epidemiology: the pink city scene. Burns 19: 47-51.

[7] Luterman A, Dasco CC and Curreri PW (1986). Infection in burn patients. Am J Med. 81: 45-52.

[8] Ogunsola FT, Oduyebo O, Iregbu KC, Coker AO and Adetunji A (1998). A review of nosocomial infections at LUTH: problems and strategies for improvement. J Nigerian infection Control Association. 1: 14-20.

[9] Mooney DP and Gamelli RL (1989). Sepsis following thermal injury. Comp Ther. 15:22 29.

[10] Monafo WW and Freedman B (1987). Topical therapy for burns. Surg Clin North Am. 67: 133-145.

[11] Hansbrough JF (1987). Burn wound sepsis. J Intensive Care Med. 2: 313-327.

[12] Manson WL, Pernot PC, Fidler V and Sauer EW (1992). Colonization of burns and duration of hospital stay of severely burned patients. J Hosp Infect. 22: 55-63.

[13] Forbes BA, Sahm DF, Weissfeld AS (1998). Bailley and Scott Diagnostic Microbiology. 10th ed., Mosby.

[14]. National Committee for Clinical Laboratory Standards (1993). Methods for determining bactericidal activity of antimicrobial agents.Tentative guidelines, M26-T NCCLS. Villanova, P

Isolation and Characterization of Different Types of Bacteria from Wound Samples

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***Abstract*: Samples of patients suffering from chronic wound infections were collectedandthese were processed for identification of various bacteria. Different types of bacterial species were isolated and identified by selective culture medium and standard biochemical tests from the collected wound samples. *Pseudomonas aeruginosa* was found to be the most common isolate followed by *Staphylococcus aureus*.**

Keywords*: *Wound samples, Pseudomonas aeruginosa, Staphylococcus aureus.

I. INTRODUCTION

A wound is a breakdown in the protective function of the skin which can be due to the loss of continuity of epithelium, with or without loss of underlying connective tissue .The wounds can be accidental, pathological or post-operative. An infection of this breach in continuity results in infection of wound. Wound infection is thus the presence of pus in a lesion as well as the general or local features of sepsis such as Pyrexia, pain and indurations. Infection can be a result of virulence factors expressed by one or more microorganisms in a wound whichhave capacity to compete the host's natural immune system.

Wound infections are one of the most common hospital acquired infections and are an important cause of morbidity and account for 70-80% mortality (Gottrup et al., 2005; Wilson et al., 2004). Wound infections can be caused by different groups of microorganisms like bacteria, fungi and protozoa. However, different microorganisms may exist in polymicrobial communities especially in the margins of wounds and in chronic wounds (Percevil and Bowler, 2001). The infecting microorganism may be aerobic or sometimes anaerobic. Most commonly isolated aerobic microorganism include *Staphylococcus aureus*, Coagulase-negative *Staphylococci* (CoNS), *Enterococci*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Enterobacter* species, *Proteus mirabilis*, *Candida albicans* and *Acinetobacter* ((Rajendra Gautam et al., 2013; Tayfour et al., 2005).

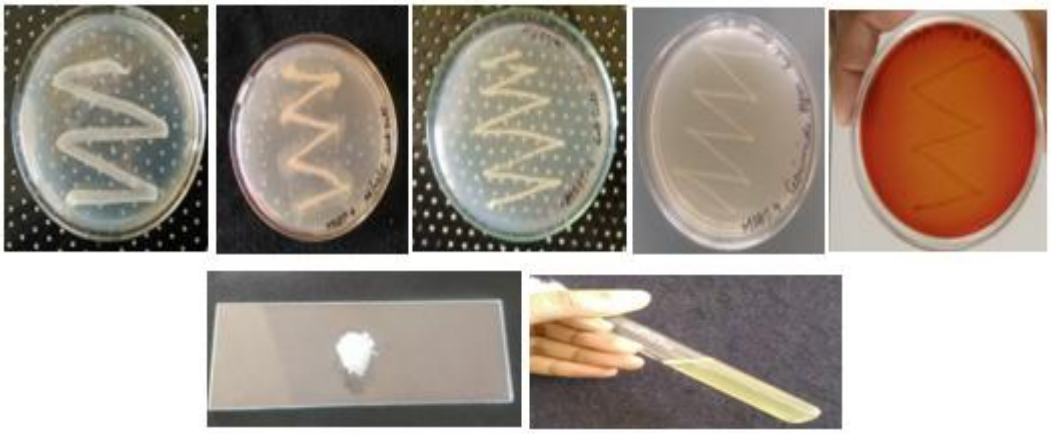
II. MATERIALS AND METHODS

A Collection of wound pus samples:

A total of 20 wound swabs were obtained from wound sites before the wound was cleaned using 70% alcohol. The specimen was collected on sterile cotton swab without contaminating them with skin commensals. Different types of wound samples were collected namely accident wound, post operation sepsis, skin infection and burn wound. All samples were collected from hospitals in Amritsar and properly labeled indicating the source and age of patients. The samples were transported soon to the laboratory after being obtained. In the laboratory, the specimens were registered and swabs were cultured on nutrient broth and incubated at 37□C for 24 hr.

B Isolation and identification of wound bacterial isolates:

Culture plates of Eosin methylene blue agar, MacConkey agar, Nutrient agar, Citramide agar and Mannitol salt agar were used. The swab sticks used for the collection of the samples were streaked directly on the labeled agar plates and incubated at 37°C for 24 h. After incubation, cultures were examined for significant growth. Subcultures were then made into plates of nutrient agar and incubated for another 24 h. The primary identification of the bacterial isolates was made based on colonial appearance and pigmentation. Biochemical tests were performed to identify the isolates. Biochemical tests applied were standard catalase test, coagulase, oxidase, gelatine test, carbohydrate fermentation test using glucose, sucrose, maltose and lactose. Characterization and identification of the isolates was done using the methods of Cowanand Steel (1985), Cheesbrough (2004).



III. RESULTS AND DISCUSSION

A total of 20 patients with different types of wounds samples were collected during the study period. Different types of bacterial species were isolated and identified by selective culture medium and standard biochemical tests. Each wound samples showed one or more bacterial isolate. Among them, Pseudomonas aeruginosa was the predominant followed by Staphylococcus aureus and the lowest percentage was recorded by *Escherichia coli*. Bacterial isolates were identified using biochemical tests and cultural characteristics. Gram positive cocci were associated more conspicuously with wound infections in hospitalized patients than in the out patients. There was almost equal prevalence of gram positive and gram negative bacteria in hospitalized patients. *Staphylococcus aureus* and *Pseudomonas aeruginosa* were commonly found in wound infections.

Moreover, enterococcal infections are reported very less frequently (Anbumani *et al*., 2006). Similarly, this study also revealed the prevalence of *S. aureus* other than enterobacteriaceae bacteria such as *K. pneumoniae, P. aeruginosa* and *E. coli* in different wound infections. Polymicrobial etiology among *S. aureus* and *P. aeruginosa* occurred frequently in wound infections (Anbumani *et al*., 2006). This study also revealed poly microbial etiology among *S. aureus* and *K. pneumonia.*

Sample Identification No.	Morphology & Gram Staining Reaction	Specific media	Biochemical Characterization	
			Catalase	Oxidase
1.*Pseudomonas aeruginosa*	gram-negative rod-shaped, pinkish colored colonies	Cetrimide agar	+	+
2. *Pseudomonas aeruginosa*	gram-negative rod-shaped, pinkish colored colonies	Cetrimide agar	+	+
3. *Pseudomonas aeruginosa*	gram-negative rod-shaped, pinkish colored colonies	Cetrimide agar	+	+
4. *Staphylococcus aureus*	gram-positive coccus shaped purplish colored colonies	Mannitol Salt agar	+	-
5. *Pseudomonas aeruginosa*	gram-negative rod-shaped, pinkish colored colonies	Cetrimide agar	+	+
6. *Pseudomonas aeruginosa*	gram-negative rod-shaped, pinkish colored colonies	Cetrimide agar	+	+
7. *Staphylococcus aureus*	gram-positive coccus shaped purplish colored colonies	Mannitol Salt agar	+	-
8. *Staphylococcus aureus*	gram-positive coccus shaped purplish colored colonies	Mannitol Salt agar	+	-
9. *Pseudomonas aeruginosa*	gram-negative rod-shaped, pinkish colored colonies	Cetrimide agar	+	+
10. *E. coli*	gram-negative rod-shaped pinkish colored colonies	MacConkey's agar	+	-
11.*Pseudomonas aeruginosa*	gram-negative rod-shaped, pinkish colored colonies	Cetrimide agar	+	+
12. *Pseudomonas aeruginosa*	gram-negative rod-shaped, pinkish colored colonies	Cetrimide agar	+	+
13. *Pseudomonas aeruginosa*	gram-negative rod-shaped, pinkish colored colonies	Cetrimide agar	+	+
14. *E. coli*	gram-negative rod-shaped pinkish colored colonies	MacConkey's agar	+	-
15. *Pseudomonas aeruginosa*	gram-negative rod-shaped, pinkish colored colonies	Cetrimide agar	+	+
16. *Pseudomonas aeruginosa*	gram-negative rod-shaped, pinkish colored colonies	Cetrimide agar	+	+
17. *Pseudomonas aeruginosa*	gram-negative rod-shaped, pinkish colored colonies	Cetrimide agar	+	+
18. *Staphylococcus aureus*	gram-positive coccus shaped purplish colored colonies	Mannitol Salt agar	+	-
19. *Pseudomonas aeruginosa*	gram-negative rod-shaped, pinkish colored colonies	Cetrimide agar	+	+
20. *Staphylococcus aureus*	gram-positive coccus shaped purplish colored colonies	Mannitol Salt agar	+	-

In this study, highest occurrence were observed in burn wound samples (44%) and second most is the accident and post-operative wound samples (25%) followed by skin wound samples (24%).

IV. CONCLUSION

This study revealed the presence of wound infection causing bacteria, those are capable of causing various human illness. The bacterial isolates screened in various wound infections includes Burn (43.7%), accident wound (25%), post operative wound (25%) and skin infections (24%). The bacterial isolates of different wound infections were *P. aeruginosa*, S. aureus, and *E. coli*. Further, it is necessary to treat wound infected patients with appropriate antibiotics after sensitivity testing. Health education programme and hygienic practices should be adopted in order to

avoid community acquired spreading of wound infections causing bacteria.

REFERENCES

[1]. Agnihotri, N., Gupta, V. and Joshi, R.M. 2004. Aerobic bacterial isolate from burn wound infections and their antibiograms: A five-year study. *Burns*. 30: 241-243.

[2]. Anbumani, N., Kalyan, J. and Mallika, M. 2006. Epidemiology and microbiology of wound infections. Ind. J. Practising Doctor. 3(5): 11-12.

[3]. Baquero, F. 1997. Gram positive resistance: Challenge for the development of new antibiotics. *J. Antimicrob. Chemotherp*. 39: 1-6.

[4]. Cheesbrough, M. 2004. Morphology and characterization of *E. coli* and *S. aureus*. District laboratory practice in tropical countries part II. Cambridge University. pp.157-179.

[5]. Church, D., Elsayed, S., Reid, O., Winston, B. And Lindsay, R. 2006. Burn wound infections. *Clin. Microbiol. Rev.* 19(2): 403-434.

[6]. Cowan, S.T. and Steel, K.J. 1985. Manual for the identification of medical bacteria (4th Ed.). Cambridge University Press. London. p.217.

[7]. Donati, L., Scammazo, F., Gervasoni, M., Magliano, A., Stankow, B. and Fraschini, R. 1993. Infection and antibiotic therapy in 4000 burned patients in Milani Italy between 1976 and 1988. *Burns*. 4: 345-348.

[8]. Heinzelmann, M., Scott, M. and Lam, T. 2002. Factors predisposing to bacterial invasion and infection. *Am. J.Surg.* 183(2): 179-190.

[9]. Lawrence, J.C. and Lilly, H.A. 1972. A quantitative method for investigating the bacteriology of skin: Its

application to burns. *Br. J. Exp. Pathol.* 53(5):550-559.

[10]. Mathur, T., Singhal, S., Khan, S., Upadhyay, D.J., Fatma, T. and Rattan, A. 2006. Detection of bio-film

[11]. Formation among the clinical isolates of *Staphylococci*: An evaluation of three different screening methods. *Ind. J. Med. Microbiol.* 24(1): 25-29.

[12]. Mc Manus, A.T., Mason, A.D., McManus, W.F. and Pruitt, B.A. 1994. A decade of reduced gram-negative infections and mortality improved isolation of burned patients. *Arch. Surg*. 129: 1306-1309.

[13]. Muhammad, N.S., Naheed, A., Iftikhar, H.K., Arif, B.M. and Faisal, W. 2012. Bacterial profile of burn wound infections in burn patients. *Ann. Pak. Inst. Med. Sci*. 8(1): 54-57.

[14]. Riaz, I. and Babar, A.H. 1996. Burn wound microfloraand their sensitivity pattern: A prospective study. *Pak. J.Surg*. 12: 30-32.

[15]. Senthilkumar, B., Senthilkumar, N. andGurusubramanium, G. 2012. Practical Microbiology-Alaboratory manual. Panima Publishing Corporation, NewDelhi, India (in press).

[16]. Siddique, N.A. 1998. Burn injury is preventable. An analysis of 716 cases in a burn unit. *JCPSP*. 8:14

Isolation and Characterization of Malassezia Furfur

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Abstract: **Malassezia species were identified by culturing on Saboured Dextrose Agar (SDA) and Potato Dextrose Agar (PDA) containing Chloramphenicol and Ampicillin to avoid growth of bacterial contaminants. The isolates were identified on basis of morphological, biochemical and physiological characteristics. Biochemical tests were carried out, yielding negative esculin hydrolysis test and positive catalase reaction which are typical of *Malassezia furfur*. Microscopic examination was done by preparing Lactophenol cotton blue wet mount of the samples from 25 patients where 7 patients showed negative result while in 18 patients the smear showed characteristic sphagetti and meatball appearance of hyphal growth and microconidia respectively; the only characteristic microscopic appearance that differentiates *M. furfur* from other species of *Malassezia*. Growth was obtained on SDA and PDA with olive oil and 75% of the isolates obtained were *M.furfur*.**

Keywords: Malassezia furfur, Dandruff, Isolation, Identification.

I. INTRODUCTION

Malassezia (formerly known as Pityriasis) is a genus of related fungi. These yeasts are naturally found on skin surfaces of many animals including man . *Malassezia* belongs to the division of fungi Basidiomycota in the class Exobasidiomycetes (those found outside the host body) and in the order *Malasseziales*. Dandruff is a condition characterized by flaking of skin (most commonly scalp skin) resulting from rapid turnover and release of skin cells. Two types of dandruff are mainly observed:

A. Pityriasis-capitis
B. Seborrhea dermatitis

Dandruff is reliant on three factors that favor its survival and reproduction which include:

- sSebum production
- Microbial metabolism
- Susceptibility of individual.

II. MATERIALS AND METHODS

A. Sample Collection

A sharp and sterile scalpel was used to detach the hair and scalp samples from the infected persons . The infected region was first washed with 70% ethanol followed by scraping with the sterile scalpel. The specimen was then transferred into a sterile petri plate.

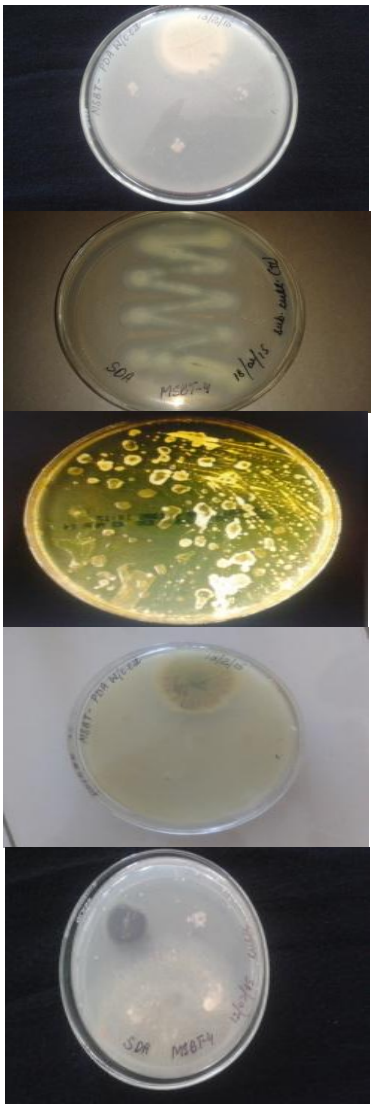

Figure 1: Isolated samples of Malassezia furfur

B. Sample Analysis

a) Direct microscopy

A drop of 70% Alcohol, lactophenol cotton blue was introduced onto a slide containing the sample and covered with cover slip.

b) Culture

The samples collected were cultured on SDA (Saboraud Dextrose Agar) and PDA (Potato Dextrose Agar) incorporated with Chloramphenicol and Ampicillin to rid the media of bacterial contaminants. Small amounts of the samples collected were introduced into Petri dishes Containing the media using sterile forceps. The Petri dishes were then labelled and incubated at room temperature ($25^{o-}32^{0}$C) for three days and then, up to a week .

c) Biochemical tests

- *Catalase test*

Catalase test was carried out to ascertain the presence of *M. furfur* as it is, unlike *M. restricta* that is catalase negative, catalase positive. 3 ml of 3% hydrogen peroxide (H_2O_2) solution was poured into a test tube. Several colonies of the isolated fungal colonies were immersed into the test tube using a sterile glass rod. Active bubbling observed, signifying the release of oxygen from the H_2O_2 indicated positive test for catalase production .

- *Esculin hydrolysis test*

The medium used was bile esculin agar slant; a nutrient agar-based medium containing 0.1% esculin and 10% bile salts, and allowed to solidify at a slant. The bile salts inhibit some bacteria, and so the ability to grow in the presence of bile salts represents a second test use for the medium. An inoculum from a pure culture was aseptically transferred to a sterile tube of ile esculin agar and streaked along the slant. The medium was not stabbed anyway.

The inoculated tube was incubated at 35-37^{o}C for 24 hours and the results were determined. Abundant growth on the slant indicated a positive test for growth in the presence of bile. *M. furfur* is negative for this test.

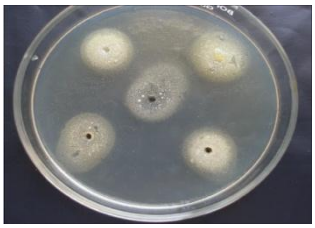

Figure2: Hydrolysis of Esculin

III. RESULTS

Out of the 25samples, 18 showed hyphae and conidiospores exhibiting the characteristic "sphagetti and meatball". All the 25 samples exhibited growth on SDA and PDA.

Identification of *M. furfur* was based on characteristic "sphagetti and meatball" appearance by direct microscopy using KOH as well as Indian Ink /LCB preparation as well as biochemical tests.

Sample No.	**Colony characteristics on specific media**		**Growth characteristics**			**Catalase reaction**	**Assimilation of glycine**
	Size	**Color/morphology**	**SDA**	**TE slant**	**EL slant**		
1.M.furfur	Small	Creamy, Round	Growth Observed	Growth & no Change	Growth Observed	+ve	+ve
2.M.furfur	Small	Creamy, Round	Growth Observed	Growth & no Change	Growth Observed	+ve	+ve
3. M.furfur	Small	Yellowish Brown, Round	Growth Observed	Growth & no Change	Growth Observed	+ve	+ve
4. M.furfur	Small	Creamy, Round	Growth Observed	Growth & no Change	Growth Observed	+ve	+ve
5.M.globosa	Large	Brown, Round	Growth Observed	Growth& Blackzone	Growth Observed	+ve	+ve
6. M.furfur	Small	Creamy, Round	Growth Observed	Growth & no Change	Growth Observed	+ve	+ve
7.M.globosa	Large	Brown, convex pointed centers	Growth Observed	Growth& Blackzone	Growth Observed	+ve	+ve
8. M.furfur	Small	Yellowish Brown	Growth Observed	Growth & no Change	Growth Observed	+ve	+ve
9. M.furfur	Small	Creamy, Round	Growth Observed	Growth & no Change	Growth Observed	+ve	+ve
10.M.furfur	Small	Creamy, Round	Growth Observed	Growth & no Change	Growth Observed	+ve	+ve
11.M.furfur	Small	Creamy, Round	Growth Observed	Growth & no Change	Growth Observed	+ve	+ve
12. M.furfur	Small	Yellowish Brown, Round	Growth Observed	Growth & no Change	Growth Observed	+ve	+ve
13. M.furfur	Small	Creamy, Round	Growth Observed	Growth & no Change	Growth Observed	+ve	+ve
14.M.globosa	Large	Brown, Round	Growth Observed	Growth& Blackzone	Growth Observed	+ve	+ve
15. M.furfur	Small	Creamy, Round	Growth Observed	Growth & no Change	Growth Observed	+ve	+ve

16.M.globosa	Large	Brown, convex pointed centers	Growth Observed	Growth& Blackzone	Growth Observed	+ve	+ve
17. M.furfur	Small	Yellowish Brown	Growth Observed	Growth & no Change	Growth Observed	+ve	+ve
18. M.furfur	Small	Creamy, Round	Growth Observed	Growth & no Change	Growth Observed	+ve	+ve
19.M.furfur	Small	Creamy, Round	Growth Observed	Growth & no Change	Growth Observed	+ve	+ve
20.M.furfur	Small	Creamy, Round	Growth Observed	Growth & no Change	Growth Observed	+ve	+ve
21. M.furfur	Small	Yellowish Brown, Round	Growth Observed	Growth & no Change	Growth Observed	+ve	+ve
22. M.furfur	Small	Creamy, Round	Growth Observed	Growth & no Change	Growth Observed	+ve	+ve
23.M.globosa	Large	Brown, Round	Growth Observed	Growth& Blackzone	Growth Observed	+ve	+ve
24.M.globosa	Large	Brown, convex pointed centers	Growth Observed	Growth& Blackzone	Growth Observed	+ve	+ve
25.M.globosa	Large	Brown, convex pointed centers	Growth Observed	Growth& Blackzone	Growth Observed	+ve	+ve

IV. DISCUSSION

Present study is confined to identification of Malassezia species from the scrapings of scalp of the patients between age group 18-21years by direct microscopy conducted using 70% Alcohol and Lactophenol cotton blue. Based on the microscopy, *M. furfur* was the predominant species which shows sphagetti and meatball appearance of mycelia and microconidia respectively. However, the catalase production test shows that in addition to *M. furfur* which is catalase positive, some other Malassezia species are also positive, including *M. sympodialis*, *M. obtus*. The only negative one is *M. restricta*.

V. CONCLUSION

Based on the morphology, colony characteristics and biochemical properties of the scalp and hair scrapings as well as the microscopic morphology in Gram stained smears, the 18 specimens out of 25 were identified as *M. furfur* .

REFERENCES

[1] Ashbee, H.R. and Evans, E.G.V. (2002). Immunology of diseases associated with Malassezia species. Clin. Microbiol Rev 2002; 15(1):21-57.

[2] Batra R., Boekhout T., Gueho E., Cabanes F.J., Dawson T.L. and Gupta A.K. (2005). "Malassezia Baillon, emerging clinical yeasts" FEMS Yeast Res 5(12) 1101-13

[3] BBC News (06-11-2007). Genetic code of dandruff cracked. Retrieved 20-04- 2010.

[4] Cheesbrough M. (2000). Fungal Pathogens. District Laboratory Practice in Tropical Countries, Part 2. Pp. 235-48. Cambridge University Press.

[5] Crespo V.E., Ojeda A.M., Vera A.C., Crespo A.E and Sanchez F.F. (2000). Malassezia globosa as the causative agent of Pityriasis versicolor. British Journal of Dermatology. 143:799-803.

[6] Dawson T.L. (2006). "Malassezia and Seborrheic dermatitis: etiology and treatment." Journal of cosmetic Science 57(2): 181-2.

[7] Gemmer C.M., DeAngelis Y.M., Theelen B., Boekhout T. and Dawson T.L. Jr (2000). Fast Noninvasive Method for Molecular Detection and Differentiation of Malassezia species on Human Skin and Application of the Method to Dandruff Microbiology. J. Clin. Microbiol. 40(9): 3350-7.

[8] Gueho E., Midgley G and Guillot J. (1996). The genus Malassezia with description of four new species. Antonie Van Leeuwenhoek. 69:337-55.

[9] Gupta A.K., Batra R., Bluhm R., Boekhout T. and Dawson T.L. (2004). " Skin diseases associated with Malassezia species". J. Am. Acad. Dermatol. 51(5): 785-98.

[10] Inamadar A.C. and Palit A. (2003). "The genus Malassezia and human disease". Indian J. Dermatol. Venereol Leprol 69(4): 265-70.

Track-4

Technical Session 1

CHEMISTRY & EVS

Polymers as Micro/Nano Ensembles and its Characterization

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***Abstract*- The fabrication of these micro/ nano materials have extensive range of applications in the variety of fields of science and technology including material based technologies, micro-engineering, powerful electronics and optoelectronic devices, magnetic devices, chemical and biosensors. Inspite of the fact that there exists variety of technique like electron/ion beam lithography, photolithography etc. for growing such ensembles but structures grown through electrode position technique is very simple and inexpensive and can generate micro/nanostructures with high aspect ratio and different geometrical shapes of not only metals but also semiconductors or metal-semiconductor junctions.**

We have used this technique of electrode position involving template growth of (homo and hetero) structures of metal and metal-semiconductor (Cu-Se) through the pores of ITFs of Makrofol. The profile characterization of these microstructures involving metal-semiconductor junctions was studied using XRD and nano photographs of metal (Cu) were obtained using SEM through Makrofol .

Keyword- polymers, track-etch membrane, nanotechnology, template synthesis.

I. INTRODUCTION

Ion Track Filters (ITFs) are defined by independent parameters viz. pore diameter, thickness and areal density of pores and are produced by physico-chemical treatments to thin films of polymers irradiated by heavy ions. One of the most potential and technological use of ion track filters (ITFs) lies in their use in synthesizing micro/nano structures, whiskers, fibrils, tubules, quantum wires and dots.

During the past several years, various new microporous membranes and filters have been developed for use in the fields of science and technology, viz. health, medicine, air pollution, beverage industries, development of microtubules, material science characterization, etc. These filters are generally made from polymeric materials, ceramics and minerals. The technique that led to the development of etched track membranes was first discovered by Price and Walker[1]. They found that the damage trails in insulating materials caused by the ionization as a result of the passage of travelling charged

particles can be revealed by the chemical etching to form the cylindrical pores. They observed the fine pores due to fission fragments in 12 μ m thick layer of synthetic mica. Since 1972, fission fragments from various radioactive sources have been used for the commercial manufacture of nuclear track filters up to 10 μm track length[2]. Heavy ion accelerators are a promising alternative for generating these filters. In order to produce ion track filters, thin sheets of plastics are exposed to a collimated beam of particles from an accelerator having different energies. When heavy charged particles pass through these thin foils, they produce continuous damage along their path and thus leave behind a trail of radiation-damaged material. The chemical etching of these irradiated foils leads to the formation of fine hollow channels along the path of the charged particles due to preferential etching along the latent trail. If the thickness of the sheet is less than the particle range in it, the above process leads to the formation of the fine pores in the irradiated sheet.

The porosity of these membranes can be controlled by the flux of the ion beam and pore diameter can be controlled by ion characteristics and etching parameters like etching time, etching temperature, etchant concentration, etc. Filters of diameter from 50 Å to a few microns can be produced by this method in minerals and various plastics. Ion track filters are mainly divided into two categories: (a) Single pore filters and (b) Multi-pore filters. Single pore track filters can be produced from the accelerator by controlling the beam optics and fluence of the heavy ion beam.

II. MATERIALS

The materials used for the production of single and multi-pore ion track filters and their etching conditions are summarized in Table 1.

Table1. Some ion track recording films with typical etching conditions used for production of ITFs.

Table 1. Some ion track recording films with typical etching conditions used for production of ITFs

Material	Etching condition
Makrofol (N, KG, SKG)	5.0–7.0 N NaOH at 40–70°C
Kapton-H and F $[C_{22}H_{10}O_5N_2]_n$	(a) 1.0 N KOH in 80% ethanol and 20% H_2O (b) Sodium hypochlorite (NaOCl)
Polyvinylidene fluoride (PVDF, CH_2CF_2)	(a) 5–10 N NaOH (b) KOH + $KMnO_4$ at 70°C
CR-39 ($C_{12}H_{18}O_7$)	6.25 N NaOH at 70°C
Lexan polycarbonate ($C_{16}H_{14}O_3$)	5.0–7.0 N NaOH at 50–70°C
Muscovite mica	48 vol% HF at 23°C
Cellulose nitrate	2.5–5.0 N NaOH at 40–60°C

Table 2. Activation energies for bulk etching, E_b, for different track recording films

Table 2. Activation energies for bulk etching, E_b, for different track recording films

Film	Etchant	E_b (eV)
Makrofol-KG	6.0 N NaOH	0.61
	6.5 N KOH	0.62
SR-86	6.0 N NaOH	0.67
	6.5 N KOH	0.62
Kapton	NaOCl	0.41
Lexan polycarbonate	6.25 N NaOH	0.68
CR-39	6.25 N NaOH	0.74
	6.5 N KOH	0.76

III. DEVELOPMENT OF ION TRACK FILTERS

Samples of various polymer films have been irradiated by different heavy ion beams from the UNILAC accelerator at GSI, Darmstadt, Germany. Details of ion beams, irradiation and chemical etching parameters are as follows:

- Production of filters in Makrofol-KG

The samples of Makrofol-KG have been irradiated by the ^{132}Xe (14.5 and 5.9 MeV/u), ^{208}Pb (13.6 MeV/u) and ^{238}U (14.0 MeV/u) heavy ions. All the irradiations were made at an angle of 90° with respect to the surface of the detector. The irradiated samples were cut into small pieces and etched in 6.0 N NaOH solution at various temperatures, viz. 40, 50, 60 and 70°C. The etched samples were dried in the folds of a tissue paper. The etched and dried samples were scanned under a Carl Zeiss optical microscope. The bulk etch rate (V_b) of the film is determined by using the thickness measurement technique[3]. The bulk etch rate V_b has an exponential dependence on the temperature of the etching solution as given by the relation[4]

$$V_b = A_b e^{-Eb/kT}$$

where, A_b is the pre-exponential constant, E_b the activation energy for the bulk etching, k the Boltzmann constant and T the temperature of the etchant. The value of activation energy for the bulk etching, E_b, is calculated (Figure 1) by plotting ln(V_b) vs 1000/T (K^{-1}). The activation energies for SR-86, lexan polycarbonate, CR-39 and Kapton have been determined by a similar way (Table 2). All the films were etched at different temperatures of 40, 50, 60 and 70°C in different recommended solutions. The photomicrograph of the observed ion (^{132}Xe) track pores in Makrofol-KG is shown in Figure 2. The variation of pore diameter (for ^{132}Xe heavy ion) with etching time at different temperatures is shown in Figure 3.

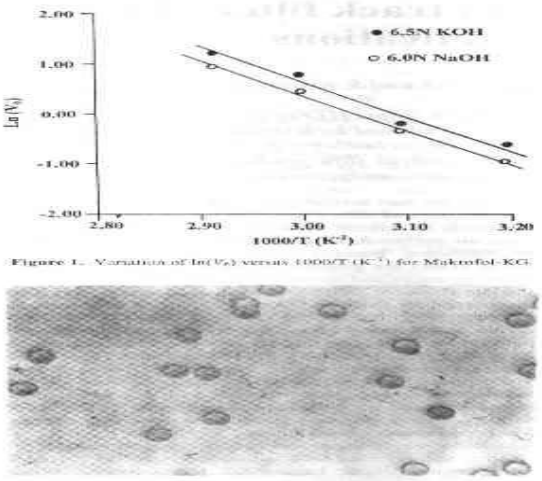

Fig.1 Variation of ln (V_A) versus 1000/T(K^{-1}) for Makrofol-KG.

Fig.2 Photomicrograph of ^{132}Xe (14.5 MeV/u) ion track pores (~13.3 µm) in Makrofol-KG.

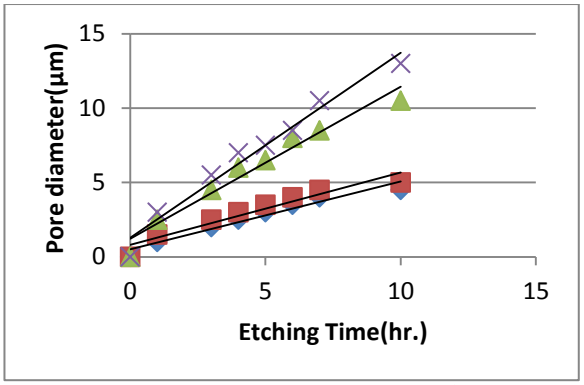

Fig. 3 Variation of pore diameter with etching time for ^{132}Xe (14.5 MeV/u) at various temperatures of etching solution in Makrofol- KG.

IV. FABRICATION OF METAL & METAL-SEMICONDUCTOR NANO/MICROSTRUCTURES

Fabrication of nanostructures is being considered a potential technology not only for use in nano mechanics and nano electronics but also in the studies pertaining to behaviour of materials at micro and nano levels. Nanostructures comprising nano-dimensional devices, dots, fibrils, wires, cones, tubules and whiskers have invited attention for use in multidisciplinary areas[5]. There are different techniques for the development of nanostructures[6] but template growth through the etched pores considered to be very simple and nanostructures with extraordinary low dimensions have been reported by Wu and Bein[7]. The methodology of the development of nanostructures is based upon the earlier work of Possin[8] and Penner and Martin[9] producing thin metal wires, etc. This simple and well known underlying concept of electrode position of metals is described as an electrochemical process in which metallic ions in supporting solution are reduced to the metallic state at the cathode if it is covered by an ion track membrane, and thus would lead to the formation of growth of plated film as embodiment of micro and nano-structures[11-14] as shown in Fig. 4. After chemical dissolution or peeling off the polymer film from the metal substrate, the free metallic whiskers are obtained.

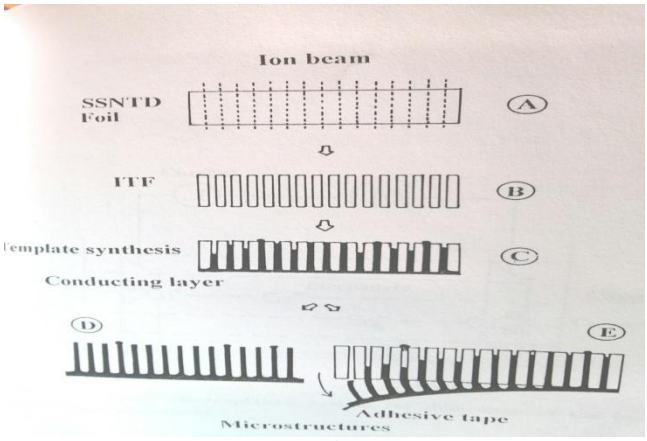

Fig 4. Production of ITF as template

In the present work, we describe the simple method of electrode position of copper into the etched pores of polymeric ITFs by using an electrochemical cell[10]. The electrolyte used here is $CuSO_4.5H_2O$ acidic solution in high resistivity ion-free water + 25% vol. H_2SO_4. A current of 0.05 A/cm^2 was applied for 20 min. After the electrode position was over, the electrolyte was drained out and the copper electrode was detached from the copper substrate. After drying, the Makrofol-KG thin film was removed from the microstructure substrate by dissolving in chloroform ($CHCl_3$) followed by rinsing with water and ethanol. The developed microstructures were coated with gold by the sputtering method and then scanned under scanning electron microscope (SEM) "Carl Zeiss Supra-55 for morphological and structural studies. The nanostructures of copper (Cu) grown through the single and multipore ITFs of Makrofol-KG are shown in Figures 4 and 5 respectively. The metallic needles developed by this technique have various possible applications, e.g. field ion emitters, as a stylus in STM, cantilever of AFM, etc. For template synthesis of metal-semiconductor heterostructures, the synthesis is accomplished by filling desired metal from one side until the growth has taken place half-way through the pores.The process is interrupted, followed by deposition of required semi-conductor from electrolyte through the other side of the ITF. This process was used for fabrication of micro-diode arrays. The 3-dimensional heterostructure of Cu-Se was grown using electrolytes of $CuSO_4.5H_2O$ + 25% of dilute H_2SO_4 and $Na_2SeO_3.5H_2O$ by template synthesis technique. The X-ray diffraction pattern Fig. 6 clearly shows the peaks due to Cu-Se heterostructure and metallic Cu.

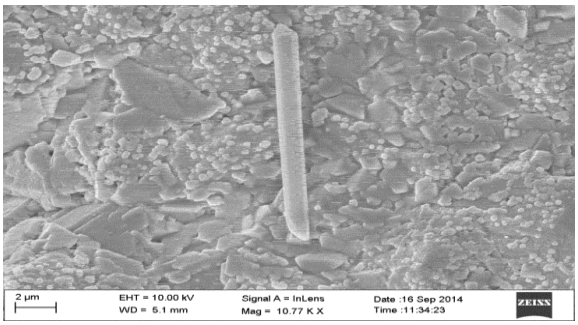

Fig.5 Nanostructure (scanned by SEM) ensembles of Cu grown electrochemically through single-pore of Makrofol-KG.

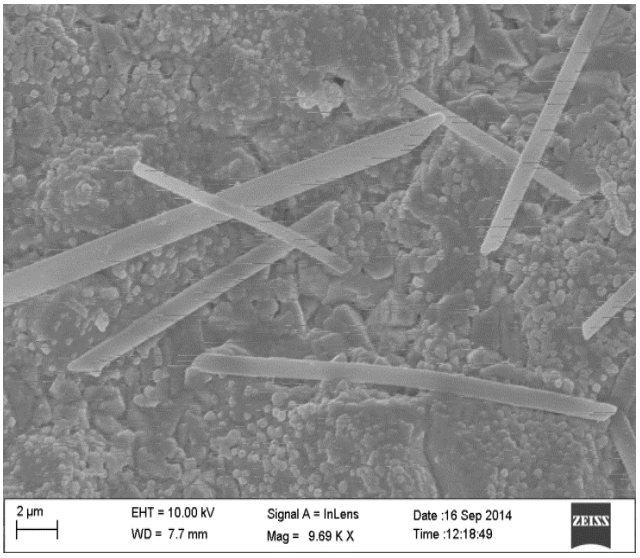

Fig.6 Nanostructure (scanned by SEM) ensembles of Cu grown electrochemically through multipore filter of Makrofol-KG.

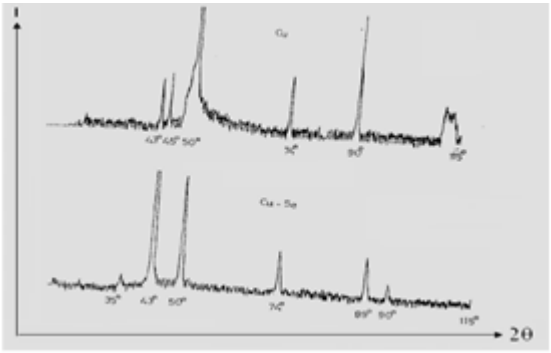

Fig.7. X Ray diffractogram of Cu and Cu-Se heterostructures showing different peaks.

V. CONCLUSION

Morphological and structural studies done through electrochemical methods and replicas of etched tracks in ITFs used as templates has various advantages. Firstly, it provides the finest and critical details of geometry and dimensions of nano/microstructural constituent elements. Secondly, it enables to study the various aspect of interaction of nuclear particle with the given material leading to the formation of tracks in ITFs. It is well known that parameters which control the shapes of track in ITFs include the nature of material, the ion beam and its energy deposition rate, pre and post- irradiation storage, environment and etch conditions. The metallic structures reveal the finer details of constituents of the etched pores of ITFs viz. diameter, length, shape (cylinder, conical etc.) were used for track profile studies.

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REFERENCES

[1]. P. B. Price and R. M. Walker, *United States Patent Office*, No. 3 303 085, Feb., 1967.

[2]. R. L. Fleischer, P. B.Price and R. M. Walker, *Nuclear Tracks in Solids: Principles and Applications*, University of California Press, Berkeley, 1975.

[3]. S. A. Durrani and R. K. Bull, Solid State Nuclear Track Detection: Principles, Methods and Applications, Pergamon Press, Oxford, 1987.

[4]. W. Enge, K. Grabisch, R. Beaujean and K. P. Barthloma, *Nucl. Instrum. Methods*, 115, 1975, 125–135.

[5]. R. Spohr, Ion Tracks and Microtechnology: Principles and Applications, Vieweg Verlag, 1990.

[6]. S. K. Chaksssarvarti and J. Vetter, Proceedings of the 10th National Conference on SSNTDs, Kurukshetra University, Kurukshetra, Oct., 1996, pp. 51–61.

[7]. Wu, C. G. and Bein T., *Science*, 264, 1994, 1757–1759.

[8]. G. E. Possin, *Rev. Sci. Instrum.*, 41, 1970, 772–774.

[9]. R. M. Penner and C. R. Martin, *Anal. Chem*., **59**, 1987, 2625–2628.

[10]. Chakarvarti, S. K. and Vetter, J., *Nucl. Instrum. Methods*, B62, 1991, 109–115.

[11]. M.E. Toimil Molares, N. Chtanko T.W. Cornelius, D. Dobrev, I. Enculescu, R.H. Blick and R. Neumann, *Nanotechnology* Vol.15(4), 2004, p. 5201.

[12]. S. Kumar asnd S.K. Chakarvarti*: J. of Nanomaterials & Biostructures* Vol. 1, 2006 p.139.

[13]. Latika Menon, in: Quantum Dots and Nanowires, edited by S. Bandyopadhyay and H.S.Nalwa), American Scientific Publishers, USA 2003, p. 142.

[14]. A.K. Ganguli and Tokeer Ahmad, J. of Nanoscience and Nanotechnology Vol. 7**,** 2007, p. 2029.

Enhancing Solubility of Poorly Water Soluble Drugs Witssh Surfactants by Micellization

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Abstract **- Surfactants are known to play important role in many processes of interest in both fundamental and applied science. The most important property of surfactant is the formation of micelle in solution, which have particular significance in medicine because of their ability to enhance the solubility of poorly water soluble drugs viz. Norfloxacin, Clofibrate, Glibenclamide , Taxol, Hydrochlorothizide etc. Poorly water soluble drugs often require high doses in order to reach therapeutic plasma concentration after oral administration. Low aqueous solubility is the major problem encountered with formulation development of new chemical entities. Any drug to be absorbed must be present in the form of an aqueous solution at the site of absorption. The use of surfactants to improve the dissolution performance of poorly soluble drugs has successfully employed. Surfactants can reduce surface tension and improve the dissolution of lipophilic drugs in aqueous medium. When the concentration of surfactants exceeds their Critical Micelle Concentration (CMC) it entraps the drugs within the micelles**

Keywords: Surfactants, Poorly Water Soluble Drugs, CMC, Micellization

I. INTRODUCTION

Amphiphiles nature has vital role in the existence of the life and widely used in the industry, medicine, pharmacology, etc. The single features of amphiphiles that give rise to broad utility is their ability to coexist with and function as an interface between polar and non-polar phases. This ability is determined by a balance between ionic and dipolar interactions with polar media and dispersion interactions with non-polar media.

II. SURFACTANTS AND GEMINI SURFACTANTS

Surfactants are amphiphilic molecules consist of hydrophobic or polar head group and hydrophilic or non-polar tail group. The head may be charged (anionic or cationic) , dipolar (zwitterionic) or non-charged (nonionic) in nature.Sodium dodecyl sulfate (SDS), dodecyltrimethylammonium bromide (DTAB), *n* -dodecyl tetra (ethylene oxide) ($C_{12}E_4$) and dioctanoyl phosphatidylcholine (C *8* -lecithin) are typical examples of anionic, cationic, nonionic and zwitterionic surfactants, respectively (Figure 1). The surfactant tail is usually a long chain hydrocarbon residue and less often a halogenated or oxygenated hydrocarbon or siloxane chain

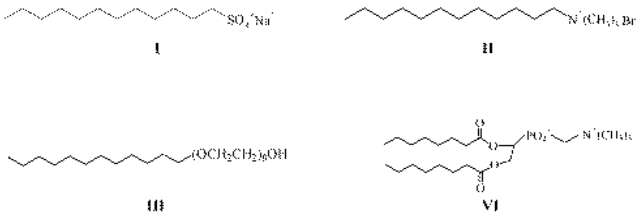

Figure 1: Examples of I-anionic (SDS), II-cationic (CTAB), III- nonionic (C12 E4) and VI-zwitterionic (C8 -lecithin) surfactants.

Gemini Surfactants: another class of amphiphilc molecules comprising two conventional surfactants linked by spacer at their head (Gemini) or tail (bolaamphiphile). The spacer may

II. CLASSIFICATION OF SURFACTANTS

A Cationic Surfactants

Most of cationic surfactants are based on the nitrogen atom carrying positive charge. Both amine and quaternary ammonium-based products are common[1-2]. A common class of cationics is the alkyl trimethyl ammonium chloride, where R contains 8–18 C atoms. Primary, secondary or tertiary amines of cationic surfactants are pH dependent. Primary amines become positively chsarged at pH < 10, secondary amines become charged at pH < 4. The prime use of cationic surfactants is their tendency to adsorb at negatively charged surfaces, e.g., anticorrosive agents for steel, flotation collectors for mineral ores, dispersants for inorganic pigments, antistatic agents for plastics, other antistatic agents and fabric softeners, hair conditioners, anticaking agent for fertilizers and as bactericides. *Examples:* Dodecyltrimethylammonium bromide CH3 (CH2)11N+ (CH3) Br– Dodecylamine hydrochloride CH3 (CH2)11N+H3 Cl–

B Anionic Surfactants

The Surfactants carrying negative charged head group , referred as anionic surfactants. Carboxylate (CnH2n+1COO–X+), sulfate (CnH2n+1OSO3–X+), and sulfonate ($C_nH_{2n+1}SO_3$–X+), are the polar groups found in anionic surfactants. These are the most widely used class of surfactants in industrial applications[3-4], due to their relatively low cost of manufacture. Anionics are used in most detergent formulations and the best detergency is obtained by alkyl and alkylarye chains in the C_{12}–C_{18} range. The counterions most commonly used are sodium,

potassium, ammonium, calcium and various protonated alkyl amines.

Examples: Sodium laurate , Sodium dodecylbenzene sulfonate

C Non-Ionic Surfactants

In these surfactants the head group or the surface active portion carry no charge, referred as non-ionic surfactants. Non-ionic surfactants have either a polyether or a polyhydroxy unit as the polar group. In most of non-ionics, the polar group is a polyether consisting of oxyethylene units, made by polymerization of ethylene oxide. Several classes can be distinguished: alcohol ethoxylates, alkyl phenol ethoxylates, fatty acid ethoxylates, monoalkanolamide ethoxylates, sorbitan ester ethoxylates, fatty amine ethoxylates and ethylene oxide–propylene oxide copolymers (sometimes referred to as polymeric surfactants).

Examples: Polyoxyethylene monohexadecyl ether , Polyoxyethylene octylphenylether

D Zwitterionic Surfactants

Zwitterionic surfactants contain two charged groups of different sign. Whereas the positive charge is generally ammonium, the source of negative charge may vary, most commonly it is carboxylate group.. Zwitterionics are often referred to as amphoterics. An amphoteric surfactant is one that changes from net cationic via zwitterionics to net anionic on going from low to high pH. Neither the acid nor the basic site is permanently charged, i.e., compound is only zwitterionic over a certain pH range.

The properties like foaming, wetting and detergency etc of these surfactants are greatly affected by change in pH. These will all depend strongly on solution pH. At the isoelectric point the physico-chemical behavior often resembles that of non-ionic surfactants. Zwitterionic group show excellent dermatological properties. They also show low eye irritation and are frequently used in shampoo and other cosmetic products. Common types of zwitterionic surfactants are N-alkyl derivatives of simple amino acid, such as glycine (NH_2CH_2COOH), betaine ($(CH_2)_2NCH_2COOH$) and amino propionoic acid ($NH_2CH_2CH_2COOH$).

Examples: 3-(Dimethyldodecylammonio)-propane-1-sulfonate , *N*-Dodecyl-*N*,*N*-dimethyl betaine

E Gemini Surfactants

A surfactant generally contains two conventional surfactants connected by spacer. Recently, there has been considerable research interest in a new class of surfactants, the gemini surfactants[5-7] have generated interest in colloid chemistry due to their better performance over conventional surfactants in various industrial and medicinal applications. Gemini surfactants are also referred to as twin surfactants, dimeric surfactants[8-9], or bis surfactants. The term "Gemini surfactant" (Figure 2) coined by Menger, has become accepted in the surfactant literature for describing dimeric surfactants, that is, surfactant molecules containing two hydrophobic groups and two hydrophilic groups, connected by a linkage (spacer) close to hydrophilic groups. A schematic representation of a gemini surfactant.. Most geminis are composed of two identical halves, but unsymmetrical gemini surfactants have also been synthesized, either having different hydrophobic tail lengths, or different types of polar groups (heterogemini surfactants), or both. The first reports on dimeric surfactants concerned bisquaternary ammonium halide surfactants which were used to catalyze chemical reactions[10].

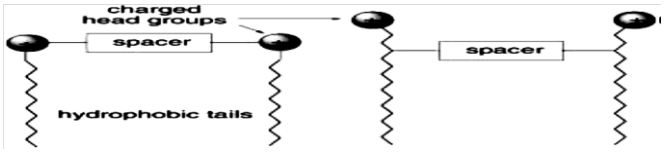

Figure 2. Structural representation of Gemini Surfactant

F Bolaform Surfactants

Connecting two surfactant moieties towards the end of their hydrophobic tail results in a so-called „bolaform surfactant" and the physico-chemical properties of such species are very different from those of conventional and gemini surfactants. Their self-association ability is less, compared to conventional ionic surfactants. However, they show biological activity[11-12] and some special bolaforms are capable giving rise to organized assemblies of peculiar structure[13].

III. MICELLE FORMATION & CRITICAL MICELLIZATION CONCENTRATION (CMC)

A surfactant, when present at low concentrations in a system, adsorbs onto surfaces or interfaces significantly changing the surface or interfacial free energy. Surfactants usually act to reduce the interfacial free energy, although there are occasions when they are used to increase it. When surfactant molecules are dissolved in water at concentrations above the *critical micelle concentration (cmc)* , they form aggregates known as micelles.

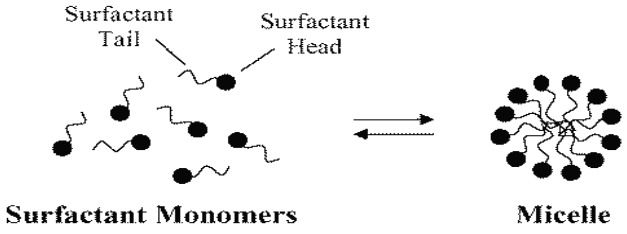

Figure 2: Schematic illustration of the reversible monomer-micelle thermodynamic equilibrium. The black circles represent the surfactant heads (hydrophilic moieties) and the black curved lines represent the surfactant tails (hydrophobic moieties**).**

In a micelle, the hydrophobic tails flock to the interior in order to minimize their contact with water, and the hydrophilic heads remain on the outer surface in order to maximize their contact with water (see Figure 2). The micellization process in water results from a delicate balance of intermolecular forces, including hydrophobic, steric, electrostatic, hydrogen bonding, and van der Waals interactions. The main attractive force results from the hydrophobic effect associated with the nonpolar surfactant

tails, and the main opposing repulsive force results from steric interactions and electrostatic interactions between the surfactant polar heads. Whether micellization occurs and, if so, at what concentration of monomeric surfactant, depends on the balance of the forces promoting micellization and those opposing it.

IV. SOLUBILITY OF DRUGS

More than 40% NCEs (new chemical entities) developed in pharmaceutical industry are practically insoluble in water. These poorly water soluble drugs having slow drug absorption leads to inadequate and variable bioavailability and gastrointestinal mucosal toxicity. For orally administered drugs solubility is the most important one rate limiting parameter to achieve their desired concentration in systemic circulation for pharmacological response. Problem of solubility is a major challenge for formulation scientist[14].

V. CLASSIFICATION OF DRUGS: (BCS) (BIOPHARMACEUTICS CLASSIFICATION SYSTEM)

Biopharmaceutical Classification System (BCS) based on its solubility and permeability. Bioavailability of drug affected by three major factor like solubility, permeability and dissolution. Bioavailability of drug may be defined as the rate and extent of drug which is present in systemic circulation at particular period of time.

Majority of drugs are present in second class of drug which is poorly soluble drug. BCS class of drug divided in to four categories-high solubility and high permeability, low solubility and high permeability, high solubility and low permeability, low solubility and low permeability. Solubility of drug can be increase by increasing of dissolution rate.

There are four types of drugs as per BCS**:**

According to the BCS class drugs are classified in four subtypes such as

A. Class I drugs

Drugs belong to this class has high solubility and high permeability. There is no problem related for bioavailability of this class drugs.

i.e. Verapamil, Diltizem, Metoprolol, Propranolol.

B. Class II drugs

Drugs belong to this class has low solubility and high permeability. There is problem related for bioavailability of this class drugs. Due to this for solubility improvement there are some techniques to improve solubility such as High-Pressure Homogenization, Solvent Evaporation, Solid dispersions and Spray-Drying Method.

E.g. Simvastatin, Valsartan, Glipizide, Omeprazole.

C. Class III drugs

Drugs belong to this class has high solubility and low permeability. Due to the low permeability of drug it is rate limiting step for drug absorption.

E.g. Acyclovir, Captopril, Cimetidine, Neomycin.

D. Class IV drugs

Drugs belong to this class has low solubility and low permeability. Due to the low solubility and low permeability of drug it is challenging for the oral route of absorption.

E.g. Taxol, Hydrochlorothizide**.**

Table 1. Biopharmaceutical classification systems (bcs) of drugs

Class I High solubility High permeability e.g. Verapamil, Propranolol	Class II Low solubility High permeability e.g. Simvastatin, Valsartan
Class III High solubility Low permeability e.g. Acyclovir, Captopril.	Class IV Low solubility Low permeability e. g. Taxol, Hydrochlorothizide

VI. MICELLAR SOLUBLIZATION

The use of surfactants to improve the dissolution performance of poorly soluble drug products has also been successfully employed. Surfactants can lower surface tension and improve the dissolution of lipophilic drugs in aqueous medium.[15-17]. They can also be used to stabilize drug suspensions. When the concentration of surfactants exceeds their critical micelle concentration (CMC, which is in the range of 0.05-0.10% for most surfactants), micelle formation occurs, entrapping the drugs within the micelles[18]. This process is known as micellisation and generally results in enhanced solubility of poorly soluble drugs. Commonly used non-ionic surfactants include polysorbates, polyoxy ethylated castor oil, polyoxyethylated glycerides, lauroyl macroglycerides and mono- and di-fatty acid esters of low molecular weight polyethylene glycols. Surfactants are also often used to stabilize microemulsions and suspensions into which drugs are dissolved[19-21]. Micellar solubilization is a widely used alternative for the dissolution of poorly soluble drugs[22-24].

Solubilization of poorly soluble drugs is one of the most important physicochemical properties for drug development since more than one-third of drugs are poorly water soluble or water insoluble. In order to prepare a liquid dosage formulation of these drugs, a solubilization technique is usually applied. The most commonly used techniques are pH adjustment, cosolvency, micellization, and complexation[25-28]. Cyclodextrins (CDs) are widely used as complexing agents for lipophilic and amphiphilic substances and functional excipients that have gained widespread use and attention because of their ability to solubilize, and in some instances stabilize, poorly water-soluble drug candidates enabling both oral and parenteral formulation [29-33].

VII. CONCLUSION

It is concluded that for the bioavailability of drugs in Gastrointestinal Track (GIT), it must be sufficiently soluble in aqueous medium. For enhancing the solubility of poorly water soluble drugs, various carbohydrate derived

surfactants were used in our laboratory, the result showed that the solubility of poorly water soluble drugs can be increased to many folds, viz. the solubility of Norfloxacin enhance by 32 times by encapsulating it in carbohydrate derived surfactants, these surfactants were synthesized in our lab by our team, and characterized by ^{1}H NMR, ^{13}C NMR, Mass spectroscopy and elemental analysis.

REFERENCES:

[1] *Cationic Surfactants,* E. Jungermann (Ed.), Marcel Dekker, New York, 1970.

[2] *Cationic Surfactants: Physical Chemistry,* D. N. Rubingh, P. M. Holland (Eds.), Marcel Dekker, New York, 1991.

[3] *Anionic Surfactants,* W. M. Linfield (Ed.), Marcel Dekker, New York, 1967.

[4] *Anionic Surfactants: Physical Chemistry of Surfactant Action,* E. H. Lucassen-Reynders (Ed.), Marcel Dekker, New York, 1981.

[5] S. De, V. K. Aswal, P. S. Goyal, S. Bhattacharya, *J. Phys. Chem.*, 100, **1996,** 11664.

[6] M. J. Rosen, D. J. Tracy, *J. Surfact. Deterg.*, 1, **1998,** 547.

[7] F. M. Menger, J. S. Keiper, *Angew. Chem. Int. Ed*., 39, **2000,** 1906.

[8] *Novel Surfactants,* K. Holmberg (Ed.), Marcel Dekker, New York, 1998.

[9] M. J. Rosen, *Surfactants and Interfacial Phenomena,* 3rd ed., John Wiley & Sons, New Jersey, 2004.

[10] C. A. Bunton, L. Robinson, J. Schaak, F. M. Stam, *J. Org. Chem.*, 36, **1971,** 2346

[11] F. M. Menger, S. Wrenn, *J. Phys. Chem.*, 78, **1974,** 1387.

[12] S. Agharkar, S. Lindenbaum, *J. Phys. Chem.*, 79, **1975,** 2068.

[13] R. Zana, in: *Specialist Surfactants,* I. D. Robb (Ed.), Blackie, Academic and Professional, New York, 1997.

[14] Sharma D, Soni M, Kumar S, Gupta GD. Solubility enhancement—eminent role in poorly soluble drugs. Research Journal of Pharmacy and Technology. 2009;2(2):220–224

[15] Torchilin, V.P. Structure and design of polymeric surfactant based drug delivery system, Journal of Control Release, 2001; 73, 137-172.

[16] Jones M.C, Leroux, J.C. Polymeric micelles- a new generation of colloidal drug carriers. *EuropeanJournal of* Pharmaceutics and Biopharmaceutics, 1999; 48, 101-111.

[17] Martin A, Physical Pharmacy, 4th edition, Baltimore, Willaims and Wilkins, 1993; 396-398.

[18] Dutt G.B., Rotational diffusion of hydrophobic probes in Brij-35 micelles, Effect of temperature on

miceller internal environment, Journal of Physical Chemistry B, 2003; 107: 10546-10551.

[19] Shirley S, Sonia V.P, Eneida P, Surface active drugs self-association and interaction with membranes and surfactants and Physicochemical and biological aspects, International Journal of Biochemistry, Biophysics and Molecular Biology, 2000; 1508, 210- 234.

[20] Carlota O.R, Adalberto P.J, Leoberto C.T. Micellar solubilization of drugs. Journal of Pharmacy and Pharmaceutical Sciences, 2005; 8(2), 147-163.

[21] Yua B. G, Okanob T, Kataokac K., Kwona G. Polymeric micelles for drug delivery, Solubilization and haemolytic activity of Amphotericin B. Journal of Control Release, 1998; 53, 131-136.

[22] K.G.H. Desai, A. R. Kulkarni, Aminabhavi TM, Solubility of rofecoxib in the presence of methanol, ethanol and sodium lauryl sulfate at (298.15, 303.15 and 308.15) K. Journal of Chem. Eng. Data 48:942–945 (2003).

[23] C. Liu, K. G. H. Desai, and C. Liu. Solubility of valdecoxib in the presence of Ethanol and Sodium lauryl sulfate at (298.15, 303.15 and 308.15) K. Journal of Chem. Eng. Data, 2004; 49, 1847–1850.

[24] K.G.H. Desai and H. J. Park. Solubility studies of valdecoxib in the presence of carriers, co-solvents and surfactants. Drug Development Research, 2004; 62, 41–48.

[25] Y. He and S. H. Yalkowsky, "Solubilization of monovalent weak electrolytes by micellization or complexation," International Journal of Pharmaceutics, vol. 314, no. 1, pp. 15–20, 2006

[26] S. Sweetana and M. J. Akers, "Solubility principles and practices for parenteral drug dosage form development," PDA Journal of Pharmaceutical Science and Technology, vol. 50, no. 5, pp. 330–342, 1996.

[27] P. Li, S. E. Tabibi, and S. H. Yalkowsky, "Solubilization of flavopiridol by pH control combined with cosolvents, surfactants, or complexants," Journal of Pharmaceutical Sciences, vol. 88, no. 9, pp. 945–947, 1999.

[28] A. T. Florence and D. Atwood, Physicochemical Principles of Pharmacy, Pharmaceutical Press, London, UK, 3rd edition, 1998.

[29] D. O. Thompson, "Cyclodextrins-enabling excipients: their present and future use in pharmaceuticals," Critical Reviews in Therapeutic Drug Carrier Systems, vol. 14, no. 1, pp. 1–104, 1997

[30] R. Challa, A. Ahuja, J. Ali, and R. K. Khar, "Cyclodextrins in drug delivery: an updated review,"AAPS PharmSciTech, vol. 6, no. 2, pp. E329–357, 2005.

[31] M. E. Davis and M. E. Brewster, "Cyclodextrin-based pharmaceutics: past, present and future,"Nature Reviews Drug Discovery, vol. 3, no. 12, pp. 1023–1035, 2004.

[32] T. Loftsson, M. E. Brewster, and M. Másson, "Role of cyclodextrins in improving oral drug delivery," American Journal of Drug Delivery, vol. 2, no. 4, pp. 261–275, 2004.

[33] T. Loftsson and M. Masson, "Cyclodextrins in topical drug formulations: theory and practice,"International Journal of Pharmaceutics, vol. 225, no. 1-2, pp. 15–30, 2001.

Advanced Adsorption Materials for Waste Water Treatment (Dye)

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***ABSTRACT*- The objective of this work is the study of adsorption of dye solution which is a mixture of three dyes (methylene blue, congo red & malachite green) using commercial activated carbon. Removal of these dyes from aqueous solution using commercial activated carbon has been investigated. Liquid phase adsorption experiments were conducted. Batch adsorption studies are carried out by observing the effect of experimental parameters, pH, amount of adsorbents, contact time and temperature. Adsorption capacity of activated carbon is determined for competitive adsorption of mixture of dyes. Optimum conditions for dye removal are studied like pH value, contact time required, amount of adsorbent, temp etc. The results generated by this paper can be used for determination of optimum conditions for adsorption of mixture of dyes in aqueous solutions. Dyes are present in mixture form in various industrial effluents like Textile Industries, Sewage water, Water treatment plants.**

Keywords: Adsorption, Dyes, Activated carbon

I. Introduction

Dyes have long been used in dyeing, paper and pulp, textiles, plastics, leather, cosmetics and food industries. Colour stuff discharged from these industries poses certain hazards and environmental problems. These coloured compounds are not only aesthetically releasing but also inhibiting sunlight penetration into the stream and affecting aquatic ecosystem. Dyes usually have complex aromatic molecular structures which make them more stable and difficult to biodegrade. Furthermore, many dyes are toxic to some microorganisms and may cause direct destruction or inhibition of their catalytic capabilities. There are various conventional methods of removing dyes including coagulation and flocculation, oxidation or ozonation and membrane separation. However, these methods are not widely used due to their high cost and economic disadvantage. Chemical and electrochemical oxidations, coagulation are generally not feasible on large scale industries. In contrast, an adsorption technique is by far the most versatile and widely used. The most common adsorbent materials are: alumina silica, metal hydroxides and activated carbon. Many researchers proved that, removal of dyes by activated carbon is economically favorable and technically easier. Activated carbon is widely used as an adsorbent due to its high adsorption capacity, high surface area, microporous structure, and high degree of surface respectively.

II. Materials and methods

A. ADSORBENT

Coconut shell activated carbon is used as adsorbent for dye removal. It is a form of carbon that has been processed to make it extremely porous and thus have a very large surface area available for adsorption or chemical reactions. The word activated in the name is sometimes substituted by active. Due to its high degree of microporosity, just 1 gram of activated carbon has a surface area of 1000 m^2, as determined typically by nitrogen gas adsorption. The samples were washed several times and dried in an oven at 50°C overnight and was ground into fine powder form before being used.

Specifications: Size 12x40 ASTM, oversize 0.6%, undersize 0.3%, Iodine No.1050 mg/g, Hardness 98.60%, Moisture 2.677%, Ash 2.15%

B. GLASSWARE AND APPARATUS USED

All glass wares (Conical flasks, Measuring cylinders, Beakers, Petri plates and Test tubes etc.) used.

C. ADSORBATE

Mixture of three dyes each with conc. 50mg/lt is used for experimental purpose.

- The malachite green dye used during was manufactured by Merck. It is a basic cationic dye. The solution is green in color. Chemical formula: = $C_{52}H_{54}N_4O_{12}$, Molecular Weight = 927.00.

λmax = 617nm.ed are of Borosil/Rankem.

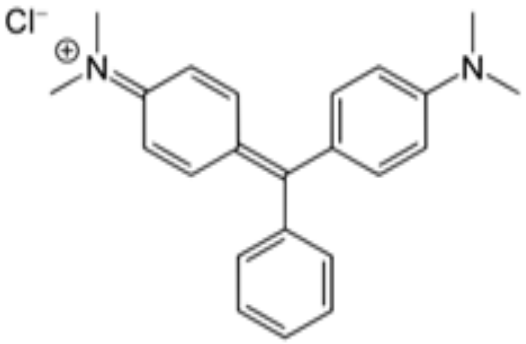


Fig: 1 Structure of malachite green

- The methylene blue dye was discovered by Caro in 1878.It is a basic cationic dye, heterocyclic aromatic chemical compound with molecular formula: $C_{16}H_{18}N_3SCl$, Molecular Weight=319.85. λmax=663nm.

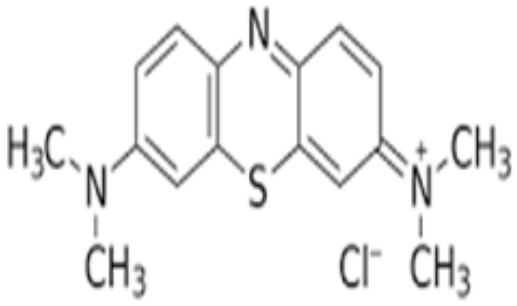


Fig: 2 Structure of methylene blue

- The Congo red dye was first discovered in 1883 by Paul Bottiger who was working then for the Friedrich Bayer Company in Elberfeld, Germany. Due to a color change from blue to red at pH 3.0-5.2, Congo red can be used as a pH indicator. It is the sodium salt of benzidinediazo-bis- 1-naphthylamine-4-sulfonic acid (formula: $C_{32}H_{22}N_6Na_2O_6S_2$; molecular weight: 696.66 g/mol). It is a secondary diazo dye. λmax = 497nm

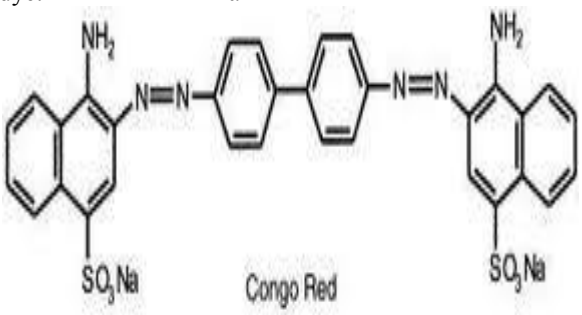


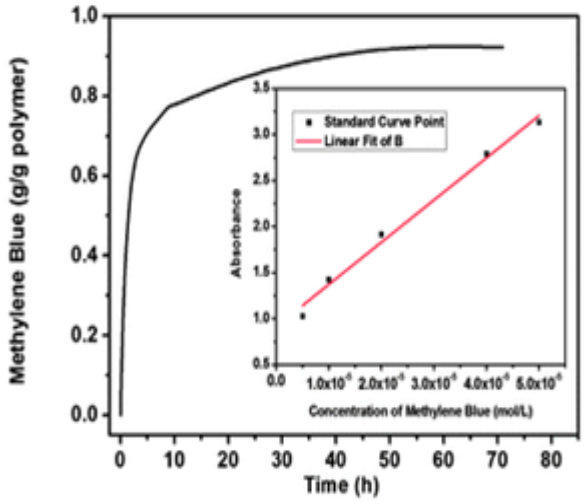
Fig:3 Structure of Congo red

Adsorption Studies Include:

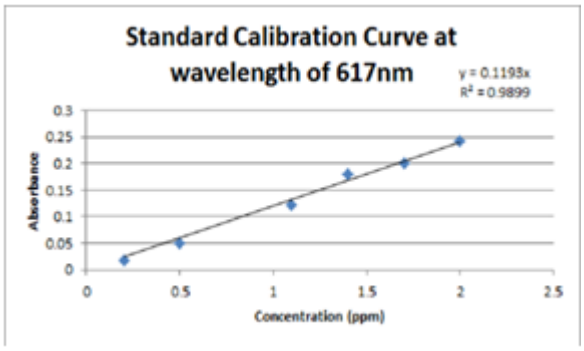
1. Effect of contact time
2. Effect of initial pH
3. Effect of adsorbent dose
4. Effect of temperature

III. RESULTS AND DISCUSSION

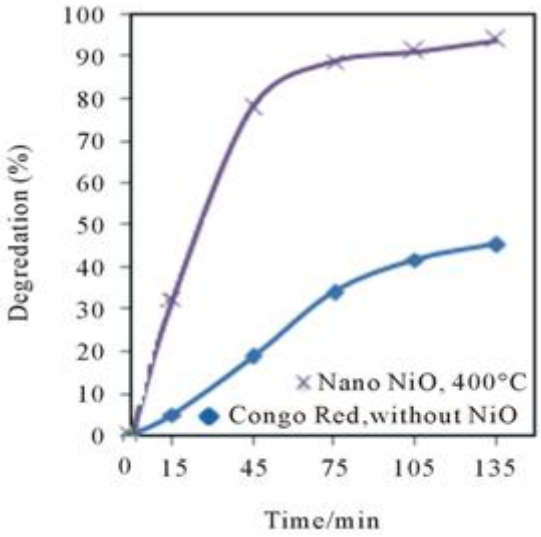
Methylene blue Calibration curve (663nm)



Malachite Green Calibration curve (617nm)



Congo Red Calibration curve (497nm)



IV. CONCLUSION

Removal of dyes, mixture of methylene blue, malachite green and Congo red from aqueous solutions by adsorption with activated carbon has been experimentally determined and following observations are made:

- The percentage of color removed increases with increasing adsorbent dosage, increases with increasing contact time and varied with dye solution pH.
- The adsorption rates increases with increasing temperature.
- Optimum contact time for equilibrium to be achieved is found to be 2 hours (120 min). It is basically due to saturation of the active site which do not allow further adsorption to take place.
- For malachite green maximum adsorption found to be at pH = 9. In case of methylene blue higher the pH, greater is removal by adsorption .For Congo red there is no significant change in amount adsorbed after pH 7. Infact adsorption found to decrease with increase in pH of solution. The adsorption of these positively charged dye groups on the adsorbent surface is primarily influenced by the surface charge on the adsorbent which in turn is affected by the solution pH.
- The result shows that availability of negatively charged groups at the adsorbent surface is necessary for the adsorption of basic dyes to proceed at pH -2 is almost unlikely as there is a net positive charge in the adsorption system due to the presence of H_30^+ .Thus as pH increased,

more negatively charged surface was available thus helping in greater dye removal .

- Optimum adsorbent dose for the dye is 6g/150ml. It is obvious as with increasing amount the active sites for adsorption of mixture of three dyes increases which results in an increase in removal efficiency. The decrease in adsorption capacity with an increase in the adsorbent concentration could be assign to the fact that some of the adsorption sites remained unsaturated during the process and agglomeration of activated carbons as a result all the surface area is not available for adsorption process.
- Optimum temperature is 30^{o}C .The adsorption capacity of activated carbon for the three dyes (methylene blue, malachite green and Congo red) increased with temperature. This may be a result of enhancing the mobility of the large dye ion with temperature. An increasing number of molecules may also acquire sufficient energy to undergo an interaction with active sites at the surface. Further, increasing temperature may produce a swelling effect within the internal structure of the activated carbon enabling large dyes to penetrate further.

REFERENCES

[1] B.H. Hameed, A.T.M. Din, A.L. Ahmad (2006) Adsorption of methylene blue onto bamboo-based activated carbon: Kinetics and equilibrium studies.

[2] C. Namasivayam, D. Kavitha(2001) Removal of Congo Red from water by adsorption onto activated carbon prepared from coir pith, an agricultural solid waste, Dyes and Pigments 54 (2002) 47–58.

[3] Emad N. El Qada∗ , Stephen J. Allen, Gavin M. Walker (2006) Adsorption of Methylene Blue onto activated carbon produced from steam activated bituminous coal, Chemical Engineering Journal 124 (2006) 103–110.

[4] Grabowska Ewa Lorenc, Gryglewicz Gra_zyna (2005) Adsorption characteristics of Congo Red on coal-based mesoporous activated carbon ,Dyes and Pigments 74 (2007)

34-40.

[5] I.A. Rahman, B. Saad, S. Shaidan, E.S. Sya Rizal (2005) Adsorption characteristics of malachite green on activated carbon derived from rice husks produced by chemical–thermal process, Bioresource Technology 96 (2005) 1578–1583.

[6] Indra Deo Mall , Vimal Chandra Srivastava,Nitin Kumar Agarwal, Indra Mani Mishra,adsorptive removal of malachite green dye from aqueous solution by bagasse fly ash and activated carbon kinetic study and equilibrium isotherm analysis. Colloids and surfaces, 264(2005) 17-28.

[7] Khan A. Tabrez , Imran Ali, Singh Ved Vati and Sharma Sangeeta (2009) Utilization of Fly ash as Low-Cost Adsorbent for the Removal of Methylene Blue, Malachite Green and Rhodamine B Dyes from Textile Wastewater, journal of environmental protection science (2009), vol. 3, pp.11 – 22.

[8] M. Hema and P. Martin Deva Prasath (2009) Adsorption of malachite green onto carbon prepared from borassus bark, The Arabian Journal for Science and Engineering, Volume 34, Number 2A, July 2009.

[9] Nagarethinam Kannan and Mariappan Meenakshisundaram (2001) ,Adsorption of Congo red on Various Activated Carbons -A Comparative Study.

[10] Nirmala lugun (2009) Removal of malachite green using mahua oil cake as adsorbent.n31

[11] R. A. Shawabkeh and E. S. M. Abu-Nameh Absorption of Phenol and Methylene Blue by Activated Carbon from Pecan Shells ISSN 1061-933X, Colloid Journal, 2007, Vol. 69, No. 3, pp. 355–359. © Pleiades Publishing, Ltd., 2007.

[12] Raghavacharya C (1997) Colour Removal from Industrial effluents – A comparative review of available technologies Chem. Eng. World 32(7): 53–54.

[13] V.K. Garg), Moirangthem Amita, Rakesh Kumar, Renuka Gupta (2004) Basic dye (methylene blue) removal from simulated wastewater by adsorption using Indian Rosewood sawdust: a timber industry waste, Dyes and Pigments 63 (2004) 243e250.

[14] Y. Onal,C. Akmil-Basar, Didem Eren, Cigdem Sarıcı-O zdemir, Tolga Depci (2006)Adsorption kinetics of malachite green onto activated carbon prepared from Tunc¸bilek lignite, Journal of Hazardous Materials B128 (2006) 150–157.

[15] Yamin Yasin , Mohd Zobir Hussein and Faujan Hj Ahmad (2007) Adsorption of Methylene blue onto Treated Activated Carbon , The Malaysian Journal of Analytical Sciences, Vol 11, No 11 (2007): 400 – 406.

Thermal Analysis of Swift Heavy Ion Irradiated Poly Ethylene Naphthalate (PEN)

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***Abstract*: Polymers, which are radiation sensitive, play a crucial role in semiconductor industry, since due to irradiation, polymers either degrade or crosslink. The commercially purchased Poly ethylene naphthalate (PEN) polymer was irradiated with Li^{3+},C^{6+},$Ni^{10+}$$Ag^{9+}$ ion beams to analyze the modifications induced by swift heavy ions as a function of ion fluence, ranging from $1x10^{11}$ to $3x10^{12}$ ions/cm^2. Thermal degradation studies of the polyethylene naphthalate (PEN) have been carried out from a non-isothermal condition under nitrogen atmosphere at a heating rate of 10 °C min^{-1}. The decomposition steps and thermal stability of PEN was confirmed by thermal analysis technique DTG.**

***Keywords*- Swift Heavy Ion; Polymer; Irradiation; Polyethylene Naphthalate; Thermal Analysis**

I. INTRODUCTION

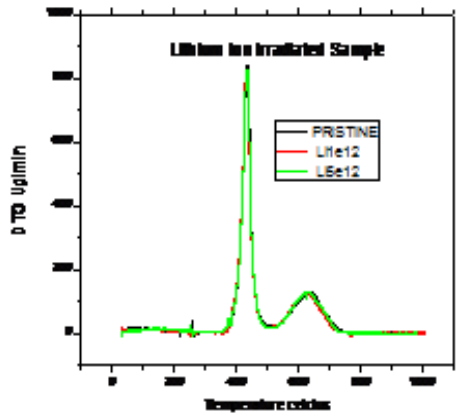
Swift heavy ion irradiation is a technique, which inserts irreversible alterations in the properties of polymers. An energetic ion loses its energy by interacting with target nuclei (nuclear stopping) and by interaction with target electrons (electronic stopping). The scissoring of original bonds, yield of radicals and excited atoms, cross linking and rearrangement of bonds occur in case of polymers, due to ion irradiation in which electronic stopping process is more salient at higher ion fluences. The above said processes are responsible for the irreversible changes in properties of the polymer due to creation of defects inside the polymer [1]. Polyethylene naphthalate (PEN) polymer has many applications due to the naphthalene ring in the main chain [2]. The different properties of PEN have been studied in number of research papers [3,4,5,6]. The energy deposition and modifications by MeV light ion and UV laser stimulated sluminescence of PET films divulged the reduction of luminescence centers by irradiation [7]. The electrical properties of gamma ray irradiated PEN films and the morphology of the melt crystallized PEN structures in the blends has also been investigated [8, 9]. The present work deals with the irreversible changes introduced in the polymeric structure and improve the properties dramatically due to the thermal degradation of PEN polymer after irradiation with lithium ions (50 MeV), carbon ions (85 MeV), nickel ions (120 MeV) and silver ions (120 MeV).

II. EXPERIMENTAL

The specimens of PEN in the form of flat polished thin films (25μm) having the size of 1 cm x 1 cm were obtained from Good Fellow Ltd. (England). The samples were irradiated with lithium (50 MeV), carbon (85 MeV), nickel (120 MeV) and silver (120 MeV) ion beams, by using 15 UD pelletron facility for the general purpose scattering chamber (GPSC) under vacuum of ~10^{-6} Torr at Inter-University Accelerator Center, New Delhi. The electronic energy loss of lithium (50 MeV), carbon (85 MeV), nickel (120 MeV) and silver (120 MeV) ions in PEN is ~6.96, 27.85, 563.3 and 965.5eV/Å respectively [10]. The ion beam fluence was varied from 1 x 10^{11} to 3 x 10^{12} ions cm^{-2}. In order to expose the whole target area, the beam was scanned in the x-y plane. The beam current was kept low to suppress thermal decomposition and was monitored intermittently with a Faraday cup. Thermal analysis was carried out with a Mettler Toledo, TGA/DTA 851. The analysis was performed with a 4 mg (approx.) sample under a nitrogen atmosphere from 30 to 900 °C at a scan rate of 10 °C min$^{-1.}$

III. RESULTS AND DISCUSSION

The DTG curves of pristine and ion irradiated samples of PEN are shown in Fig 1. The peak at 435°C represents the first weight loss step is due to thermal degradation of the polymer backbone i.e. chain scission of the ester bonds [11] and other peak at 641°C demonstrates the second step of weight loss, which is due to thermal degradation of smaller chain fragments into volatile products [12]. Fig. 2 shows the DTA graphs. The lithium irradiated PEN samples show two prominent peaks, at lower fluence the peak is flatter and decomposition starts at temperature lesser than pristine but at higher fluence, the decomposition temperature approaches to pristine decomposition temperature. In carbon ions irradiated PEN samples, different trend is observed for DTA analysis, for the samples of PEN irradiated at lower fluence, decomposition starts at lower temperature, with further increase in ion fluence, decomposition starts at lower temperature. The second peak becomes flatter but decomposition temperature approaches to that of pristine sample. DTA curves for samples of PEN irradiated with heavier ions (Nickel, Silver) shows degradation at lower temperatures and there is no second peak, which may be due to complete degradation of irradiated sample. It can be concluded that PEN samples irradiated with lighter ions are thermally more stable than samples irradiated with heavier ions.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PRISTINE
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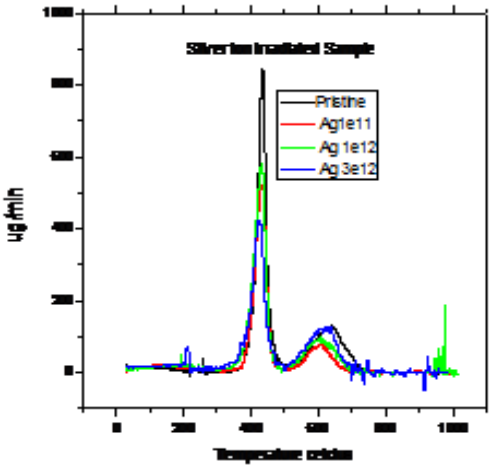
Li5e12
DTG ug/min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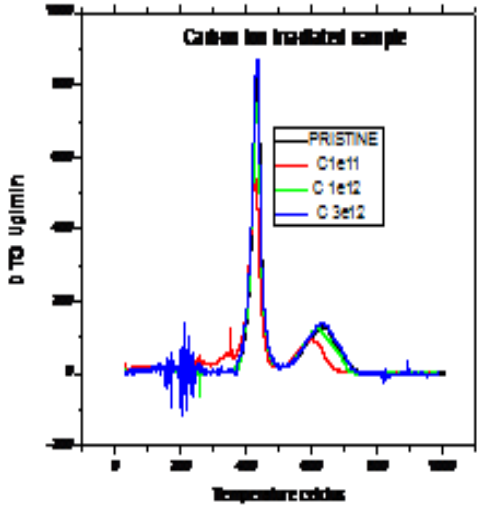
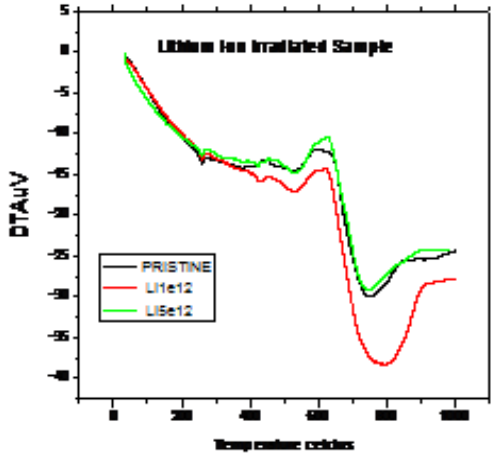
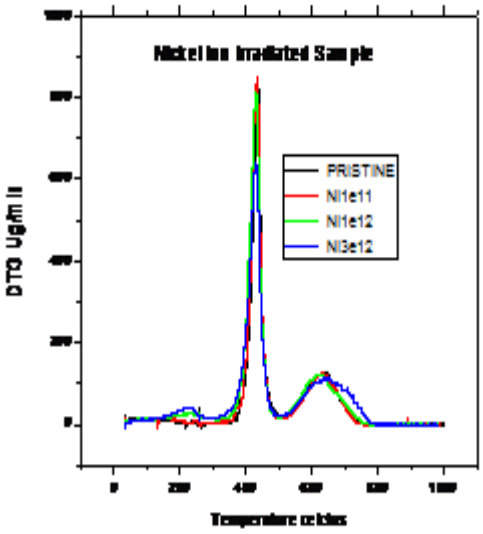
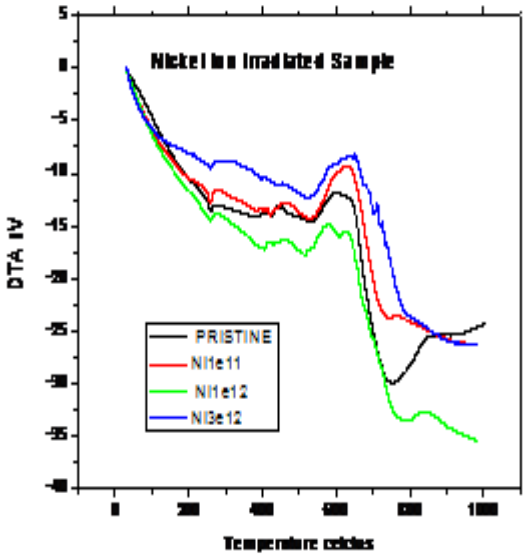
Pristine
Ag1e11
Ag 1e12
Ag 3e12
ug/min


Carbon Ion Irradiated sample
PRISTINE
C1e11
C 1e12
C 3e12
DTG ug/min


Lithium Ion Irradiated Sample
PRISTINE
Li1e12
Li5e12
DTA uV


Nickel Ion Irradiated Sample
PRISTINE
Ni1e11
Ni1e12
Ni3e12
DTG Ug/m in


Nickel Ion Irradiated Sample
PRISTINE
Ni1e11
Ni1e12
Ni3e12
DTA uV

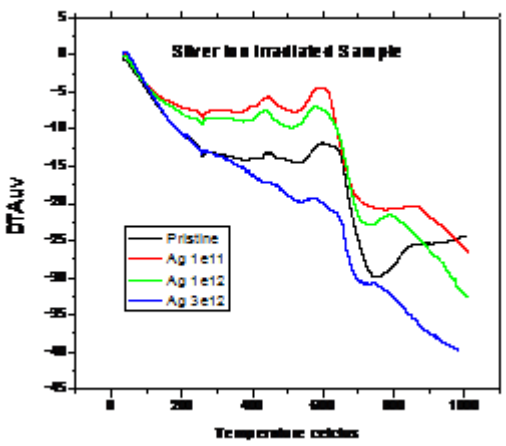


Fig.2. DTA plots of swift heavy ion irradiated PEN at varying fluence

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REFERENCES

[1]. M. Nasef, M. Dahlan, and M. Khairal, "Electron irradiation effects on partially fluorinated polymer films; structural property relation ships," Nucl. Instrum. Methods phys. Res., Sect. B, vol. 201, pp. 604-614, April 2003.

[2]. K. Nakamae, T. Nishino, T. Tada, T. Kanamoto, and M. Ito, "Elastic modulus of crystalline regions of poly (ethylene-2,6-naphthalate)," Polymer, vol. 34, pp. 3322-3324, April 1993.

[3]. W.J. Jackson, "Liquid crystalline polymers. 5. Liquid crystalline polyesters containing naphthalene rings," Macromolecules, vol. 16, pp.1027-33, july 1983.

[4]. S.Z.D. Cheng, and B. Wunderlich, "Thermal analysis of thermoplastic polymers," Thermochim Acta, vol. 134, pp. 161-166, October 1988.

[5]. S. Buchner, D. Wiswe, and H.G. Zachmann, "Kinetics of crystallization and melting behavior of poly (ethylene-2,6 naphthalate)," Polymer, vol. 30, pp. 480-488, March 1989.

[6]. S. Murakami, M. Yamakawa, M. Tsuji, and S. Kohjiya, "Structural development in the uniaxial drawing process of poly (ethylene naphthalate)," Polymer, vol. 37, pp. 3945-3951, August 1996.

[7]. S. Nagata, H. Katsui, K. Takahiro, B. Tsuchiya, and T. Shikama, "Radiation-induced luminescence of PET and PEN films under MeV ion and pulsed UV laser irradiation," Nuclear Instrum. Methods phys. Res., Sect. B, vol. 268, pp. 3099-3102, October 2010.

[8]. J.W. Mackersie, M.J. Given, S.J. Macqreqor, and R.A. Fouracre, "Gamma radiation effects in Polyethylene naphthalate-Electrical Properties," IEEE. pp. 183-187, October 2001.

[9]. L. Minkova, and P.L. Magagnini, "Blends of poly(ethylene 2,6-naphthalate) with liquid-crystalline polymers: crystallization behavior and morphology," Polmer, vol. 42, pp. 5607-5613, June 2001.

[10]. J.F. Ziegler, and J.P. Biersack, "The Stopping ranges of ions in matter," SRIM-2006 IBM Research, New York, 2006.

[11]. B.J. Holland, and J.N. Hay, "The thermal degradation of PET and analogous polyesters measured by thermal analysis-Fourier transform infrared spectroscopy," Polymer, vol. 43, pp. 1835-1847, March 2002.

[12]. Samperi, C. Puglisi, R.Alicata, G. Montando, "Thermal degradation of poly (ethylene tere phthalate) at the processing temperature," Polym. Degrad. and Stab, vol. 83, pp. 3-10, January 2004

Removal of Chlorinated Resin and Fatty Acids from Paper Mill Wastewater through Photocatalysis

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***Abstract*—This study evaluates the effectiveness of photocatalysis (UV/TiO_2 and $UV/TiO_2/H_2O_2$ processes) for the removal of chlorinated resin and fatty acids (cRFA) from paper mill wastewater. The primary clarified (PC) and biotreated (BT) wastewaters were analysed in terms of cRFA by gas chromatography and subjected to photocatalysis with UV radiation under optimum conditions, i.e. TiO_2 = 0.50 g/L, pH = 7.0, time = 4 h, and H_2O_2 = 15 mM/L in a slurry reactor. Four types of cRFA i.e. chlorodehydroabietic acid (CDAA), 12,14-dichlorodehydroabietic acid (DCDAA), 9,10-dichlorostearic acid (DCSA), and 9,10,12,13-tetrachlorostearic acid (TCSA) were identified in the PC and BT wastewaters. $UV/TiO_2/H_2O_2$ process has been found to be more effective for the removal of cRFA as compared to UV/TiO_2 process. The chloro-resin acids (cRA) were removed to the higher extent as compared with chloro-fatty acids (cFA). BT wastewater was found to be more amenable to photocatalysis for the removal of cRFA as compared to PC wastewater.**

Keywords—Photocatalysis; Paper Mill Wastewater; Resin and Fatty Acids

I. INTRODUCTION

The paper industry is among twelve most polluting industries in India due to the enormous volume and quality of the wastewaters generated [1]. Wood preparation, pulping, washing, bleaching, and coating are the main sources of pollution [2; 3]. The bleach plant wastewaters account for 60-70% of biochemical oxygen demand (BOD) and 80-90% of color load of the whole mill using chemical recovery [4].

The residual lignin, lignin derivatives, polymerized tannins along with wood extractives and chlorinated organics (e.g. phenols, dioxins, and furans etc.) formed during pulp bleaching are responsible for the wastewater color [5; 6]. The chlorine bleaching (Cl_2 or chlorine derived chemicals) is known to generate a variety of chlorinated organics (> 500) in the wastewater, i.e. phenols, chloro-resin and fatty acids (cRFA), dioxins and furans etc. They are collectively estimated as adsorbable organic halides (AOX) [7, 8]. The generation of chloroorganics is proportional to the consumption of bleach chemical [9].

The wastewater toxicity depends upon the organically bound chlorine, raw materials extractive content, and extent of removal of extractives during different processes [10]. The high toxicity and low biodegradability of resins, long chain fatty acids, tannins, terpenes, lignins are mainly responsible for toxicity of paper mill wastewaters [11]. The chlorinated organics bioaccumulate through food chain and are potent toxic [12]. The pulp and paper mill wastewater affect reproductive physiology of fish by endocrine disruption [13]. The resin acids have been reported to cause teratogenicity in fish larvae [14] and genotoxicity to mussels [15]. The hepatopancreas DNA activity decreased in mussels after exposure to abietic acid and dehydroabieteic acid [16; 17].

The conventional, primary and biological, remediation processes utilized for wastewater treatment by Indian paper mills have low efficiency for chlorinated organics removal and no color decrease [18; 19]. The photocatalysis is an emerging technique which leads to the complete mineralization of organic pollutants essentially to CO_2, H_2O, NO_3^-, PO_4^{3-}, and halide ions [20].

The exposure of TiO_2 to UV radiation leads to the excitement of electrons from the valence band to the conduction band leaving behind highly oxidative holes in valence band and generation of radicals (mainly $OH^\bullet$). The $OH^\bullet$ radicals are reactive electrophiles (2.33 V oxidation potential), hence cause rapid degradation of nearly all electron rich organic compounds [21]. The pollutants are oxidized by holes on TiO_2 surface as well as by radicals in the solution [22; 23]. The present study is aimed to evaluate the effectiveness of photocatalysis (UV/TiO_2 and $UV/TiO_2/H_2O_2$ processes) for the removal of cRFA from primary clarified (PC) and biotreated (BT) paper mill wastewaters.

II. MATERIALS AND METHODS

A. Wastewater and Reagents

Titanium dioxide (TiO_2) and hydrogen peroxide (30% H_2O_2) (High Media, SQ grade) were used as photocatalyst and oxidant, respectively, for the photocatalytic oxidation experiments. The cRFA were obtained from Helix Biotech. Corporation (Richmand, BC Canada). All the standards were of the highest purity commercially available. HPLC grade methyl tertiary butyl ether (MTBE), methanol, and LR grade

diethyl ether were used as solvents. Other reagents and chemicals used were of analytical grade and used without further purification. n-methyl-n-nitrosotoluene-p-sulphonamide was supplied by Aldrich, USA. Stock standard solutions of cRFA (20-30 mg/L) were prepared in methanol/diethyl ether (10:90) solution. The PC and BT wastewaters were collected from the wastewater treatment plant of a pulp and paper mill located in India. The mill uses OCEPHH sequence for bleaching the mixed hardwood (Eucalyptus and Poplar) kraft pulp.

B. Photocatalysis

The photocatalysis experiments were performed in a timber-framed UV reactor equipped with 4 UV tubes (each of 18 W) [24]. The experiments were carried out in completely mixed and batch mode at ambient conditions. The 500 mL wastewater was adjusted to pH 7.0 and 0.5 g/L of TiO_2 added. The solution was magnetically stirred in the dark (30 minutes) before H_2O_2 (15 mM/L) addition and switching on UV lamps for the adsorption/desorption equilibrium. After reaction completion, water loss was made up with distilled water. The solution was adjusted to pH 7.0 and allowed to stand for 5 h for TiO_2 settling. The supernatant was analyzed. The removal of cRFA after photocatalysis was quantified as in (1):

$$\text{Removal (\%)} = [(C_o - C)/ C_o] \times 100 \quad (1)$$

Where: C_o = initial concentration; C = concentration after photocatalysis.

The improvement in biochemical oxygen demand (BOD)/ chemical oxygen demand (COD) ratio of the wastewaters was also studied to assess the pollutants biodegradability. All the experiments were carried out in duplicate and the average values were reported.

C. Analytical Methods

The wastewaters were analyzed in terms of BOD, COD, and color (UV-VIS spectrophotometer - SPEKOL 2000, Analytic Jena) as per the Standard Methods [25]. The pH was measured using a bench scale pH meter (TOSHNIWAL). AOX was analyzed using AOX analyser (ECS 1200, THERMO). Gas chromatograph (GC) was used for the qualitative and quantitative analysis of cRFA. The extraction of cRFA from wastewater has been achieved as suggested by Voss and Rapsomatiotis [26]. The extraction was done by shaking 100 mL of wastewater (pH 9.0) with equal volume of MTBE for 1 h. The ether layer, containing extracted cRFA, was evaporated to almost dryness in a rotary vacuum evaporator. The cRFA were derivatized to their readily volatilized methyl esters prior to GC analysis [27].

The GC analysis was done on OPTIMA -1- MS column (30 m x 0.25 mm I.D. with 0.25 µm film thickness) containing 100% dimethyl polysiloxane. Detection and identification was carried out with a flame ionization detector (FID) at 100 range. The oven temperature was held at 190 °C (4 min) and increased to 210 °C at 1 °C/min, from 210 °C to 230 °C at 2 °C/min, from 230 °C to 250 °C at 3 °C/min, keeping the final temperature 250 °C for 15 min. The injector and detector temperatures were set at 300 °C. The carrier gas was nitrogen (N_2) at a flow rate of 1 mL/min. The target analytes were identified by comparing the retention times (RT) (±0.1 min) with those of derivatized standards. All injections were made in the splitless mode (1 min).

III. RESULTS AND DISCUSSION

The average analytical characteristics of PC and BT paper mill wastewaters utilized for the present study are summarized in Table I and II. The wastewaters were characterized with higher pollution load in terms of BOD, COD, and color. PC wastewater presented high organic load as compared with BT wastewater. BOD/COD ratio of the wastewaters was low, i.e. 0.25 and 0.12 for PC and BT wastewaters, respectively, indicating low biodegradability of the organics present in the wastewaters. Four cRFA, i.e. chlorodehydroabietic acid (CDAA), 12,14-dichlorodehydroabietic acid (DCDAA), 9,10-dichlorostearic acid (DCSA), and 9,10,12,13-tetrachlorostearic acid (TCSA) were detected in the paper mill wastewaters (Table II). The retention time (RT) of various cRFA reference compounds separated on OPTIMA-1-MS column are given in Table III. PC wastewater was having higher concentration of cRFA as compared to BT wastewater.

TABLE I. ANALYTICAL CHARACTERISTICS OF PC AND BT PAPER MILL WASTEWATERS

S. No.	Parameter	PC Wastewater	BT Wastewater
1.	COD (mg/L)	1092	246
2.	BOD (mg/L)	274	29
3.	BOD/COD ratio	0.25	0.12
4.	Color (Pt-Co mg/L)	2066	1012
5.	Ph	7.5	7.4
6.	AOX (mg/L)	15.8	6.6

TABLE II. CONCENTRATION OF CRFA IDENTIFIED IN PC AND BT PAPER MILL WASTEWATERS

S. No.	Compound	Concentration (µg/L)	
		PC Wastewater	BT Wastewater
1.	DCSA	34.3	25.0
2.	CDAA	19.7	16.4
3.	DCDAA	11.8	ND
4.	TCSA	17.0	20.7
Total		82.8	62.1

ND – not detected

In PC wastewater, the major contribution came from DCSA (41%) followed by CDAA (24%), TCSA (21%), and DCDAA (14%). DCSA (40%) is the major component of BT wastewater followed by TCSA (33%) and CDAA (27%). The Chloro-fatty acids (cFA) were present in higher amount as compared to chloro-resin acids (cRA). cFA contributed to 62% and 74% while cRA to 38% and 26% for PC and BT wastewaters, respectively. The presence of chloroorganics in BT wastewater proves the low efficiency of the microbial processes for the degradation of these compounds. Hence, the

advanced photocatalytic oxidation of PC and BT paper mill wastewaters have been investigated using UV/TiO_2 and $UV/TiO_2/H_2O_2$ processes. PC wastewater was diluted to bring the initial COD load to 500 mg/L before photocatalysis while BT wastewater was used directly.

TABLE III. RT (MIN) OF VARIOUS CRFA REFERENCE COMPOUNDS (METHYL DERIVATIVES) SEPARATED ON OPTIMA-1-MS COLUMN

S. No.	Name of Compound	RT (minute)
1.	9,10-Dichlorostearic acid[a]	29.74
2.	Chlorodehydroabietic acid[b]	30.24
3.	12, 14-Dichlorodehydroabietic acid[b]	37.56
4.	9,10,12,13-Tetrachlorostearic acid[a]	41.31

[a]cFA, [b]cRA

TABLE IV. CRFA REMOVAL (%) FOR PC AND BT WASTEWATERS BY UV/TiO_2 AND $UV/TiO_2/H_2O_2$ PROCESSES

S. No.	Compound	Ci* (µg/L)		Removal (%)			
				UV/TiO_2		$UV/TiO_2/H_2O_2$	
		PC D	BT	PC	BT	PC	BT
1.	DCSA	15.7	25.0	33	28	38	32
2.	CDAA	9.0	16.4	50	39	53	41
3.	DCDAA	5.4	ND	64	----	68	----
4.	TCSA	7.8	20.7	46	30	48	36
Total		37.9	62.1	44	31	48	35

ND – not detected, *Initial concentration, D – Concentration after dilution (500 mg/L of COD)

For PC wastewater, 44% and 48% removal of cRFA was achieved after treatment with UV/TiO_2 and $UV/TiO_2/H_2O_2$ processes, respectively. While for BT wastewater, 31% and 35% removal of cRFA was achieved after treatment with UV/TiO_2 and $UV/TiO_2/H_2O_2$ processes, respectively. For PC wastewater, DCDAA was removed up to 64% and 68% followed by CDAA (50% and 53%), TCSA (46% and 48%), and DCSA (33% and 38%) after treatment with UV/TiO_2 and $UV/TiO_2/H_2O_2$ processes, respectively (Table IV). cRA were removed to the higher extent, 55% and 59%, as compared to cFA, 37% and 41%, after treatment with UV/TiO_2 and $UV/TiO_2/H_2O_2$ processes, respectively [Fig. 1(a)]. For BT wastewater, CDAA was removed up to 39% and 41% followed by TCSA (30% and 36%), and DCSA (28% and 32%) after treatment with UV/TiO_2 and $UV/TiO_2/H_2O_2$ processes, respectively (Table IV). cRA were removed to the higher extent (38% and 41%) compared to cFA (28% and 34%) [Fig. 1(b)].

Comparatively higher cRFA removal efficiency was observed with $UV/TiO_2/H_2O_2$ process as compared to UV/TiO_2 process. Machado et al. [28] reported 20-30% increase in reaction rate by the addition of H_2O_2. H_2O_2 can produce additional $OH^{\bullet}$ radicals by its decomposition and reaction with superoxide radicals. It can also accept conduction band e^- thus prevent e^-/h^+ re-combination. The $OH^{\bullet}$ radicals can be produced easily from H_2O_2 splitting as compared to H_2O [29]. The photocatalytic oxidation of a variety of organic pollutants occurs by the concomitant action of highly reactive intermediates, i.e. hydroxyl radicals ($OH^{\bullet}$), holes (h^+), superoxide radicals and hydroperoxyl radicals ($OOH^{\bullet}$) [30].

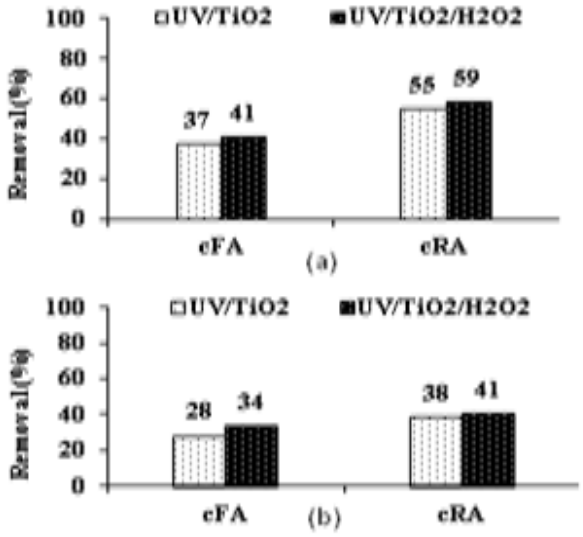

Fig. 1. Removal of cRA and cFA for PC (a) and BT (b) wastewaters by UV/TiO_2 and $UV/TiO_2/H_2O_2$ processes

Higher pollutants removal efficiency was achieved for BT wastewater as compared to PC wastewater. The biological treatment may convert some functional groups of organic pollutants to more easily oxidisable forms that are then easily degraded during photocatalysis [31]. The chloroorganics present in paper mill wastewaters were removed to different extent after treatment by photocatalysis. The possible reason behind this may be the initial concentration, and presence of reaction intermediates which compete for photoactive sites. BOD/COD ratio improved to 0.34 and 0.31 for PC wastewater and 0.22 and 0.21 for BT wastewater after photocatalysis by $UV/TiO_2/H_2O_2$ and UV/TiO_2 processes, respectively. These findings indicate easy removal of pollutants in biological treatment plant. Balcioglu and Arslan [31] also observed improvement in BOD/COD ratio after photocatalysis after 5 h of treatment. Yeber et al. [32] reported rapid COD removal and slight improvement in BOD/COD ratio of the wastewaters after photocatalysis. Yeber et al. [32; 33] stated that photocatalysis could be a good pre-oxidation step to the biological treatment as the biodegradability of the residual organic matter is improved. The partial mineralisation and structural changes in the organic pollutants are the fundamental for BOD/COD ratio improvement and toxicity reduction of the wastewaters and chlorinated phenols [33].

IV. CONCLUSION

$UV/TiO_2/H_2O_2$ process was found suitable for the remediation of cRFA from paper mill wastewaters as compared with UV/TiO_2 process. The photocatalysis improved biodegradability of the wastewaters by removal of toxic compounds. This indicates the easy removal of the degradation products in the biotreatment.

ACKNOWLEDGMENT

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REFERENCES

[1] P. Singh and I.S. Thakur, "Removal of colour and detoxification of pulp and paper mill effluent by microorganisms in two step bioreactor," J. Sci. Ind. Res. India, vol. 63, pp. 944-948, 2004.

[2] S.K. Kansal, M. Singh, and D. Sud, "Effluent quality at kraft/ soda agro-based paper mills and its treatment using a heterogeneous photocatalytic system," Desalination, vol. 228, pp. 183-190, 2008.

[3] Mohanrao et al., "Sesbania aculeata - a potential raw material for small and big paper mills," IPPTA J., vol. 19 (3), pp. 47-51, 1982.

[4] N.J. Rao, "Approaches to cleaner production in pulp and paper industry," IPPTA Convention Issue, pp. 135-155, 1997.

[5] C.R. Lange and N. Mendez-Sanchez, "Biological and abiotic color reduction of paper mill effluents during anaerobic composting," J. Environ. Eng., vol. 136 (7), pp. 701-708, 2010.

[6] K.S. Rajesh, M. Singaravel, P. Sankaralingam, S. Subramanian, and S.V. Subrahmanyam, "Color removal from pulp and paper mill effluent - methods and industrial applications - a review," IPPTA J., vol. 21 (1), pp. 143-148, 2009.

[7] L.R. Suntio, W.Y. Shiu, and D.A. Mackay, "A review of the nature and properties of the chemicals present in pulp and paper mill effluents," Chemosphere, vol. 17 (7), pp. 1249-1290, 1988.

[8] Roy et al., "Characterization of chlorinated organic material in eucalyptus pulp bleaching effluents," J. Sci. Ind. Res. India, vol. 63 (June), pp. 527-535, 2004.

[9] D.V. Savant, R. Abdul-Rahman, and D.R. Ranade, "Anaerobic degradation of adsorbable organic halides (AOX) from pulp and paper industry wastewater," Bioresource Technol., vol. 97 (9), pp. 1092-1104, 2006.

[10] N.J. Rao and S. Kumar, "Toxic effluents from pulp and paper mill," IPPTA Convention Issue, pp. 203, 1987.

[11] A.P. Buzzini, L.J. Patrizzi, A.J. Motheo, and E.C. Pires, "Preliminary evaluation of the electrochemical and chemical coagulation processes in the post-treatment of effluent from an up flow anaerobic sludge blanket (UASB) reactor," J. Environ. Manage., vol. 85, pp. 847-857, 2007.

[12] S.K. Mittal and S. Maheshwari, "Integrated approach to reduce adsorbable organic halide (AOX) in pulp manufacturing," IPPTA Convention Issue, pp. 119-130, 2001.

[13] Hewitt et al., "Altered reproduction in fish exposed to pulp and paper mill effluents: roles of individual compounds and mill operating conditions," Environ. Toxicol. Chem., vol. 27, pp. 682-697, 2008.

[14] L.C. Brinkworth, P.V. Hodson, S. Tabash, and P. Lee, "CYP1A induction and blue sac disease in early developmental stages of rainbow trout (Oncorhynchus mykiss) exposed to retene," J. Toxicol. Env. Health: A, vol. 66, pp. 627-646, 2003.

[15] C. Gravato, M. Oliveira, and M.A. Santos, "Genotoxic effects and oxidative stress responses induced by retene in marine mussels (Mytilus galiprovincialis)," Freenius Environ. Bulletin, vol. 13, pp. 795-800, 2004.

[16] C. Gravato, M. Oliveira, and M.A. Santos, "Oxidative stress and genotoxic responses to resin acids in Mediterranean mussels," Ecotox. Environ. Safe., vol. 61, pp. 221-225, 2005.

[17] P.S. Merilainen, A. Krasnov, and A. Oikari, "Time and concentration dependent metabolic and genomic responses to exposure to resin acids in brown trout (Salmo trutta M. lacustris)," Environ. Toxicol. Chem., vol. 26, pp. 1827-1835, 2007.

[18] K. Lindstrom, and M. Mohamed, "Selective removal of chlorinated organics from kraft mill total effluents in aerated lagoons," Nordic Pulp and Paper Res. J., vol. 3 (1), pp. 26-33, 1988.

[19] C.F. Yin, "Characterization, bacterial and fungal degradation, dechlorination, and decolorization of chlorolignins in the bleach plant effluent," Ph.D. Thesis, North Carolina State University, Raleigh, NC, 1989.

[20] U.I. Gaya and A.H. Abdullah, "Heterogeneous photocatalytic degradation of organic contaminants over titanium dioxide: a review of fundamentals, progress and problems," J. Photoch. Photobio. C, vol. 9, pp. 1-12, 2008.

[21] P.R. Gogate and A.B. Pandit, "A review of imperative technologies for wastewater treatment I: oxidation technologies at ambient conditions," Adv. Environ. Res., vol. 8, pp. 501-551, 2004.

[22] M.R. Hoffmann, S.T. Martin, W. Choi, and D.W. Bahnemann, "Environmental applications of semiconductor photocatalysis," Chem. Rev., vol. 95, pp. 69-96, 1995.

[23] O. Carp, C.L. Huisman, and A. Reller, "Photoinduced reactivity of titanium dioxide," Prog. Solid State Ch., vol. 32, pp. 33-177, 2004.

[24] P. Kumar, S. Kumar, N.K. Bhardwaj, and A.K. Choudhary, "Optimization of process parameters for the photocatalytic treatment of paper mill wastewater," Environ. Eng. Manag. J., vol. 10(5), pp. 595-601, 2011.

[25] L.S. Clesceri, A.E. Greenberg, and A.D. Eaton, "Standard Methods for the Examination of Water and Wastewater," 20th ed., American Public Health Association, Washington, DC USA., 1998.

[26] R.H. Voss and A. Rapsomatiotis, "An improved solvent extraction based procedure for the GC analysis of resin and fatty acids in pulp mill effluents," J. Chromatogr., vol. 346, pp. 205-214, 1985.

[27] A.I. Vogal, A text book of practical organic chemistry (3rd ed.), English Language Book Society, London, pp. 292, 1975.

[28] Machado et al., "Destruction of the organic matter present in effluent from a cellulose and paper industry using photocatalysis," J. Photoch. Photobio. A: Chemistry, vol. 155, pp. 231-241, 2003.

[29] C. Sattler, L. de Oliveira, M. Tzschirner, A.E.H. Machado, "Solar photocatalytic water detoxification of paper mill effluents," Energy, vol. 29, pp. 835-843, 2004.

[30] M. Sleiman, P. Conchon, C. Ferronato, and J.M. Chovelon, "Iodosulfuron degradation by TiO2 photocatalysis: Kinetic and reactional pathway investigations," Appl. Catal. B: Environ., vol. 71 (3-4), pp. 279-290, 2007.

[31] I.A. Balcioglu and I. Arslan, "Application of photocatalytic oxidation treatment to pretreated and raw effluents from the kraft bleaching process and textile industry," Environ. Poll., vol. 103, pp. 261-268, 1998.

[32] M.C. Yeber, J. Rodriguez, J. Freer, J. Baeza, N. Duran, H.D. Mansilla, "Advanced oxidation of a pulp mill bleaching wastewater," Chemosphere, vol. 39(10), pp. 1679-1688, 1999.

[33] M.C. Yeber, J. Freer, M. Martonez, H.D. Mansilla, "Bacterial response to photocatalytic degradation of 6-chlorovanillin," Chemosphere, vol. 41 (8), pp. 1257-1261, 2000.

Qualitative and Quantitative Estimation of Carcinogenic Pahs Emission Pattern Generated by Three Wheeler Standing Vehicles

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***Abstract*—Vehicular emission has been found associated with unpleasant health effects. The sources or constituents responsible for these adverse effects have been recognized by several workers. Scientists of the environmental all over the world are concerned about growing level of PAHs within the city environment. The PAHs were extracted by soxhlet using toluene as a solvent and detected on GC-FID. Recovery range was found between 35 % and 75 % with the lower value corresponding to the low molecular weight PAHs compound. The objective of this study was to observe major PAHs produced in ambient air from the automobile exhaust as a function of petrol fuels, qualitatively and quantitatively. The study was carried out on three wheelers (light vehicles) on standing mode (without load conditions) on petrol and diesel engine. B(a)A and B(a)P was the common PAH found in higher concentration in almost all fuels.**

Keywords: Polycyclic Aromatic Hydrocarbons, Gas Chromatography, Pollutants, Concentration,

I. INTRODUCTION

A study conducted in United States of America demonstrated that motor vehicle distributes to 36% of its annual total PAH emissions of all sources (Benner *et al*., 1989). In Taiwan and Iran, the effect of the traffic source on PAH emissions has been detected by many researchers due to high traffic density within the city i.e. 475 vehicles/km^2 (highest in world). Lee *et al*. (1995) indicated that the total PAH contents at the intersection of two main roads of a city area in southern Taiwan were 5.3 and 8.3 times higher in magnitude than that in the urban and rural atmosphere.

The automobile industry is the second highest wealth initiator in India. It is, however, a well known fact that almost 75% of all air pollution is from vehicular emission in most of the urban environment (Matani, 1998). Such kind of study could be of great significance in Indian context, especially in fast developing cities like Jalandhar because of varying nature of socio economical conditions of mass, road condition, traffic norms, types of vehicles that ply on the road and their age, quality of fuel and poor maintenance of road.

Taking serious note of rising air pollutants levels in Delhi in 1998 Supreme Court of India directed government of Delhi to run the public modes of transport (e.g. buses, taxis and auto-rickshaws) on CNG instead of diesel fuel vehicle. The new fuel policy has led to significant reduction in concentration levels of pollution in terms of CO_X, NO_X, SO_X and SPM in the city (Masih & Taneja, 2006). There is a need to study behavior of other carcinogenic pollutants in the ambient air due to change in fuel quality standards including use of biodiesel. Engines emit toxic substances depending upon load and engine speed (Kumar and Kothiyal, 2011,2012)

The objective of this study was to find major PAHs produced in ambient air from the automobile exhaust as a function of petrol and engine type. The study was carried out on three wheelers (petrol and diesel) without load conditions.

II. PLAN OF STUDY

One hour sampling of engine exhaust on standing mode (without load) vehicles condition three wheeler and Honda make genset) of different age group run on different types of fuels was undertaken in the study.

A. Sampling of method

Sampling was done from each kind of vehicle in standing mode run for one hour. The exhaust pipe of the vehicle was connected through a 2 -2.5 inch diameter PVC pipe and left near the canopy of the high volume sampler close to the filter paper. The high volume sampler collects the particulate matters (on a glass micro fiber filter paper) in the size range varying from 100-0.01 µm along with volatile and semivolatile hydrocarbon generated by engine exhaust. The ambient air was drawn in a laminar flow at the rate of 1.01 L/min. The airborne soot particles along with PAHs were collected on filter paper (size: 8”x10”) and Polyurethane foam (PUF) plug fitted just below the filter paper in a metallic cartridge. After the sampling, filter paper along with PUF was removed and preserved in vacuum desiccators for 24 hour. The filter papers and PUF were wrapped in separate polythene bags, covered with aluminium foil and stored in refrigerator at 4^{O}C prior to analysis.

B. Extractions Of PAHs

PAHs (both adsorbed on particulate and vapor phase) were extracted from filter paper and PUF through soxhlet

extractor using toluene as a solvent for 20 to 24 hrs at the rate of 3 cycles per hour. Toluene was used (over other solvents like benzene/methanol, dichloro methane etc.) due to its high recovery, especially for higher boiling PAHs (Caricchia *et al.*, 1999). Combined extract of filter paper and PUF was concentrated to 1ml volume in rotary flash evaporator at 60^0C under vacuum. Temperature of the water bath was kept below 60^0C to rule out any possibility of thermal breakdown. The extract was transferred to a 10 ml volumetric flask and the volume was adjusted to 10 ml with hexane. Impurities were removed by liquid-solid chromatography using silica gel (70-230 mesh) activated at 250^0C for 24h.

III. RESULTS OF PAHS CONCENTRATION FOR THREE WHEELERS (PETROL AND DIESEL) EXHAUSTS AND THEIR CORRELATION WITH ENGINE AGE

Around 14 vehicles (both petrol and diesel engine) with engine age ranging between 2 to 14 years were under taken in this study. Result of types and average concentration of 16 individual PAHs generated by petrol and diesel engine (three wheelers) has been graphically shown in Fig. 1and 2, whereas It was found that petrol driven old three vehicles (9-13 year) generate higher concentration of 16 PAHs PAHs, 2.61- 5.81 ng/m^3) as compared to new vehicles (3-8 year, 16 PAHs, 2.25- 2.45 ng/m^3).

Flu (8.61 ng/m^3), Anth (6.15 ng/m^3), Flan (6.13 ng/m^3), Dib (ah)A (8.69 ng/m^3) and B(ghi)P (5.23 ng/m^3) were the five major PAHs found in higher concentration. Fig.1 indicated that Flu and Dib(ah)A were the two individual PAHs (average) found in higher concentration (i.e. 8.61, 8.61 ng/m^3) in petrol driven three wheeler. Result shown in Fig. 2 indicated that there was gradual rise PAHs concentration in the engine exhaust from 2.25 to 5.85 ng/m^3 with increasing age of the vehicles.

It was found that PAHs concentration is directly related to the engine age. In general, a gradual rise in concentration of all 16 PAHs in petrol driven three wheelers (individual, average and total concentration) with age was found. Diesel driven three old wheelers (9-14 years) generate average higher concentration of 16 PAHs (16 PAHs, 3.94-5.08 ng/m^3) as compared to new vehicles (3-7 years,16 PAHs, 2.45-3.19 ng/m^3).

Flan (16.4 ng/m^3), Flu (6.17 ng/m^3), Dib (ah)A (8.59 ng/m^3), Anth (5.24 ng/m^3) and B(ghi)P (5.53 ng/m^3) were the five major PAHs generated in higher concentration. Fig. 5c also indicate that Flan and Dib(ah)A were the two individual PAHs (average) found in higher concentration (i.e. 17.97, 8.54 ng/m^3) in diesel driven three wheelers respectively. Result indicates that there was gradual rise in PAHs concentration (i.e. 2.49 to 5.79 ng/m^3) in the engine exhaust of diesel driven three wheelers. It was also detected that old (9-14 years of age) petrol and diesel driven three wheelers produce higher concentration of 16 PAHs (individual, total and average concentration) as compared to new vehicles. In general PAHs concentration was found directly related to the age of the vehicles.

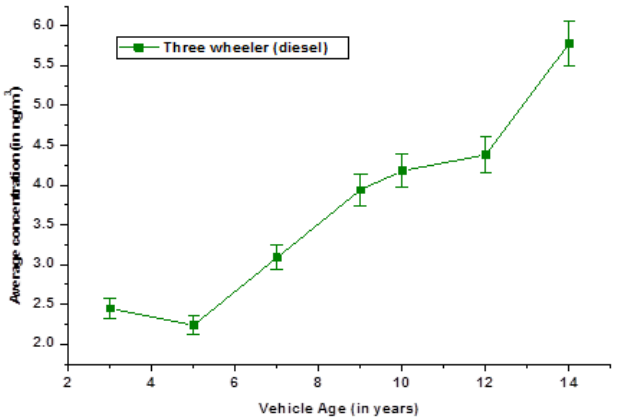

Figure 1

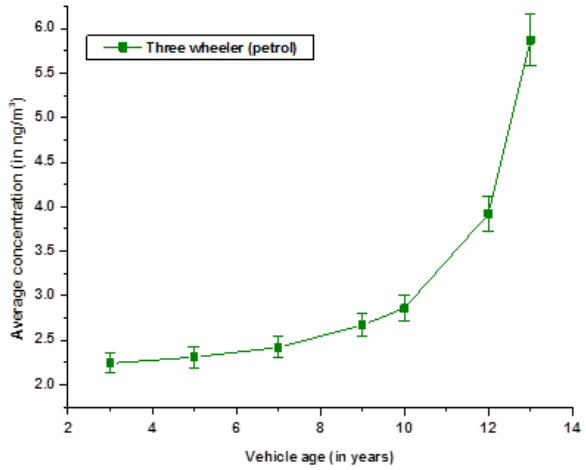

Figure 2

IV. CONCLUSION

Flan and Dib(ah)A were individual PAHs observed in higher concentration in diesel and petrol driven three wheeler respectively. In general older vehicles were generate higher PAHs concentration as compared to new three vehicles. Diesel driven three wheelers were found to add more PAHs concentration to air as compared to petrol driven three wheelers. Flu, Flan, Anth and DiB(ah)A was the four common PAHs found in highest concentration in almost all vehicles (two, three and four wheelers). In general older vehicles were found to generate higher PAHs concentration as

compared to new vehicles

REFERENCES

[1]. Benner, B.A., Gordon, G.E., Wise, S.A. (1989). "Mobile sources of atmospheric Polycyclic Aromatic Hydrocarbons: A roadway tunnel study". Environmental Science and Technology, 23, 1269-1278.

[2]. Matani, A.G. (1998). "Automobile exhaust emissions in Indian environment: Programmes and strategies needed for controlling". International Journal of Environment and Pollution, 18, 605-607.

[3]. Lee, M.L., Novotny, M.V., Bartle, K.D. (1995). "Analytical Chemistry of Polycyclic Aromatic Compound". Academic Press, New York.

[4]. Masih, A., Taneja, A. (2006). "Polycyclic Aromatic Hydrocarbons (PAHs) concentration and related carcinogenic potencies in soil at a semi arid region of India". Chemosphere, 65, 449-456.

[5]. Kumar V, Kothiyal NC (2012) Distribution behavior and carcinogenic level of some polycyclic aromatic hydrocarbons in roadside soil at major traffic intercepts within a developing city of India. Environmental Monitoring and Assessment 184:6239–6252

[6]. Kumar V, Kothiyal NC, (2011) Distribution behavior of polycyclic aromatic hydrocarbons in roadside soil at traffic intercepts within developing cities. International Journal of Environmental Science and Technology 8 (1):63-72.

[7]. Kumar V, Kothiyal N.C., Distribution pattern and contamination level of some aromatic hydrocarbons along roadside soil at major traffic intercepts during autumn in Jalandhar, India. Asian Journal of Chemistry, 23(3) (2011a), pp.1363-1368.

Green Synthesis: The Need of Tomorrow

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***Abstract:-*Green Chemistry a boon for Sustainability leads to maximum utilization of resources in such a way that there is insignificant generation of hazardous Chemical waste, which is only possible by the key aspect of The Green Synthesis. It is very helpful for chemists and chemical engineers in present research, development and production for creation of more eco-friendly and efficient raw products. It is going to become crucial tool in the field of synthetic chemistry by using unlike reagents and solvent which results in eco-friendly pathway to obtain green products and thus leads to maintain the sustainability of life and our earth planet. Growing companies realized that the practice of green chemistry not only leads to environmental benefits, but also economic and social benefits. The combination of these 3 benefits is known as the "triple bottom line" and gives strong support for businesses to develop sustainable products and processes. This indicates how green chemistry impacts a wide arrangement of fields including pharmaceuticals, pesticides, polymers, and many others field. The Green Synthesis purely based upon the twelve principles of Green Chemistry whereas, every aspect in society, it has long been acknowledged that preventing a problem is superior to trying to solve the problem once it has been created. Proverbs going back 100 of years back have said it: An ounce of prevention is worth a pound of cure. All this is only feasible by implementing the key aspect of Green Synthesis.**

Keywords: Green Synthesis, Environment, Sustainability etc.

I. INTRODUCTION

Green Chemistry is an attempt to Sustainability go ahead of mere productivity enhancements, process optimization and reducing environment load, it is virtually recreating chemistry and novel engineering so that , from raw material to its conversion to products the effects on the environment. It leads to highest utilization of resources in such a way that there is negligible or minimum production of hazardous Chemical waste, which is only possible by the key aspect of Green Synthesis. It is very helpful for chemists and chemical engineers in advance research, development and creation of more eco-friendly and efficient products. It is going to become crucial tool in the field of synthetic chemistry by using different reagents and green solvent which results in eco-friendly products and thus leads to maintain the sustainability of life and our earth planet [1].

During the 1991s many growing industries adopt green chemistry and other sustainable practices. Forward-looking companies found that the practice of green chemistry not only leads to environmental advantages, but also economic and social benefits [2]. The combination of these benefits is known as green chemistry for develop sustainable products and processes [3]. The following real-world examples of green chemistry present the accomplishments of several winners of the PGCC awards [4]. They demonstrate how green chemistry impacts a wide array of fields including pharmaceuticals, pesticides, polymers, and many others field [5].

The Green Synthesis purely based upon the twelve principles of Green Chemistry

1) Prevention pollution
2) Atom Economy in the term of pollution
3) Less Hazardous Chemical Synthesis (Green Synthesis)
4) Designing Green Chemicals
5) Safer green Solvents and Auxiliaries
6) Design for Energy Efficiency materials
7) Use of Renewable Feed stocks materials
8) Reduce Derivatives from environment
9) Green Catalysis
10) Design for Degradation of Harmful pollutants
11) Real-time Analysis
12) Inherently Safer Chemistry for Accident Prevention in chemistry

In practically every aspect in society, it has long been acknowledged that preventing a problem is superior to trying to solve the problem once it has been created proverbs going back 100 of years back have said it: An ounce of prevention is worth a pound of cure. All this is only feasible by implementing the key aspect of Green Synthesis [6].

II. GREEN REAGENTS AND REACTION CONDITIONS

A. Non-Phosgene isocyanate Synthesis process:

Polyurethanes are essential polymers that are widely used for an array of commercial applications [7]. The environmental problem with polyurethanes is that they have been tradionally manufactured through the use of phosgene which is extremely a very toxic gas

$$RNH_2 + COCl_2 \longrightarrow RNCO + 2HCl$$

$$\xrightarrow{R'OH} RNHCOOR'$$

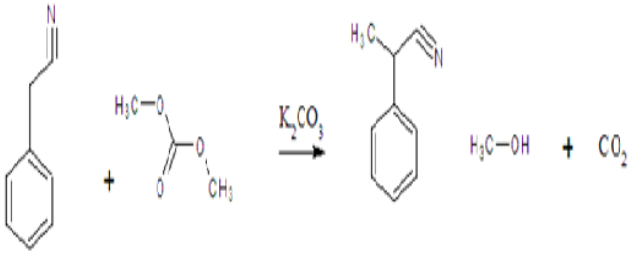
An alternate pathway for the production of polyurethanes without using phosgene is provided by green synthesis as follows

$RNH_2 + CO_2 \longrightarrow RNCO + H_2O$

$R'OH \longrightarrow RNHCOOR'$

B. Selective methylations by using dimethylcarbonate:

Conventional methylation reactions make use of CH_3-X or methyl sulphate. The toxicity of these compounds and environmental consequences render these green syntheses somewhat undesirable [8]. Moreover the methylation of active methylene compounds often involves uncontrollable multiple alkylations [9].One of the green methods for the selective methylation (>99.55%) of active methylene compounds is as follows:



C. Green Oxidative transition metal complexes:

Many oxidation processes have harmful environmental results. By creating long-lived catalytic and recyclable oxidants, metal ion concentration in the environment can be minimized by using molecular oxygen as the primary oxidant [10]. Many oxidation causing coordination compounds that appreciably resist towards the oxidative decomposition in oxidizing environment have been generated [11]. Beside this several reactive intermediates in biological and chemical processes, consisting extremely stable high oxidation state transition metal complexes have been synthesized [12].

D. *Liquid Oxidation Reactor process:*

Liquid Oxidation Reactor process (LOR) is a technology use to carry out secure oxidation of organic chemicals with pure oxygen. Following are some of the benefits of LOR:

- The use of LOR in place of conventional, air based oxidation processes decreases the amount of went gases that must be treated prior to their atmospheric release thereby promising some environmental advantages.
- Oxidation process in LOR is usually carried out at minimum temperatures and pressures. This can lead to an development in selectivity of reaction without sacrificing its rate of production.
- The increased chemical efficiency with oxygen can result in considerable raw material cost savings
- The minimum temperature allowed by LOR processes reduces the loss of reactant and solvent to byproducts and to waste streams

III. GREEN CHEMISTRY SOLVENTS AND REACTION CONDITIONS

The conventional solvents like chlorofluorocarbons hexane and other volatile organic compounds are responsible for causing many environmental problems. So there has been a large stress on the development of environmental friendly solvents and reaction conditions. The first achievement in this field is the development of Supercritical fluids.

A supercritical fluid is green solvent at temperature and pressure above its critical point. It can be used through solids like a gas, and dissolve materials similar to liquid. In addition, very close to the critical point, small changes in pressure or temperature result in large changes in density, allowing many properties of a supercritical fluid to be "fine-tuned". Supercritical fluids are suitable as a substitute for organic solvents in a wide range of industrial and laboratory processes. CO_2 and H_2O are the most commonly used supercritical fluids, being used for decaffeination and power generation, respectively.

A. Super Critical Carbon Dioxide for green synthesis:

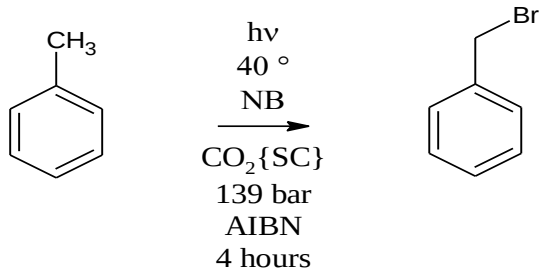
Supercritical CO_2 is used as a substitute for organic solvents over wide range of reactions such as coffee decaffeination, essential oil production and hops extraction. The extension of this approach to chemical production using CO_2 as a reaction medium is promising approach for air and soil pollution prevention. The asymmetric hydrogen transfer reduction of enamides using ruthenium catalyst can be carried out under Supercritical CO_2. This method is preferred over the traditional method because of

- A very High tunable solvent strength
- High gas miscibility factor
- High diffusivity
- High relieve of separation

Moreover the insolubility of some salts in CO_2 has been reduced by using different lyophilic anions.

B. Free Radical Bromination in Super Critical CO2 :

The free radical bromination of toluene is conventionally carried out by using bromosuccinimide (NBS) in Super Criitcal CO_2 for green synthesis purpose



Aqueous Reaction Condition

There has been a number of research of using water as a solvent in place of conventional organic solvents as a medium for carrying out synthetic transformations. For example: Diels-Alder reaction can be completed using water as a medium and it has been found that the rate of reaction and its selectivity can be increased to a great extent in an aqueous system.

C. Immobilized Green Solvents

Recently polymeric solvents have been synthesized that have salvation properties similar to those of the solvents used traditionally in chemical synthesis, separation and

cleaning operations thereby reducing the potential for the loss of environmentally favorable air emission or aqueous discharge streams is reduced. These green solvents are the polymeric derivatives of solvents currently used in reaction and many separation processes. For example: Polymeric derivative of tetrahydrofuran have been synthesized using macromonomers incorporating the desired functionality as pendant groups on backbone. These green polymeric solvents are easily recovered using mechanical separations such as ultrafilteration.

IV. TOMORROW WITH GREEN SYNTHESIS

The increased energy prices, and increased government legislation has highlighted the demand for all 'Green synthesis'. So Green Synthesis is having multidisciplinary nature benefits and thus is the best concept to maintain life on planet Earth, in the following ways

- By following the green principles can contribute to sustainable development like showing global climate concern ,spreading awareness regarding the different factors responsible for climate degradation , thus very helpful in Environmental monitoring
- Green Synthesis is targeting toward humanizing the Environment and the Bottom Line. Green Synthesis provides the very significant tools, techniques, and technologies to this innovation of producing everything Green.
- Knowledge exchange about Green Synthesis leads to improve quality of life and thus advancing global sustainability
- By maintaining the ecological balance by machine and process optimization
- Green Synthesis leads to renewable power generation like biodiesel, biofuels, hydro, wave harvesting, geothermal and high energy physics.

V. CONCLUSION

The need and importance of Green Synthesis for global sustainability has leaded to design some ethics which must be followed for Green and Healthy life as well as for green earth planet 'Prevention is better than cure, so prevent waste generation.

- Such synthesis methodologies should be designed producing lesser waste with to human as well as for environment
- The use of different solvents , separation agents should be made un-necessary where ever possible
- Excessive energy consumption should be minimized.
- Material and energy inputs should be renewable rather than depleting.
- Biodegradable substances should be synthesized, so that at the end of function they do not persist in the environment longer.
- Design of products, processes, and systems must include integration and interconnectivity with available energy and material s flows.

REFERENCE

[1] BrucePY (2004) OrganicChemistry (PearsonEducation, Upper Saddle River, NJ), 4th Ed.

[2] Nicolaou KC, Sorensen EJ (1996) Classics in Total Syn-thesis (VCH, New York).

[3] ArmstrongRW, et al. (1989)Totalsynthesisofpalytoxin carboxylic acid and palytoxin amide.J Am Chem Soc 111:7530–7533.

[4] Trost BM (1991) The atom economy: A search for syn-thetic efficiency.Science 254:1471–1477.

[5] Trost BM (1995) Atom economy—A challenge for or-ganic synthesis: Homogeneous catalysis leads the way. Angew Chem Int Ed 34:259–281.

[6] Sheldon RA (1994) Consider the environmental quo-tient.ChemTech 38–47.

[7] Anastas PT, Warner JC (1998) Green Chem Theory and Practice (Oxford Univ Press, New York).

[8] Horva th IT, Anastas PT (2007) Innovations and Green Chem. Chem Rev 107:2169–2173.

[9] Argyropoulos DS, etal. ,eds(2007) Materials,Chemicals and Energy from Forest Biomass,ACS Symposium Se- ries 954 (American Chemical Society, Washington, DC).

[10] Constable DJC, Curzons AD, Cunningham VL (2002)Metricsto'green'chemistry:Whicharethebest? Green Chem 4:521–527.

[11] Trost BM, Weiss AH (2006) Catalytic enantioselec- tive synthesis of adociacetylene.Org Lett 8:4461–4464.

[12] Trost BM (2002) On inventing reactions for atom econ-omy.Acc Chem Res 35:695–705.

Enzymatically Synthesis and Characterization of Gum Tragacanth Based Interpenetrating Polymer Network Hydrogel

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***Abstract*-In this research paper, graft copolymerization of acrylic acid on *Gum tragacanth* catalyzed by lipase enzyme. The reaction was carried in aqueous medium using gluteraldehyde as crosslinker. Various reaction parameters such as reaction time, amount of solvent, temperature, pH, lipase concentration, monomer and crosslinker concentration were optimized to get candidate polymer with maximum fluid absorbance capacity. The morphology of the synthesized IPN was studied through scanning electron microscope (SEM) and Fourier transformation infrared spectroscopy (FTIR). Synthesized interpenetrating network (IPN) absorbed large amount of water and used as device for control release of nutrient such as Urea, KNO_3. Thus, the synthesized interpenetrating network (IPN) hydrogel is important in agriculture and horticulture from technological point of view.**

Key words: Interpenetrating polymer network (IPN) hydrogel, Gum trgacanth, methylmethacrylate, lipase, Urea, KNO_3.

I. INTRODUCTION

Application of hydrogels in agricultural and horticultural on the basis of most remarkable characteristic of hydrogels is their ability to absorb large amounts of aqueous solutions, such as pure water and nutrient solution. They could make plants grow at optimal environments as the release of water and nutrients in controlled manner. The advantages not only keeps continuous optimal environment but also reduces the use of freshwater and associates labor cost, being compared to directly sprinkling water to plants (Walker and Kelly, 2003 and Kaith *et al*., 2012).

Firstly, dried superabsorbent hydrogels can absorb hundreds of times water in their own weight. Also, the absorption rate for aqueous solutions is very rapid (Jun *et. al*., 1999 and Kabiri, *et. al.*, 2004). To improve the environment in post-production, one approach to mitigate the loss of hydration to prolong the self life of plants is by developing suitable hydrogels to be added to the soil. Commercial horticultural hydrogels are being used to reduce water runoff and increase infiltration rates (Nadler *et. al*., 1996 and Sojka, *et. al*., 1998 and Saruchi *et al.*, 2014). In addition to increasing water holding capacity for horticultural and agricultural applications (Jobin, *et al.*, 2004; Al-Humaid, and Moftah, 2007). Several studies have suggested that these hydrogels can delay wilting and extend crop life and quality (Save *et al*., 1995).

Such interpenetrating polymer network device synthesized using lipase enzymes as the catalysts. Biosynthetic pathway used for *in-vitro* enzymatic polymerization process. The formation of an IPN increases the compatibility of the polymer components thus preventing phase separation and allows access to properties that may be hybrids of those of the component macromolecules. Films of polylactic acid and polystyrenes are lipase catalyzed show better tensile strength, elongation at break and optical properties in comparsion to the product obtained with chemical methods. *Gum tragacanth* consists of a mixture of water-insoluble polysaccharides, bassorin, can be extracted from small bushes of *Astragalus* species. The uses of *gum tragacanth* depend on its action as an effective emulsifying and suspending agent with an extremely long shelf life and stability to heat and acidity (Johnson, 1984). Grafting and network formation of gum tragacanth with different vinyl monomers under varied reaction condition is an important tool to develop a range of polymers with diversified properties and application.

II. EXPERIMENTAL

- Materal and methods

Gum tragancth (Gt) used as backbone, Lipase (used as Intiator) procured from SD- Fine chemicals. Gluteraldehyde (used as Crosslinker), Acrylic acid (used as Monomer) and Methylmethacrylate (MMA) used as secondary monomer were purchased from Merck.

FTIR Spectra of samples were taken in PERKIN ELMER RXI Spectrophotometer using KBr pellets. SEM of the samples was taken on JEOL STEROSCAN 150 MICROSCOPE Ltd., IIT Ropar, India.

III. SYNTHESIS OF GT-CL-POLY(AA-IP-MMA)

Gum tragacanth and acrylic acid based hydrogel was synthesized as already given in Saruchi *et al*., 2013. Gt-cl-poly(AA) hydrogel (1g) was taken in a conical flask having known amount of distilled water. To this known concentration of MMA was added with stirring and kept for overnight. Next day lipase was added followed by the addition of glutaraldehyde with continuous stirring and kept in preoptimized reaction condition. The mixture was stirred and the reaction was carried out at 40^0C for two hours. After two hours IPN washed with acetone for the removel of homopolymer and dry in oven at 60^oC. Percentage swelling was calculated using the equation given below (Saruchi *et al*.,2014): $Ps = \frac{Ws-Wd}{Wd} \times 100$

Where, w_s and w_d are weights of swollen polymer and dry polymer respectively.

IV. RESULT AND DISCUSSION

Optimization and effect of different reaction parameters on percentage swelling

Optimization of various reaction parameters like reaction time, temperature, amount of solvent, pH, concentration of lipase, monomer and cross-linker were done with respect to percentage swelling. Equlibrium on, maximum swelling was attained after 15 hours. The effect of each Parameter was stuSdied separately. When immersing the hydrogel in water, the molecule of water diffused inside the hydrogel. These water molecule interact with fuctional molecule of hydrogel and converted them to fixed charged groups. Electrostaic repulsion between similar charges on different polymeric chains resulted increase dimensional structure of the sample and lead to increased swelling. Percentage swelling in Gt-cl-poly(AA-ip-MMA) increases rapidly with time of 20 hours and maximum percentage of swelling after 26 hours is 166% was obtained shown in Fig. 1.With further increase in time interval percentage swelling was found to decrease, it occure due to the fact that with increasing time interval and after reaching the maximum swelling the three dimensional network started disintegrating. Fig. 1b show that percentage swelling increase with increasing concentration of monomer methylmethacrylate and concentration of methylmethacrylate (MMA) in combination with AA was optimized and was found to be $1.96*10^{-3}$ $molL^{-1}$ with maximum percentage of swelling is 166 %. ,Howevere, further increase concentration of MMA resulted in decrease percentage of swelling. This may be occure due to the over production of free radicals, Leading to more crosslinking occure between polymeric chains , therefore formation of compact samples and less swelling capacity of samples.

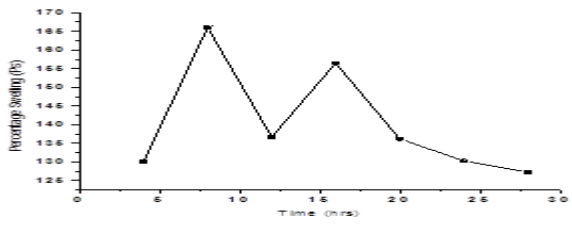


Fig. 1 Effect of time on percentage swelling (Ps) of Gt-cl-poly(AA-ip-MMA)

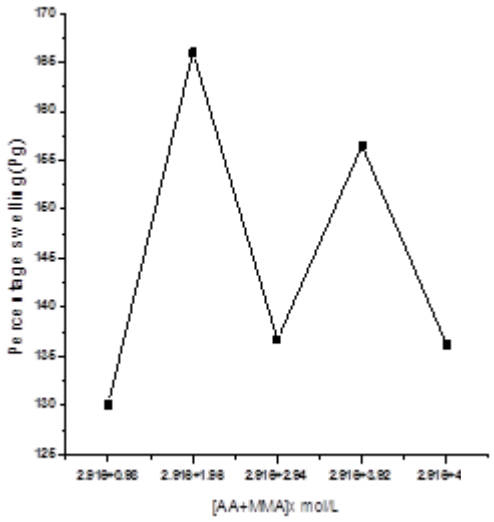
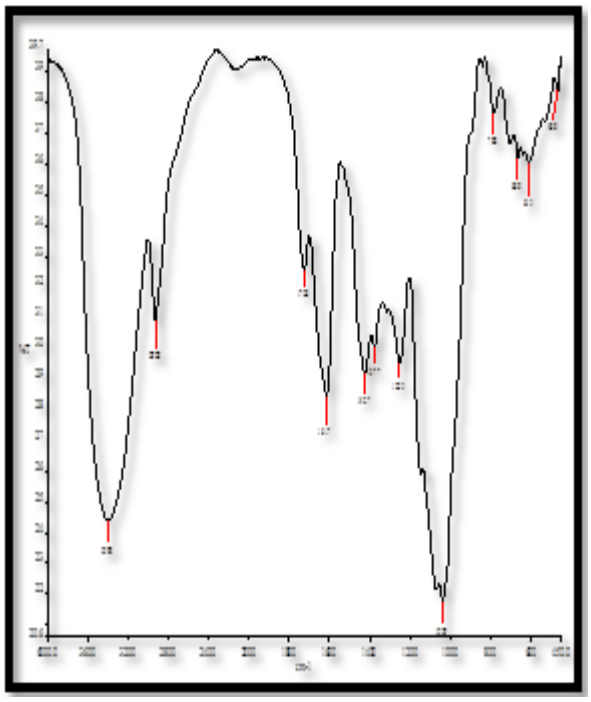


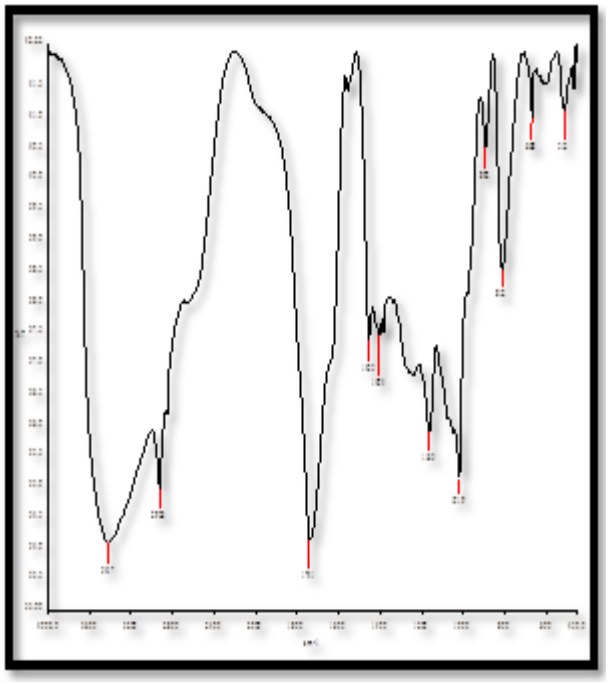
Fig. 1b: Effect of methylmethacrylate concentration on percentage swelling (Ps)of Gt-cl-poly(AA-ip-MMA)

V. FTIR SPECTROSCOPY

FTIR spectrum of *Tragacanth gum* showed broad peaks at 3398 cm^{-1} (O-H stretching bonded absorption of carbohydrates), 2928 cm^{-1} (-CH_2 asymmetric stretching), 1039 cm^{-1} (-C-O stretching region as complex bands resulting from C-O and C-O-C stretching vibrations), one peak at 1253 cm^{-1} (C-O-C stretching) and 613 cm^{-1} (glucose ring) shown in Fig. 2a.

In case of FTIR spectra Gt-cl-poly(AA-ip-MMA)-Enz Fig. 4, show peaks at 3417 cm^{-1} (O-H stretching), 2926 cm^{-1} (C-H stretching of CH_3) and 1741 cm^{-1} (C-O stretching of carbonyl of ester) were observed in addition to the peaks observed with IR of *Gum Tragacanth* shown in Fig. 2b.





Figs. 2a-b: FTIR spectra of (a) *Gum Tragacanth* (b) Gt-cl-poly(AA-ip-MMA)

- Scanning Electron Microscopic Studies

In order to have the conducting impact, the samples were gold plated and the scanning was synchronized with microscopic beam so as to maintain the small size over a large distance relative to the specimen. A remarkable three dimensional appearance with high resolution was obtained in case of crosslinked product. SEM images clearly exhibited the differences in the surface morphology of the *Gum Tragacanth*, and Gt-cl-poly(AA-ip-MMA)-Enz in (Figs. 3a,b). These morphological changes were brought about through graft copolymerization and crosslinking with gluteraldehyde.

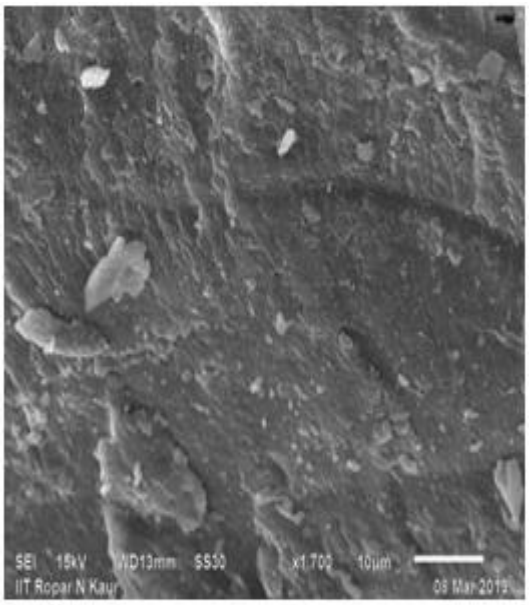


Fig.3a

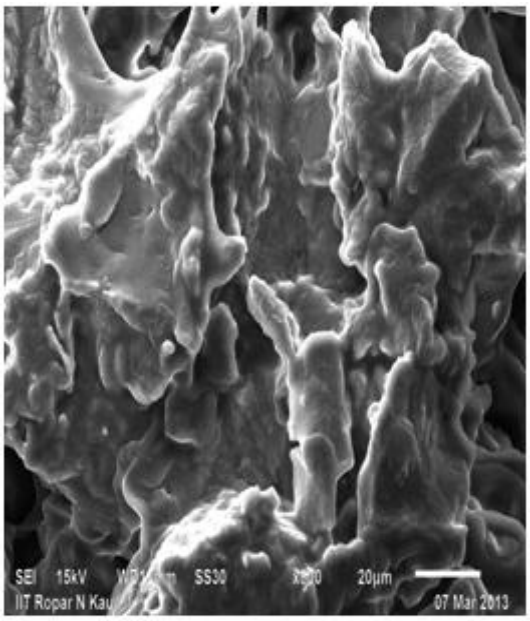


Fig. 3b

Figs. 3a-b: SEM of (a) *Gum Tragacanth* (b) Gt-cl-poly(AA-ip-MMA)

VI. CONCLUSION

IPN was synthesized through modification of *Gum tragacanth* via graft copolymerization and network formation with acrylic acid-co-methylmethacrylate improves the property profile and usability of the polymer in various technical fields. The polymer behaved as a smart polymer as it showed temperature and pH dependent absorptions. Thus, the functionalized polymer is important from technological view point. It was found that the superabsorbent has tremendous water absorbing capacity within its structure and retained it for long period and is sensitive towards pH as well as temperature. The modification of *Gum trgacanth* through copolymerization with acrylic acid using lipase and gluteraldehyde as an initiator-cross linker system has extended its applicability and improved its property profile.

REFERENCES

1. Walker, P., Kelly, T. 2003. "Solid, organic load and nutrient concentration reductions in swine waste slurry using a polyacrylamide (pam)-sided solids flocculation treatment". Bioresour. Technol., 151-158.
2. Kabiri, K. Mahammad, J.Z.M., 2004. "Porous superabsorbent hydrogel composites: Synthesis, morphology and swelling rate". Macromol. Mater., 653-661.
3. Nadler, A.E. Perfect, Kay, B.D. 1996. "Effect of polyacrylamide application on the stability of dry and wet aggregates," Soil Sci. Soc. Amer. J. 555- 561.
4. Sojka, R.E., Lentz, R.D., Ross, C.W., Trout, T.J., Bjorneberg, D.L. Aase, J.K. 1998. "Polyacrylamide effects on infiltration in irrigated agriculture," J. Soil Water Conserv., 325-331.
5. Jobin, P.J., Caron, P., Bernier, B. Dansereau, B. 2004. "Impact of two hydrophilic acrylic- basedpolymers on the physical properties of three substrates and the growth of *Petunia x hybrida* Brilliant Pink" J. Amer. Soc. Hort. Sci., 449-457.

6. Al-Humaid, A. I., Moftah, A. E. 2007. “Effects of hydrophilic polymer on the survival of buttonwood seedlings grown under drought stress,” J. Plant Nutr., 53-66.
7. Save, R., M. Pery, O. Marfá, and L. Serrano, “The effect of a hydrophilic polymer on plant water status and survival of transplanted pine seedlings” Hort. Technol., 1995, 141-143.
8. Johnson, M.S. 1984. Effects of soluble salts on water absorption by gel-forming soil conditioners. *J. Sci. Food Agric*. 35, 1196 - 1200.
9. Kaith, B.S., Saruchi, Rajeev, J., Bhatti, M.S. 2012. “Screening and RSM optimization for synthesis of a Gum tragacanth–acrylic acid based device for in situ controlled cetirizine dihydrochloride release”. Soft Matter, 8, 2286-2293.
10. Saruchi, Kaith, B,S., Jindal, R., Kapur, G.S. 2013. “Enzyme-based green approach for the synthesis of gum tragacanth and acrylic acid cross-linked hydrogel: its utilization in controlled fertilizer release and enhancement of water-holding capacity of soil”. Iranian Polymer Journal, 22, 561-570.
11. Saruchi, Kaith, B.S., Jindal, R., Kapur, G.S., Kumar, V. 2014. “Synthesis, characterization and evaluation of Gum tragacanth and acrylic acid hydrogel for sustained calcium chloride release-enhancement of water holding capacity of soil”. Journal of the Chinese Advanced Materials Society, 2, 40-52.
12. Saruchi, Kaith, B.S., Jindal, R., Kapur, G.S. 2014. “Synthesis of Gum tragacanth and acrylic acid based hydrogel: its evaluation, for controlled release of antiulcerative drug pantoprazole sodium, characterization and evaluation of Gum tragacanth and acrylic acid hydrogel for sustained calcium chloride release-enhancement of water holding capacity of soil”. Journal of the Chinese Advanced Materials Society, 2, 110-117.
13. Chen, J., Park, H., Park, K. 1999.“Synthesis of superporous hydrogels: Hydrogels with fast swelling and superabsorbent properties,” J. Biomed. Mater. Res., 44, 53-62.

Self Assembled Monolayers -A Review

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Abstract--Self assembly provides a easy route to organise suitable organic molecules on noble metal surface by using long chain organic molecules with a variety of functionalities like -SH,-COOH,-NH_2 and Silanes. These surfaces could be used to build up interesting nano level architectures materials. Self assembly is an attractive process for biological relevance because it provides a novel approach to complex structure having nanometre scale dimensions. The self assembled monolayers (SAMs) can be characterized by various techniques such as Contact angle goniometry, X-ray photoelectron spectroscopy, Infra red and scanning probe microscopy which will provides the valuable information about the SAMs.

I. INTRODUCTION

Self assembled monolayers (SAMs) are highly ordered molecular assemblies shaped spontaneously by chemisorptions and self organization of long chain molecules on the surface of suitable substrates. This is an very interesting process for its biological relevance because it provides a novel approach to complex structure having nanoscale dimensions. These types of structures are difficult to prepare by conventional methods [1]. Alkanthiols self assembly into gold is the mainly studied example of SAMs which determine the strong gold sulphur and chain- chain interactions. SAMs have been useful in the expansion of sensors, [2, 3] interfaces, [4] and microfabrication [5-9]. One of the most significant class of 2 based on the strong adsorption of sulphur- based compounds- thiols, diulphides, sulphide, and related moieties on coinage metals, particularly Au, Ag, Cu as well as Pt, Hg, GaAs {100} and InP {100} [10-16] surfaces. During the creation of self assembled monolayers adsorption is normally carried out by placing the substrate in dilute solution of thiols. Any solvent which is capable of dissolving the thiol can be used for this purpose. Adsorption could be also carried out under potential control or from the vapour phase [12]. A wide range of fundamentals groups can be combined into the SAM without any destabilisation [10-16]. Thess nature of the terminal groups plays an very important role in determining the properties of the monolayers such as wettability and ionisation [14]. The field of self assembled monolyers has been fascinated tremendous growth in synthetic sophistication and depth of characterization over the past years [17].

In 1946 Zisman have studied the preparation of mono molecular layers by adsorption (self assembly) of a surfactant into a sparkling metal surface. Nuzzo and Alara have showed that SAMs of alkanethiols on gold can be prepared by adsorption of di-n-alkyl sulphides from dilute solutions. Formation of monolayer of surfactant molecules at surface are the examples of the general phenomenon of self assembly. Self assembly process provides a chance to increase fundamental understanding of self organization, structure property, relationships and interfacial occurrence. Excellency of SAMs depends upon the tailoring of both head and tail groups of the nearby molecules. It is very useful for understanding of phenomenon affected by coupling, intermolecular, molecular substrates and molecule-solvent interaction like ordering and growth, wetting, adhesion, lubrication and corrosion [18].

Self assembly is a term of superamolecular chemistry [19] and is generally used to define the superamolecular interaction along with molecules in solution/solid state to give special arrangement. This is also used for development of micelles and other systems formed by the surfactants. In this review we will elaborate the term SAM on the metal surface or adsorption of molecules on the solid surface.

II. FORMATION OF SELF ASSEMBLED MONO / MULTILAYERS ON SURFACE OF THE METAL

Gold has been the most well studied surface for the self assembly process by using alkanethiols till date. In the literature formation of SAMs of alkanethiols on gold could be summarised as in which, Au (111) surface represent the best characteristics for the formation of SAMs. The thiolate groups are linked with the three Au atoms on the surface. Interaction between Au-Sulfur is reversible which permits the alkanethiols anions to interact among themselves in order achieve the formation of highly compact monolayers. Alkanethiolates with about 10-20 carbon atoms attain highest organised monolayers and assemble on a gold surface with an angle 30^0 from the normal to the surface.

One of the simplest ways to form the self assembled monolayers is to dip an extremely clean oxidized gold sheet surface into an solution of ethanol corresponding alkanethiols. Other types of organic solvents could also be used. The conc. of the thiol may be vary between 1mM and 1μM. There is a complete formation of SAM occur within a time limit of 12-18 hr at room temperature because self assembly of molecules occur inside first few seconds but more time is required for the organised and compact monolayers [18]. A systematic representation for the formation of SAM is given in the Fig. (1)

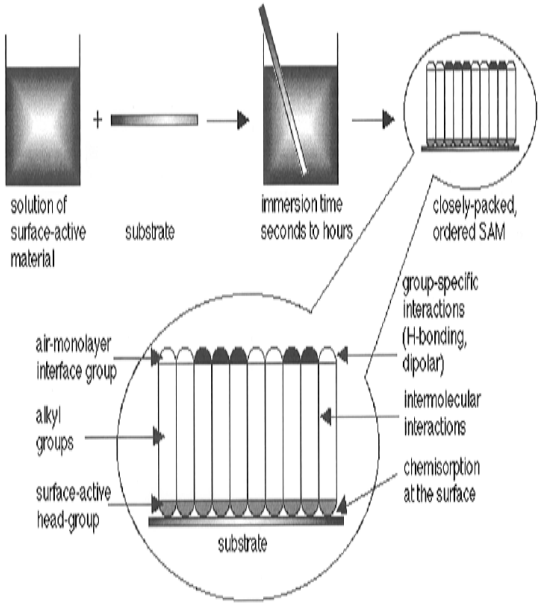

Figure. 1 Self-assembled monolayers are formed by purely immersing a substrate into a solution of the surface-active material.

SAM has been built on Silver, Copper, Nickel, Palladium and Platinum [20] metal surfaces. But Silver, Nickel and Copper are due to their less interaction can easily oxidize. Copper could be oxidize extremely so it is difficult to obtain the organised and compact SAM on this metal. A very stable SAM on the Platinum surface has been obtained by using isocyanides. Many metal complexes such as $Ru(bpy)_3$; $(C_2H_5)_2Fe$ and porphyrin can be self assembled by disulphide anchor groups on an gold or indium tin oxide (ITO) electrode, in this not only the basic electron transfer kinetics but also photocurrent generation of sensing properties have been explored. Except gold other organic groups such as carboxylate, phosphonate and isocynide also urged to operate as surface immobalised groups. These organic groups having differential reactivity towards Gold, Platinum and metal oxide materials. It is also named as orthogonal self assembly which is reported earlier i.e thiol and disulphide groups bound to Gold substrate.

On the other hand cyanide as well as pyridine groups are bound to a platinum surface and phosphonate and silanol groups to indium tin oxide and metal oxide surface. Thiol - Au self assembled chemistry has been extensively studied but till date phosphonate metal oxide self assembled chemistry is not so elder. In phosphonate –metal oxide self assembled chemistry the growth mechanism of long chain phosphonic acid on mica or sapphire has been examine earlier by many researchers.

A Self Assembled Monolayers of Fatty acids

There is a constant absorption of long chain n-alkanoic acids ($C_nH_{2n+1}COOH$) in the earlier years. In this reaction and the driving force which is responsible for formation of a surface salt between the carboxylate anion and surface metal cation. Schollter and his co-workers also reported the natural adsorption of such acids on silver surface. Chemisorption of alkanoic acids on amorphous metal oxide surface is not unique which was shown by Tao and he observed that on the AgO surfaces the carboxylate two oxygen atoms bind to the surface in a symmetrical way while on the CuO and Al_2O_3 surface. Carboxylate binds asymmetrically to the surface and show tilt angle zero. From the current Raman studies it was detected that monolayers of steric acids on a smooth Ag surface are less ordered as compared the layer formed on Al_2O_3 surface. It has been also observed that the chains in SAMs on AgO are lying along ordinary to the surface and he has also observed through the IR studies that monolayers on AgO are well arranged as compared their counterparts on Al_2O_3.

B Monolayers of organosilicon Derivatives

For the formation of self assembled monolayers of alkylchlorosilanes, alkylalkoxysilanes, and alkylaminosilanes require hydroxylated surfaces as substrates for their formation. The driving force for this self-assembly is the in situ formation of polysiloxane, which is connected to surface silanol groups (-SiOH) via Si-O-Si bonds. Substrates on which these monolayers have been successfully prepared include silicon oxide], aluminum oxide , quartz , glass ,mica, zinc selenide, germanium oxide,and gold Recently Allara and his coworkers have compared OTS monolayers on silicon oxide and on gold activated by UV-ozone exposure. IR spectroscopy, ellipsometry, and wetting measurements showed identical average film structures.

C Organosilane self assembled monolayers on SiO_2

Organosilanes generally consist of a silicon atom tetrahedrally bound to three similar functional groups (short chain alkoxy group or chlorines)as compared to a functional group. In case of S-Au ineraction the bond is mostly charged transfer in nature but head group-substrate interaction of the Silane and SiO_2 surface is quite different. Silane molecule condenses with native hydroxyl group adorning the SiO_2 surface, forming a thin layer of covalently polysiloxane at the interface. Organosilane SAMs on SiO_2 have a huge importance in the photo resist industry because of their patterening by energetic beams which affords structures that can direct the substrates topographical etching.

D Alkanthiolates on the noble metal surfaces

Lot of the work have been reported in the field of structure as well as placement of alkanethiolate films on the surfaces other than the gold such as Platinum, Palladium, Silver and Copper. This area has not been spread extensively but no doubt it will be extremely useful in balancing order and placement of molecules with an ability to create stable and functional nanostructures.

III. CONCLUSION

Self assembled monolayers (SAMs) are crystalline chemisorbed organic single layer formed on solid state substrates by spontaneous organization of molecules. Self assembly of thiols on gold has stimulated and facilitated numerous surface chemical studies and oppournities. SAMs are an ideal model that could be used to study phenomenon

such as wetting, friction, adhesion and biological interaction.

REFERENCES

[1] L. Isaacs, D. N. Chin, N. Bowden, Y. Xia and G. M. Whitesides, *Perspectives in Supramolecular Chemistry*, Wiley & Sons,Chichester, **4**, 1 (1999).

[2] B.-H. Huisman, R. P. H. Kooyman, F. C. J. M. van Veggel and D. N. Reinhoudt, *Adv. Mater*., **8**, 561(1996).

[3] K. D. Schierbaum, T. Weiss, E. U. Thoden van Velzen,J. F. J. Engbersen, D. N. Reinhoudt and W. Gopel, *Science*, **265**, 1413(1994).

[4] Y. S. Shon, S. Lee, R. Colorado, Jr., S. S. Perry and T. R. Lee, *J. Am. Chem. Soc.*, **122**, 7556 (2000).

[5] D. J. Dı´az, J. E. Hudson, G. D. Storrier, H. D. Abrun˜a, N. Saudararajan and C. K. Ober, *Langmuir*, **17**, 5932 (2001).

[6] C. Alain, M. Geissler, H. Schmid, B. Michel and E. Delamarche, *Langmuir*, **18**, 2406(2002).

[7] G. P. Lopez, H. A. Biebuyck, C. D. Frisbie and G. M. Whitesides, *Science*, **260**, 647(1993).

[8] S. Xu, S. Miller, P. E. Laibinis and G. Y. Liu, *Langmuir*, **15**,7244(1999).

[9] G.-Y. Liu, S. Xu and Y. Qian, *Acc. Chem. Res*., **33**, 457 (1999).

[10] A. Ulman, Academic Press: New York, 1991.

[11] A. Ulman, *Chem. Rev*. **96**, ss1533 (1996).

[12] H. O. Finklea, *Electroanalytical Chemistry*, Eds. A. J. Bard, I. Rubinstein, Marcel

Dekker: New York, **19**,109- 335(1996).

[13] L. H. Dubois, R. G. Nuzzo, *Annu. Rev. Phys. Chem.*, **43**, 437 (1992).

[14] H. O. Finklea, *Encyclopedia of Analytical Chemistry*, Ed. R. A. Meyers, Wiley: Weinheim, **10**, 10090-10115 (**2000)**.

[15] R. G. Nuzzo, D. L. Allara, *J. Am. Chem. Soc.*, **105**, 4481(1983).

[16] L. Strong, G. M. Whitesides, *Langmuir*, **4**, 546 (1988).

[17] A. Ulman, *Academic Press: Boston*, 1991.

[18] A. Ulman , *Chem. Rev.*, **96**, 1533-1554 (1996).

[19] J.M. Lehn, *Supramolecular Chemistry*, VCH, Weinheim, 1995.

[20] G.M.Whitesides, J.A.Williams, C.B. Gorman, J. Phys. Chem. C **111**, 12804 (2007) .

Track-4

Technical Session 2

PHYSICS

Equivalent Atomic Numbers for Some Polymers

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***Abstract:*--Equivalentatomic numbers(Z_{eq}) for some polymers viz. PEEK, VECTRA-A, PC, PET and PTFE have been computed in the energy range of0.015 - 15.0 MeV using the mass attenuation coefficient database of WinXCom (2001).The equivalent atomic number(Z_{eq}) of a composite material (compound/mixture) is analogous to atomic number of an element. However, unlike atomic number, it is an energy dependent parameter. It is computed on the basis of contribution of Compton scattering process in the total photon interaction processes. It is the basic tool for the computations of the gamma rays buildup factors, which finds its applications in nuclear shield designing and dose computations. Finally, the variation of Z_{eq} with incident photon energy for the selected polymers has been studied.**

I. INTRODUCTION:

Polymers have a variety of applications in the field of nuclear industry due to the vulnerability of polymeric materials to different type of radiations. In the nuclear industry, polymers can be used to make tools for handling radioactive materials. The nuclear industry generates considerable amount of radioactive wastes. Polymers were used in radioactive waste management and it has high radiation stability (IAEA (1988), Debre(1997), Ozdemir (2008)).

II. THE EXPOSURE OF THE HIGHLY PENETRATING

Radiations from the nuclear waste produces numerous health hazards. Hence, nuclear and radiation physicists are looking for some affordable and flexible shielding materials. Keeping in view the advantages of polymers; an attempt has been made to compute the Equivalent atomic numbers (Z_{eq})for some polymers.

sThe equivalent atomic number (Z_{eq}) is a parameter similar to the atomic number of elements, which describes the properties of the composite materials (compounds/mixture) in terms of equivalent elements. Since, the interaction of gamma radiations with materials based on domination of different partial photon interaction processes in different energy regions; hence unlike atomic number of elements, equivalent atomic number (Z_{eq}) is an energy dependent parameter. It is computed from the contribution of Compton scattering processs and it is the basic tool in the computations of the buildup factor.

Computations of Equivalent Atomic Numbers (Z_{eq}):For the computation of Z_{eq}, firstly the values of Compton partial attenuation coefficient (μ_{Comp}) and the total attenuation coefficients(μ_{total}) were obtained incm^2/g for the selected polymers in the energy range of .015-15.0MeVusingWinXComcomputerprogramof Gerward et al.(2001). The values of Z_{eq} for the selected polymers were computed by matching the ratio R (μ_{Comp}/μ_{total}) of a particular polymer at a selected energy with the corresponding ratio of an element at the same energy. In case, the value of ratio lies between ratios for known successive elements, the value Z_{eq} was then interpolated using the following logarithmic interpolation formula by Singh et al.(2009):

$$Z_{eq} = \frac{Z_1\,(logR_2 - logR) + Z_2\,(logR - logR_1)}{(logR_2 - logR_1)} \quad (1)$$

Where Z_1 and $Z_2$are the atomic numbers of elements corresponding to the(μ_{Comp}/μ_{total}) ratios, R_1 and R_2, respectively, and R (μ_{Comp}/μ_{total}) is the ratio for the selected polymers at a particular energy, which lies between ratios R_1 and R_2.The chemical composition of the selected polymers selected for the present investigations has been given in the Table 1.

III. RESULT AND DISCUSSION:

The chemical composition (equivalent atomic number) plays an important role in the interaction of radiation with the selected polymers. The equivalent atomic numbers are directly proportional to the atomic number of the constituent elements of the interacting material and this dependence on the atomic number further varies with the dominance of photon interaction processes in different energy regions. The equivalent atomic numbers (Z_{eq}) of the selected polymers at different incident photon energies has been given in Table 2 and also shown in Fig. 1. Since, the equivalent atomic numbers have been computed on the basis of Compton scattering process, hence the slight variation observed in it with the incident photon energy can be explained on the basis of dependence of cross-section for Compton scattering process on incident photon energy.

Among the selected polymers, the equivalent atomic numbers increases very slightly with the increase in incident photon energy, and remain constant upto 1.5 MeV and then decreases upto 5.0 MeV for polycarbonate and PEEK. PTFE (Poly-tetra-fluoro-ethylene) possesses the highest values for equivalent atomic numbers and the least values of equivalent atomic numbers has been shown by PET (poly-ethylene terephthalate).This can be explained on the basis of weight fraction of different constituent elements, higher is the weight fraction of higher atomic number element; higher will be its equivalent atomic number.

TABLE 1. CHEMICAL COMPOSITION OF THE SELECTED POLYMERS

S.No.	Selected Polymers	Chemical Formula Fractional weight
[1]	PEEK (Poly-ether-ether-ketone)	$C_{19}H_{12}O_3$ C: 0.79156, H: 0.04195 O: 0.16649
[2]	VECTRA-A (73 mol% hydroxyl benzoic acid and 27 mol% hydroxyl naphthoic acid)	$C_{18}H_{10}O_4$C: 0.74480, H: 0.03472 O: 0.22047
[3]	PC (poly-carbonate)	$C_{16}H_{14}O_3$C: 0.75675, H: 0.05549 O: 0.18976
[4]	PET (poly-ethylene terephthalate	$C_{10}H_8O_4$C: 0.62502,H: 0.04196 O: 0.33302
[5]	PTFE (Poly-tetra-fluoro-ethylene)	C_2F_4C: 0.24018, Fl: 0.75982

TABLE 2. EQUIVALENT ATOMIC NUMBERS (Z_{EQ}) WITH INCIDENT PHOTON ENERGY

S.No.	Energy (MeV)	Equivalent atomic numbers (Z_{eq})				
		PEEK	VECTRA	POLYCARBONATE	PETF	PTFE
1	1.50E-02	6.73E+00	6.565881	6.72E+00	6.34E+00	8.539529
2	2.00E-02	6.73E+00	6.57221	6.73E+00	6.35E+00	8.543044
3	3.00E-02	6.75E+00	6.592349	6.75E+00	6.36E+00	8.551737
4	4.00E-02	6.76E+00	6.61031	6.77E+00	6.38E+00	8.560591
5	5.00E-02	6.78E+00	6.625604	6.78E+00	6.40E+00	8.568625
6	6.00E-02	6.79E+00	6.638112	6.80E+00	6.42E+00	8.57563
7	8.00E-02	6.81E+00	6.657735	6.83E+00	6.44E+00	8.586138
8	1.00E-01	6.83E+00	6.672153	6.84E+00	6.46E+00	8.59403
9	1.50E-01	6.85E+00	6.695523	6.88E+00	6.49E+00	8.606077
10	2.00E-01	6.87E+00	6.709347	6.89E+00	6.51E+00	8.614475
11	3.00E-01	6.88E+00	6.723128	6.91E+00	6.53E+00	8.623317
12	4.00E-01	6.89E+00	6.729593	6.92E+00	6.53E+00	8.627871
13	5.00E-01	6.89E+00	6.733525	6.92E+00	6.54E+00	8.630354
14	6.00E-01	6.89E+00	6.735518	6.93E+00	6.54E+00	8.631938
15	8.00E-01	6.90E+00	6.737038	6.93E+00	6.54E+00	8.633569
16	1.00E+00	6.90E+00	6.737894	6.93E+00	6.54E+00	8.633253
17	1.50E+00	5.02E+00	6.852922	5.09E+00	6.69E+00	8.717654
18	2.00E+00	5.07E+00	6.893262	5.15E+00	6.74E+00	8.746699
19	3.00E+00	5.08E+00	6.902379	5.16E+00	6.75E+00	8.751847

20	4.00E+00	5.08E+00	6.905049	5.16E+00	6.76E+00	8.750137
21	5.00E+00	5.08E+00	6.905679	5.16E+00	6.76E+00	8.748944
22	6.00E+00	5.08E+00	6.906434	5.16E+00	6.76E+00	8.750448
23	8.00E+00	6.67E+00	6.628366	5.70E+00	6.59E+00	8.747271
24	1.00E+01	6.36E+00	6.297428	5.38E+00	6.25E+00	8.744869
25	1.50E+01	6.25E+00	6.212625	5.27E+00	6.18E+00	8.747763

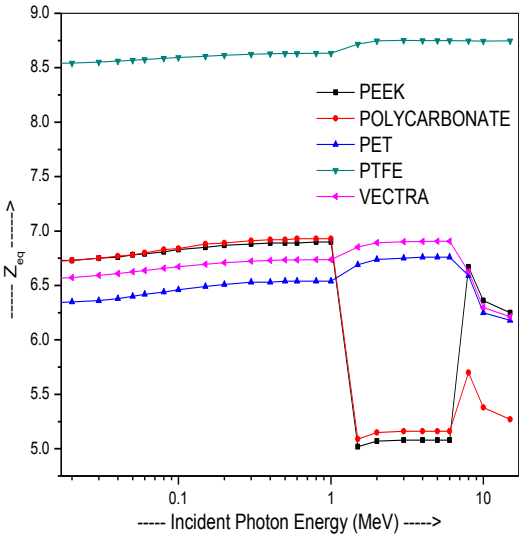

Figure1. Variation of equivalent atomic numbers (Zeq) with incident photon energy

REFERENCE

[1] IAEA, International Atomic Energy Agency. Immobilization of low and intermediate level radioactive wastes in polymer. IAEA, Vienna (Technical Report Series–289), (1988).

[2] Debre´ O.,NsouliB.,Thomas,J.P., Stevenson I.,ColombiniD.,Romero, M.A., Gamma irradiation-induced modifications of polymers found in nuclear waste embedding processes PartI:the epoxy/amine resin.*Nucl.Instru. MethodB* 131,313–320,(1997).

[3] O¨zdemirT.,UsanmazA.,Degradationofpoly(bisphenola-co-epichlorohydrin) bygammairradiation.*Radiat. Phys. Chem.*77, 799–805,(2008)

[4] Gerward L., Guilbert N., Jensen K.B. and Lerving H.,X-ray absorption in matter. Reengineering XCOM.*Radiat. Phys. Chem.*, **60**, p23, (2001).

[5] Singh T., Kumar N., Singh P.S., Chemical composition dependence of exposure buildup factors for some polymers. *Ann. Nucl. Energy* 36, 114–120,(2009).

Δi=2 Staggering in Super Deformed Nuclei in A=130 Mass Region

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***Abstract* - The analysis has been done which allow us to confirm Δ*I* = 2 staggering in the SD bands in A=130 mass region by performing a staggering parameter analysis. For each band, we calculated the deviation of the gamma ray energies from smooth reference representing the finite difference approximation to the fourth derivative of the gamma ray transition energies at a given spin.**

Keywords: Nuclear Structure, Staggering, Superdeformed Bands

I. INTRODUCTION

The super deformed (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 ≈ 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. Apart from the search for new super deformation and hyper deformation, much effort has been devoted to studying the underlying physics of the SD bands and a number of interesting issues have been raised. In fact, the most straightforward problem is the amazing regularities exhibited in the SD transition energies. In this aspect, the so-called 'identical' SD bands and the ΔI=2 staggering have been discussed extensively in recent years. The ΔI =1 staggering has been familiar for a long time in normally deformed nuclei.

In this paper, we investigate the ΔI=2 staggering in a detailed manner for the SD bands in A=130 mass region.

II. FORMALISM

To explore more clearly the ΔI=2 staggering, for each band the deviations of the transition energies from a smooth reference ΔE_γ is determine by calculating the fourth derivative of the transition energies $E_\gamma(I)$ at a given spin given by

$$\Delta E_\gamma(I) = \frac{3}{8}(E_\gamma(I) - \frac{1}{6}[4E_\gamma(I-2) + 4E_\gamma(I+2) - E_\gamma(I-4) - E_\gamma(I+4)])$$

(1)This expression was previously used in [12] and is identical to the expression for $\Delta^4 E_\gamma(I)$ in reference [13]. We chose to use the expression above in order to be able to follow higher order changes in the moments of inertia of the SD bands.

III. RESULT AND DISCUSSIONS

The formula given in equation (1) has been used to study the staggering in the SD bands of A=130 mass region. The experimental data are taken from Ref. [3] and the continuously updated ENSDF and XUNDL databases [4]. We have considered only the SD bands of ^{130}Ce for which some kind of estimates of spin assignments are available. The result of the present work is the observation of a ΔI =2 staggering effects in the γ−ray energies, where the two sequences for spins I=4j, 4j+1 (j=0, 1, 2..) and I= 4j+2 (j=0, 1, 2, ….) are bifurcated. For each band the deviation of the γ−ray energies from a smooth reference ΔE_γ is determined by calculating the fourth derivative of the γ−ray energies $\Delta E_\gamma(I)$ at a given spin $\Delta^4 E_\gamma$.

The staggering in the γ−ray energies is indeed found for the SD bands in ^{129}Ce, ^{130}Ce, ^{131}Ce(SD-1) and ^{131}Ce(SD-2) in Fig. (1). With the exception of ^{131}Ce(1), all other bands shows large amplitude staggering.

It is necessary to discuss the SD band in ^{130}Ce in detail. The staggering amplitude increases at the rotational frequency ≈ 0.5 and then turn to decrease with the increasing value of rotational frequency.

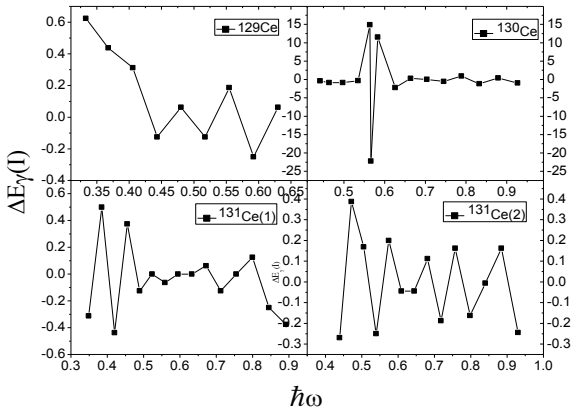

Fig. 1 The calculated $\Delta^4 E_\gamma$ staggering as a function of rotational frequency ω of the SD bands in ^{129}Ce, ^{130}Ce and ^{131}Ce(SD-1) and ^{131}Ce(SD-2).

IV. CONCLUSION

In summary, the $\Delta I = 2$ staggering has been investigated and parameterized in this paper. A large-amplitude staggering pattern is found in the SD bands of A=130 mass region. The staggering in the γ−ray energies has been found for the SD bands in ^{129}Ce, ^{130}Ce, ^{131}Ce(SD-1) and ^{131}Ce(SD-2). With the exception of ^{131}Ce(1), all other bands have showed the large amplitude staggering. It is very important to note that staggering amplitude in the SD band of ^{130}Ce has been increased at the rotational frequency ≈ 0.5 and then has been decreased with the increasing value of rotational frequency.

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REFERENCES

[1] Strutinsky, . V. M., "Shell effects in nuclear masses and deformation energies", Nucl. Phys. A 122, 1968, pp. 1.

[2] Twin, P. J., Nyak, B. M., Nelson, A. H., Simpson, J., Bentley, M. A., Cranmer Gordon, H. W., Forsyth, P. D., Howe, D., Mokhtar, A. R., Morrison, J. D., Sharpey Schafer, J. F., and Sletten, G., 1986, "Observation of a discrete-line superdeformed band up to 60~ in 152Dy" Phys. Rev. Lett., 57, 811.

[3] Singh, B, . Zywin, R and Firestone, R. B. " Table of Superdeformed Nuclear Bands and Fission Isomers", Nuclear Data Sheets 97, 2002, pp. 241.

[4] www.nndc.bnl.gov.

[5] Ideguchi, E., Sarantites, D. G., Reviol, W., Afanasjev, A., Devlin, M., Baktash, C., Janssens, R. F., Rudolph, D., Axelsson, A., Carpenter, M. P., Galindo-Uribarri, A., LaFosse, D. R., Lauritsen, T., Lerma, F., Lister, C. J., Reiter, P., Seweryniak, D., Weiszflog, M., and Wilson, J. N., 2001, "Superdeformation in the doubly magic nucleus Ca20": Phys. Rev. Lett., 87, 222501.

[6] Ideguchi, E., Ota, S., Morikawa, T., Oshima, M., Koizumi, M., Toh, Y., Kimura, A., Harada, H., Furutaka, K., Nakamura, S., Kitatani, F., Hatsukawa, Y., Shizuma, T., Sugawara, M., Miyatake, H., Watanabe, Y. X., Hirayama, Y., and Oi, M., 2010, "Superdeformation assymetric N > Z nucleus 40Ar", Phys. Lett. B, 86, 18.

[7] Wilson, A. N., Korichi, A., Siem, S., Astier, A., Bazzacco, D., Bednarczyk, P., Bergstrom, M. H., Chmel, S., Cullen, D. M., Davidson, P. M., Gorgen, A., Hannachi,

F., Hubel, H., Kintz, N., Lauritsen, T., Lopez-Martens, A., Lunardi, S., Naguleswaran, S., Nyako, B. M., Rejmund, M., Schonwasser, G., Schuck, C., Sharpey-Schafer, J. F., Timar, J., Wadsworth, R., and Libert, J., 2010, "Twoparticle separation energy trends in the superdeformed well", Phys. Rev. Lett., 104, 162501.

[8] Dudeja, M., Malik, S. S., and Jain, A. K., 1997, "An empirical analysis of superdeformed bands: A semiclassical view", Phys. Lett. B, 412, 14.

[9] Malik, S. S., Dudeja, M., Amita, and Jain, A. K., 2000, "Semiclassical quantization of Particle Rotor Model and ΔI =2 staggering of SD bands", Int. J. Mod. Phys. E, 9, 487.s

[10] Gallardo, M., Frauendrof, S, and Brogli, R.A., Phys. Lett. B, 166, 1986, pp. 252.

[11] Bes, D.R. and Broglia, R A. Nucl. Phys. A, 80, 1966, pp. 289.

[12] Cederwall B., et al. 1994 "New Features of Superdeformed bands in 194Hg": Physical ReviewLetters, 72, 3150.

[13]] Reviol W., Jin H. Q. and Reindinger L.L.,1996 "Transition energy staggering and band interaction in rare earth nuclei". Phys. Letters B, 371, 19.

Effect on Physical Parameters of Ge-Sn-Se Glass System with Compositional Variations

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***Abstract*--- Tin (Sn) based chalcogenide glasses have wide glass forming ability and thus forms an important class of arsenic free glass system. In this paper an attempt has been made to analyze the effect on physical properties of $Ge_xSn_{10}Se_{90-x}$ (x= 14, 18, 22, 26) ternary glass system by making partial replacement of Se by Ge. Various physical parameters viz. average co-ordination number, floppy modes, stoichiometric parameter, cohesive energy, heat of atomization has been calculated. The effect of mean bond energy and heat of atomization on glass transition temperature has been calculated by using two independent approaches i.e. Tichi-Ticha and Lankhorst relations.**

Keywords: **Chalcogenide, Heat of Atomization, Cohesive Energy**

I. INTRODUCTION

Chalcogens are considered as ore formers, those find place in the 16th group of modern periodic table. Group 16 consists of five elements i.e. O, S, Se, Te, Po but out of these elements only S, Se, Te are regarded as chalcogens due to their unique properties viz. phase transformation, high transparencies in low and middle IR region [1] and optical properties. Chalcogenide glasses (Ch.Gs) are covalently bonded amorphous semiconductors with the lack of long range ordering. Due to lack of translational symmetry, these semiconductors are more viscous and flexible as compared to crystals and thus known as *soft semiconductors* [2]. Ch.Gs have attracted interest of many researchers but due to lack of complete structural knowledge, their potential is still not fully exploited.

Selenium Se is the only element possessing vitreous state even at the room temperature [3]. The vitreous (glassy) Se consists of helical chains, and Se_8 rings [4]. Covalent bonds exist within chains and rings and in between them Vander wall forces exist. Rings prevent chains from coming closer and collapsing thus disordered structure is restored. Se possess some characteristic features viz. phase transformation thus are exploited in various applications like memories, rectifiers, optical fibers etc. [5] but low sensitivity, ageing are certain shortcomings those can be removed by alloying it with elements from 13, 14, 15 i.e. As, Ge, In etc [6-8]. The second element so added will act as a bond modifier and hence strengthen the average bond strength. This will lead to the increase in glass transition temperature consequently stabilize the network. If the third component is also added it will introduce some defects in the system thereby making the system more flexible.

Physical parameters like co-ordination number, electro negativity, number of floppy modes etc. plays an important role in understanding the nature of bonds formed, structure of network and thus leads to their applications in different fields like memory, photoreceptors, switching etc [9-10]. Knowledge of glass transition temperature T_g defines the working limits of glasses. So in this paper an attempt has been made to study the effect of partial replacement of Ge at the cost of Se in ternary $Ge_xSn_{10}Se_{90-x}$ (x= 14, 18, 22, 26) chalcogenide glass system on physical parameters viz. average co-ordination number, floppy modes, electro-negativity, heat of atomization, cohesive energy and glass transition temperature

II. THEORATICAL METHODOLOGY

Average Co-ordination number in multi-component glasses determines the degree of distortion or disorder in the system. Co-ordination number reveals the degree of cross-linking in the covalently bonded materials. Average co-ordination number <r> can be calculated by the standard result suggested by J.C. Philips [11-12] for the composition $Ge_xSn_{10}Se_{90-x}$ (x= 14, 18, 22, 26) as

$$<r> = \frac{aN_{Ge}+bN_{Sn}+cN_{Se}}{a+b+c} \quad (1)$$

where a, b, c are concentrations (in %) and $N_{Ge} = 4$, $N_{Sn} = 4$, $N_{Se}=2$ are the co-ordination numbers of Ge, Sn, Se respectively.

Kirkwood (1939) propounded that amorphous structure can be obtained by changing the bond length and bond angle [13]. Thus during deformation of structure some of the energy is consumed in bond stretching and bond bending. Consequently, atomic species with average co-ordination number <r> dominated by bond stretching constraints N_S and angular constraints N_A can be represented as

$$N_S = <r>/2 \quad (2)$$

where N_S is number of bond stretching per unit atoms.

$$N_A = 2<r>-3 \quad (3)$$

where N_A is the number of bond bending per unit atoms.
Total number of bonding constraints can be given as

$$N_{CO} = N_S+N_A \quad (4)$$

Or

$$N_{CO} = <r>/2 + (2<r>-3) \quad (5)$$

In three dimensional structure if $N_{CO} = 3$ then $<r> = 2.4$ this defines the most stable glassy network and termed as rigid percolation. Boolchand *et al.* (2001) evinced that for $<r> > 2.4$ the system is said to be over co-ordinated and for $<r> <2.4$ the system is said to be under co-ordinated. $<r>= 2.4$ is also called Boolchand phase at which the glass occupies the most stable state [14] or glass forming ability is easy at this point.

In multicomponent glasses, the system is said to be under co-ordinated if the nature of bands are flexible or floppy whereas the over co-ordinated network characterizes rigid or stressed. Philips and Thorpe (1985) suggested that if number of constraints becomes equal to number of degrees of freedom, then the condition is said to be zero floppy modes [13]. Number of floppy modes can be given as

$$f = 2- (5/6) <r> \quad (6)$$

Degree of flexibility of glasses is characterized by number of lone pairs in Ch.G network. The flexibility of bonds enables the network to form amorphous structure and to accommodate number of other atoms. Lone pairs of electrons are a function of average co-ordination number and can be expressed as

$$L = V - <r> \quad (7)$$

where V is the number of valance electrons.

Heat of atomization (H_S) is the quantity of heat required to break a network into respective atoms. H_S determines the average bond strength in the glassy network. In the ternary glass network, Heat of Atomization H_S can be expressed as

$$H_S = \frac{aH_{S_{Ge}} + bH_{S_{Sn}} + cH_{S_{Se}}}{a+b+c} \quad (8)$$

where a, b, c are concentrations (in %) and H_{Ge}, H_{Sn}, H_{Se} is heat of atomization of Ge, Sn, Se respectively. Average single bond energy can be calculated by Hs/<r>. For ternary chalcogenide glass system band gap energy can be given as

$$Eg = aEg_{Ge} + bEg_{Sn} + cEg_{Se} \quad (9)$$

where $Eg_{Ge,}$ Eg_{Sn}, Eg_{Se} is the energy band gap of Ge, Sn, Se respectively.

Chemically ordered network as proposed by Bicerano and Ovshinsky (1985), advocated that formation of hetropolar bond dominates over homopolar bonds in a glassy network and bonds are formed in the decreasing order [15]. Pauling suggested a relation between the hetropolar bond energy and electro negativity as [16]

$$E_{A-B} = (E_{A-A} \times E_{B-B})^{1/2} + 30\,(\chi_A-\chi_B)^2 \quad (10)$$

where E_{A-A}, E_{B-B} are homopolar bond energies and χ_A, χ_B are electro negativities of elements A, B. Cohesive energy of the system defines the stabilization energy of the system. It is the measure of inter molecular energy. Cohesive energy can be expressed as

$$C_E = \sum P_i E_i \quad (11)$$

Where P_i is the expected number of bonds and E_i is the corresponding energy of bonds.

Mean bond energy E as suggested by Tichi-Ticha (1994) is determined by degree of cross linking, type of bonds and bond energy. Mean bond energy is given by

$$E = E_C + E_{rm} \quad (12)$$

Where E_c determines energy contribution by number of hetropolar bonds and E_{rm} represents energy contribution by remaining matrix. Remaining matrix is characterized by number of wrong bonds (i.e. homopolar bonds). E_C and E_{rm} can be calculated for ternary glass system $Ge_xSn_{10}Se_{90-x}$ (x= 14, 18, 22, 26) as

$$E_C = aE_{Ge-Se} + bE_{Sn-Se} \quad (13)$$

and

$$E_{rm} = \frac{(cN_{Se} - aN_{Ge} - bN_{Sn})}{a+b+c} \quad (14)$$

where a, b, c are concentrations (in %) and $N_{Ge} = 4$, $N_{Sn}= 4$, $N_{Se}=2$ are the co-ordination numbers of Ge, Sn, Se respectively. E_{Ge-Se} , E_{Sn-Se} is the hetropolar bond energy of Ge-Se and Sn-Se bonds.

Stoichiometeric parameter R measures the ratio of chalcogen to non- chalcogen bondings in the composition. For the ternary composition $Ge_xSn_{10}Se_{90-x}$ (x= 14, 18, 22, 26) is given as

$$R = \frac{cN_{Se}}{aN_{Ge} + bN_{Sn}} \quad (15)$$

Where a, b, c, N_{Se}, N_{Ge}, N_{Sn} have their ususal meanings. If R>1, the composition is chalcogen rich and for R< 1 the composition is chalcogen deficient.

Glass transition temperature T_g is the temperature below which the melt when rapidly super cooled from higher temperature get converted into glassy network. When the melt is super cooled rapidly below its glass transition temperature its atoms never get time to relax and reorganize into symmetry. So the disordered network so formed is regarded as glassy state. Glass transition temperature is not the thermodynamic discreet transition but is the range of temperatures above which the mobility of chains increases [19].

Tichi-Ticha suggested that glass transition temperature is also affected by quality of connectivity i.e. bond strength. So the empirical formula for glass transition temperature related with bond energy can be expressed as

$$T_g = 311(E-0.9) \quad (16)$$

where E is the mean bond energy. Lankhorst (2002) [20] provided another relation between T_g and heat of atomization as

$$T_g = 3.44\, H_s-488 \quad (17)$$

where H_S is heat of atomization .

III. RESULT AND DISCUSSION

The values of average co-ordination number, number of constraints, number of floppy modes and number of lone pair electrons for $Ge_xSn_{10}Se_{90-x}$ (x= 14, 18, 22, 26) is shown in the table 1. From table 1 it can be inferred that average co-ordination number <r>, total number of constraints is increasing with the increasing percentage of Ge. It can be observed from the table that <r> >2.4 and N_T >3 this means that the system is becoming more and more rigid and over constrained.

Table 1: Values Of Average Coordination No. (<r>), Constraints Bond Bending (N_A), Bond Stretching (N_s) and Total number of constraints (N_{CO}), Number of Floppy Modes (f), number of valence electrons, Lone Pairs of Electrons (L) for $Ge_xSn_{10}Se_{90-x}$ (x= 14, 18, 22, 26)

	<r>	N_A	N_S	N_{CO}	F	L
$Ge_{14}Sn_{10}Se_{76}$	2.48	1.96	1.24	3.2	-0.07	3.04
$Ge_{18}Sn_{10}Se_{72}$	2.56	2.12	1.28	3.4	-0.13	2.88
$Ge_{22}Sn_{10}Se_{68}$	2.64	2.28	1.32	3.6	-0.2	2.72
$Ge_{26}Sn_{10}Se_{64}$	2.72	2.44	1.36	3.8	-0.27	2.56

Number of floppy modes and lone pairs are decreasing with the decrease in the content of Se, which implies that the system is becoming more and more rigid and over-stressed. The variation between number of floppy modes, lone pairs and total number of constraints is shown in the fig 1.

Heat of atomization, single bond energy, glass transition temperature using Lankhorst approach for $Ge_xSn_{10}Se_{90-x}$ (x= 14, 18, 22, 26) is shown in the table 2. Here with the increase in Ge content heat of atomization also increases while that of average bond strength decreases. This implies that chalcogen bonds are decreasing at the cost of metal bonds average bond strength of hetropolar bonds are decreasing. Since Se is more electronegative (χ =2.55) is replaced by more electropositive Ge atoms (χ=2.01), thus energy of lone pairs get enhanced and valence band moves towards band gap. This results into decrease of energy band gap.

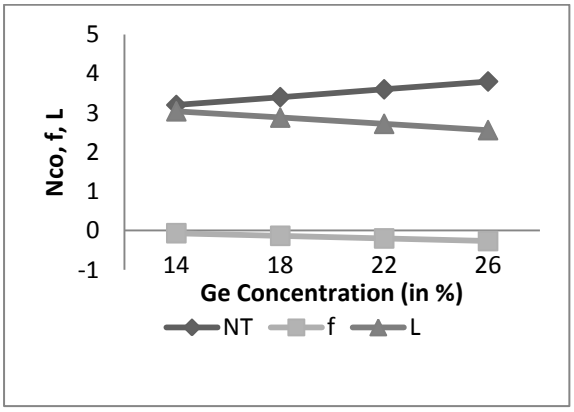

Fig. 1: Variation of Number of Constraints (N), Number of Floppy Modes (f) and Lone Pair Electrons (L) with Ge Concentration for $Ge_xSn_{10}Se_{90-x}$ (x= 14, 18, 22, 26)

Table 2: Values Of Heat Of Atomisation (Hs), Average Single Bond Energy (Hs/), Glass Transition Temperature (Tgl(Lankhorst)), Band Gap (Eg) for $Ge_xSn_{10}Se_{90-x}$ (x= 14, 18, 22, 26)

	H_s (kcal/g-atom)	H_s (KJ/mole)	H_S/<r>	T_{gL} (K)	E_g (eV)
$Ge_{14}Sn_{10}Se_{76}$	60.849	254.596	24.536	387.810	1.62
$Ge_{18}Sn_{10}Se_{72}$	62.259	260.492	24.319	408.092	1.57
$Ge_{22}Sn_{10}Se_{68}$	63.668	266.388	24.116	428.374	1.52
$Ge_{26}Sn_{10}Se_{64}$	65.077	272.284	23.925	448.656	1.47

Table 3 shows the variation of electronegativity (χ), parameter of stoichiometery, Probability of distribution of bonds, cohesive energy for $Ge_xSn_{10}Se_{90-x}$ (x= 14, 18, 22, 26). With the increase in concentration of Ge at the cost of Se, electropositive character of the network increases resulting into decrease in electro negativity. It can be inferred from the table 3 that composition is becoming chalcogen poor with the increase in Ge content, resulting in the decrease in Parameter R. This can be implied that number of hetropolar bonds are increasing at the cost of homopolar bonds.

Table 3: Values Of Electronegativity (χ), Deviation From Stoichiometry (R), Distribution Of Bonds, Cohesive Energy(C_E), for $Ge_xSn_{10}Se_{90-x}$ (x= 14, 18, 22, 26).

	χ	R	Distribution of Bonds				C_E (Kcal /mol)
			Se-Ge	Se-Sn	Se-Se	Sn-Sn	
$Ge_{14}Sn_{10}Se_{76}$	2.41	1.58	0.45	0.32	0.22	-	48.13
$Ge_{18}Sn_{10}Se_{72}$	2.39	1.28	0.56	0.31	0.12	-	48.68
$Ge_{22}Sn_{10}Se_{68}$	2.37	1.06	0.66	0.30	0.03	-	49.16
$Ge_{26}Sn_{10}Se_{64}$	2.35	0.8	0.76	0.17	-	0.05	48.49

TABLE 4: VALUES OF BOND ENERGY FOR Ge-Sn-Se SYSTEM

Bonds	Bond Energy (Kcal/mol)
Ge-Se	49.42
Sn-Se	49.233
Ge-Sn	35.934
Se-Se	44
Sn-Sn	34.20

At the composition $Ge_{26}Sn_{10}Se_{64}$, Se atoms are consumed up in making bonds with Ge and Sn. Thus left

out Sn atoms make wrong (homopolar) bonds. It is also inferred that bonds are formed in the sequence of decreasing energy i.e. Ge-Se bonds are formed first then Se-Sn bonds are formed. Bond energy (kcal/mole) is shown in the table 4.

From table 3, cohesive energy first increases which marks the increase in stabilization energy of the network but at the composition $Ge_{26}Sn_{10}Se_{64}$ there is sudden decrease in cohesive energy. This is due to the formation of metal-metal (Sn-Sn) wrong bonds, which has minimum bond energy i.e. 34.20 kcal/mol. From table 3, it is noticed that hetropolar bonds are increasing, thus contribution to bond energy by hetropolar bonds is also increasing which is reflected in table 5. But at the composition $Ge_{26}Sn_{10}Se_{64}$, contribution to bond energy by hetropolar bonds is decreasing. This is due to the formation of Sn-Sn wrong bonds which leads to the increase in homopolar bonds.

Table 5: Values Of Mean Bond Energy (E), Glass Transition Temperature (Tg_t (Tichy-Ticha)) for $Ge_xSn_{10}Se_{90-X}$ (x = 14, 18, 22, 26).

	E_c (Kcal/mol)	E_{rm} (Kcal/mol)	E (Kcal/mol)	E (eV/atom)	T_{gT} (K)
$Ge_{14}Sn_{10}Se_{76}$	47.36	9.935	57.303	2.484	492.90
$Ge_{18}Sn_{10}Se_{72}$	55.27	5.5	60.775	2.635	539.73
$Ge_{22}Sn_{10}Se_{68}$	63.18	1.333	64.515	2.797	590.17
$Ge_{26}Sn_{10}Se_{64}$	63.21	2.011	65.223	2.828	599.72

Glass transition temperature by using Tichi-Ticha approach is also calculated. Tg is showing increase with the increase in Ge content. Variation of average single bond energy, cohesive energy and mean bond energy is shown in the fig 2.

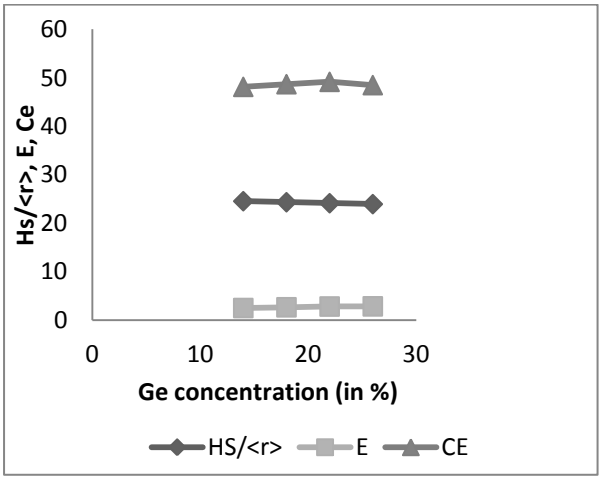

Fig. 2: Variation of Average Single Bond Energy (Hs/), Cohesive Energy (Ce) and Mean Bond Energy (E) for $Ge_xSn_{10}Se_{90-X}$ (x = 14, 18, 22, 26).

Glass transition temperature is calculated by two approaches i.e. Tichi-Ticha and Lankhorst relations. The variation between Tg and concentration of Ge in % is shown in the fig 3.

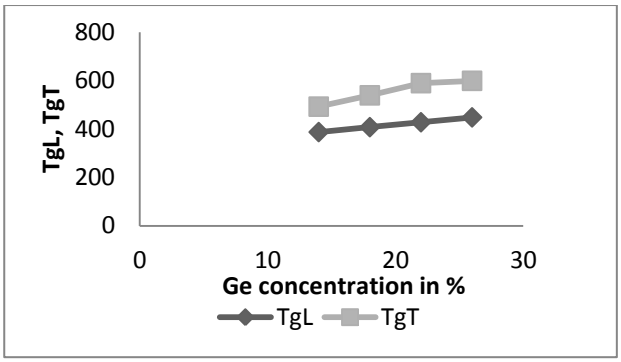

Fig. 3: Variation of Glass Transition Temperature (Tg) with Sb Concentration for $Ge_xSn_{10}Se_{90-X}$ (x = 14, 18, 22, 26).

IV. CONCLUSION

Increase in Ge concentration results in the increase in hetropolar bonds over homopolar bonds which makes the system more and more rigid. Number of lone pairs in the amorphous network is decreasing which makes the network stressed and over constrained. Mean bond energy is also increasing with increase in the concentration of Ge. The composition $Ge_{26}Sn_{10}Se_{64}$ shows some deviations from the trend. At this point number of Se atoms are consumed up resulting into the formation of Sn-Sn wrong (homopolar) bonds. This causes the decrease in cohesive energy. This implies that stabilization of the network is affected. At this point stoichiometric parameter is also less than 1 (R<1) reflecting that non-chalcogen bonds are increasing at the cost of chalcogen bonds.

REFERENCES

[1]. Lucas Jacques, (1999), "Infrared Glasses", Current opinion in solid state and materials Sciences 4, pp. 181-187.

[2]. N. Mehta, "Applications of Chalcogenide glasses in electronics and optoelectronics: A review", Journal of scientific and industrial research, 65, pp. 777-786, 2006.

[3]. Zingaro, R.A., Cooper W.C., Sellenium,Van Nostrand Reinhold Company, New York, 1974.

[4]. Unger P., Cherin P., The Physics of Selenium and Tellurium,ed. W.Charles Cooper, Pergamon, Oxford, pp.223, 1969.

[5]. K. Tanaka, K. Shimakawa," Structural phase- transitions in a chalcogenide glasses", Phy Rev. B. 39, pp1270-1279,1989.

[6]. Shimakawa K., "Residual photocurrent decay in amorphous chalcogenides", J. Non-Crystalline Solids, 77-78, Part 2, pp.1253-1256,1985.

[7]. Shim,JaeYeob, Park, Sang Wook and Baik, Hong Koo, "Silicide formation in cobalt/ amaorphous silicon, amorphous Co_Si and bais- induced Co_Si films", Thin Solids, 292 (1-2), pp. 31-39,1997.

[8]. Saiter, J.M, Ledru, J.Hamou, A. and Saffarini, G., "Crystallization of AsxSe1-x from the glassy state (0.005<x<0.03)", Physica B: Condensed Matter, 245(3), pp. 256-262, 1998.

[9]. M. Saxena, A.K. Kukreti, S. Gupta, m.k. Aggarwal, "Effect of compositional variation on physical poperties of Ge-Se-In Glassy

semiconductor", MIT Int. J. Electrical and Communication Engineering, Vol. 3 No. 1, pp 29-35, 2013.

[10]. A.K. Singh, "Recent advancement in metal containing multi-component chalcogenide glasses", Opto-Electronics Review, Vol 20(3), pp. 226-238, 2012.

[11]. J.C Phillips, "Topology of Covalent Non-Crystalline Solids 1: Short Range order in Chalcogenide Alloys", Journal of non-crystalline solids, Vol. 34, pp. 153, 1979.

[12]. Phase transitions and self-organization in electronic and molecular networks, edited by J.C.Phillips and M.F. Thorpe, Kluwer academic/Plemun Publishers, pp161-164, 2001.

[13]. J.G. Kirkwood, "Skeletal modes of vibration of long-chain molecules", J. Chem. Phys, 7, pp. 506-509, 1939.

[14]. P. Boolchand, D.G. Georgiev, B. Goodman, "Discovery of an intermediate phase in chalcogenide glasses", J. Optoelectron. Adv. Matter, 3 pp. 703-720, 2001.

[15]. J. Bicerano, S.R. Ovshinsky, "Chemical bonding and nature of glass structure", Journal of Non-Crystalline Solids, 74, pp.75, 1985.

[16]. L. Pauling, The Nature of the Chemical Bond, 3rd Edition, Cornell University Press,Ithaca, New York, 1960.

[17]. L.Tichy and H.Ticha, "On the chemical Threshold in Chacogenide Glasses," Materials Letters, Vol. 2, No. 3-4, pp. 313-319, 1994.

[18]. L.Tichy and Ticha , " Covalent Bond Approch to the glass transition temperature of Chalcogenide Glasses", Journal of Non-crystalline Solids, Vol 189, No 1-2, pp 141-146, 1995.

[19]. Callister W.D., *Fundamentals of Material Sciences and Engineering*, John Williey and sons, USA, 2000.

[20]. M.H.R Lankhorst, "Modelling Glass Transition Temperatures of chalcogenide glasses, Applied to Phase–Change optical Recording",Journal of Non Crystalline Solids, Vol 297 (2-3), pp. 210-219, 2002.

A Review on Graphene Nanoribbons (GNRS)

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***Abstract*— As graphene is a single layer of carbon atoms giving a 2D honeycomb lattice structure, graphene nanoribbons are considered as prospective material for nanoelectronics. They can easily replace silicon in fabrication of field effect transistors and interconnect. This paper is focused on graphene nanoribbons and their types , different electronic properties, their structure, and applications in electronics.**

Keywords*— *Armchair Graphene Nanoribbons, Zigzag Graphene Nanoribbons, Dimer Lines.

I. INTRODUCTION

From last two decades research is proceeding in the field of carbon as a substitute of older elements of electronics. The semiconductors silicon & germanium are not enough to handle the current demand of data & processing. According to Moore's law we have to increase the no. of transistors in the micro chips which is not possible for so long. Primarily due to scaling techniques & short channeling effect the silicon based transistors reaches to impasse in the recent decade. Discovering new allotropes in carbon help in the modification of electronics. [1]After the discovery of Buckminster fullerene C-60 in 1985, this "incredible" structure of football looking atom becomes the centre of attraction for researchers. Further adding on, In 1991 discovery of carbon nano tubes also create mark. But the benchmarking is made by discovery of newest material in 2004 which is "Graphene", only two dimensional material till date. Now we will discuss the properties structure & applications of graphene.

II. GRAPHENE

A. Discovery & Background

The research is going for solving the puzzles of carbon electronics, In 1947 Candian physicist Philips Wallace wrote paper about electronic paper about graphite that give start to the interest in the field of which is remain touched by researchers. Linaus pauling noble prize winning chemist was speculating about how flat single layers of carbon atoms would behave. In 1962, such materials were named as graphene by germabn chemist Hanns-peter Boehm, who had spotted them under his electron microscope.[2] The next four decades hypothetical research into graphene continued but boosted in the 1980s and 1990s after the discoveries of fullerenes effectively, graphene curled up into balls and carbon nanotubes graphene folded into a pipe. No-one could ever actually make the stuff in practice; graphene was only produced in a laboratory in 2004, by Russian-born scientists Andre Geim and Konstantin Novoselov working at the UK's University of Manchester. They able to find graphene by using pieces of sticky tape to pull of flakes of graphite, then folding he tape and pulling it apart to cleave the graphite into even smaller pieces.

III. GRAPHENE NANORIBBONS(GNRS)

Graphene Nanoribbons (GNRs) comprised one-dimensional structures with hexagonal two dimensional carbon lattices, which are stripes of graphene.[3] Their structures and their electronic & magnetic properties have been intensively studied both experimentally and theoretically. Due to their various edge structures, GNRs presents electronic properties which are different ranging from normal semiconductors to spin-polarized half metals, which opens the possibility of GNRs as electronic devices.

A. Structure Of Nanoribbons

The typical width of GNR is of nanometers. Different with 2D graphene, the termination in one direction introduces important quantum confinement effect (QCE), which endows GNR various attractive properties. Depends on the termination style, normally, nonchiral GNR can be divided into two kinds: Armchair and Zigzag (Fig. 1 shows the structures of Armchair and Zigzag GNRs). Adopting the standard convention, the width of armchair GNRs is classified by the number of dimer lines (Na) across the ribbons. Likewise, the one of zigzag GNRs is classified by the number of zigzag chains (Nz) across the ribbons. Perpendicular to the direction of defined width, GNRs repeat their geometric structures, and form one-dimensional periodic structures. Since GNRs are stripes of graphene, edge atoms are not saturated.Active edge states become an important factor to determine the edge structures. For armchair GNRs, there is no any edge rescontructions, and the planar patterns are kept. While for zigzag GNRs, it is unexpectedly found that the zigzag edge is metastable, and reconstructions

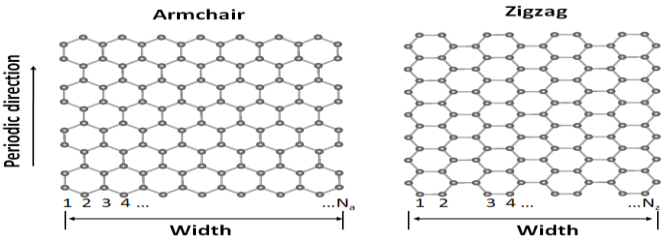

Fig.1 The structures of Armchair and Zigzag GNRs).

spontaneously take place at high temperature. Some special structures have been proposed as possible reconstructed patterns, however the detailed reconstructions still need to be further studied. To keep the planar structures of zigzag GNRs, hydrogen atoms are introduced to saturate the edge atoms of GNRs. Besides, in most of the reported structures in experiments, GNRs are found no reconstructions. Thus, most theoretical research has taken the saturated GNRs as the starting point. In the following context, edge atoms of GNRs are saturated by hydrogen atoms without special notation.

B. PROPERTIES OF NANORIBBONS

DFT calculations adopt parameter-free self consistent field calculations, and their reliability has been broadly proved in solid state field and nano-scale systems. Results show that all armchair GNRs are semiconductors with energy gaps, which decrease as a function of increasing ribbon widths. No magnetism has been found in armchair GNRs. For nanoribbons with zigzag shaped edges, without considering spin states, DFT calculations have shown that a set of doubly degenerate flat edge-state bands at Fermi level, which give rise to a very large density of states (DOS) at *EF*. This DOS peak at *EF* is half filled, which therefore provides Stoner instability leading of magnetic states.

By inclusion of the spin degrees of freedom within DFT methods, the zigzag GNRs have been predicted to have a magnetic insulating ground state with ferromagnetic ordering at each zigzag edge, and antiparallel spin orientation between the two edges Different with armchair GNRs, the zigzag GNRs have the same hierarchy of band gap-width relationship. Both armchair and zigzag GNRs have direct band gaps. Compared with graphene, which is a zero-gap semiconductor, the insulating behaviour of GNRs is very important. It is well known that two distinguished states, metallic and insulating states, are necessary to develop reliable electric devices. Thus, for the potential applications based on graphene, GNRs greatly extend the functionality of graphene.

C. APPLICATIONS

Graphene nanoribbons have lots of applications in various field will discuss few them. Graphene nanoribbons are most thinnest & light material ever known we can cover football ground so nanoribbons can be used in space shuttles. With the nanoribbon high heating conductivity graphenes have edge in the solar panels & solar cells. Heat conductive material & electrical conductivity both together makes graphene nanoribbon special, the lattice of graphene nano ribbons provides lesser to the resistances which can fasten the speed of electricity better than even copper & almost all superconductors without varying temperature, Graphene nano ribbons which even works at room temperature. So graphene nanoribbons can be used as FETs & BJTs. So initiate can be for portable gadgets like cellphones laptops with longer power backups. Graphene nanoribbons are transparent more than window glass which only passes out 80-90% of light so these can be used in optical fibers. These can be used in LCDs & touch screens. The graphene sheets have such tightly weave carbon atoms that they can work like super fine atomic nets, stopping other materials from getting through. That shows graphene nanoribbons capability for trapping & detecting gases. In addition to transistors, GNRs could find applications in nano-electromechanical systems (NEMS). An example of this was reported by Wei et al. [94] who produced a few-layer

graphene ribbon NEM switch with good reversibility, which was used in an OR gate.

D. CHALLENGES FOR NANORIBBONS

Nanoribbons are single layered nanomaterials which are very difficult to fabricate at the industrial level. The graphite is first converted into graphene layers which are 2D and then striped off with knife to form the nanoribbons from graphene layers with different edges which can be either armchair or zigzag shaped. Recently proposed approaches such as growth on polymers (polyethylene terephtalhate, PET or polydimethylsiloxane,PDMS) further provide a new class of flexible and transparent substrates (mechanical bending and twist up to 11% without any loss in conductivity). So far, mechanical exfoliation of graphene has produced high quality films on silicon [119]. Nevertheless, this method is not currently capable of selective placement of graphene at a specific location, which makes it an inadequate route to device fabrication of integrated circuit technologies.

IV. CONCLUSION.

The production of GNRs is a rapidly advancing field, and novel synthetic methods and advances towards their applications will be developed. A challenge however will remain for facile integration of graphene into electronic devices, control over the deposition of GNRs, control on the atomic edge arrangements and creating efficient electrical contacts. In addition, the extreme sensitivity of GNRs to small variations in, for instance edge chemistry or stacking order, can be advantageous for some applications (e.g. sensing, switching, data storage, drug delivery, etc.), and could also be used to control the performance of different devices. As in many other discoveries in nanoscience, theoretical and experimental approaches should occur synergistically in order to advance the field even more rapidly.

REFERENCES

[1] Ruhee, Oshin Sangha, Dr. Deep Kamal Randhwa, Nanoelectronics- An Effort to Sustain Moore's Law, International Journal of Advance Research In Science And Engineering, IJARSE, Vol. No.4, Special Issue (01), March 2015.

[2] Geim, A.K.; Novoselov, K.S. The rise of graphene. *Nat. Mater.* **2007**, *Vol. 6*, pp 183–191

[3] Dutta, S.; Manna, A. & Pati, S. (2009). Intrinsic half-metallicity in modified graphene Nanoribbons. *Physical Review Letters*, Vol. 102, No. 9, 096601, ISSN: 0031-9007

[4]] Kan, E.; Xiang, H.; Wu, F; Lee, C.; Whangbo, M. & Yang, J. (2010). Ferrimagnetism in zigzag graphene nanoribbons induced by main-group adatoms. *Applied Physics Letters*,

Vol. 96, No. 10, 102503, ISSN: 0003-6951

[5] Koskinen, P; Malola, S. & Hakkinen, H. (2008). Self-passivating edge reconstructions of

graphene. *Physical Review Letters*, Vol. 101, No.11, 115502, ISSN: 0031-9007

[6] Kosynkin, D.; Higginbotham, A.; Sinitskii, A.; Lomeda, J.; Dimiev, A.; Price, B. & Tour, J.

(2009). Longitudinal unzipping of carbon nanotubes to form graphene nanoribbons. *Nature*, Vol. 458, No.16, 872-876, ISSN: 0028-0836

[7] Li, Y.; Park, C.; Son, Y; Cohen, M. & Louie, S. (2007). Quasiparticle energies and band gaps in graphene nanoribbons. *Physical Review Letters*, Vol. 99, No.18, 186801, ISSN: 0031- 9007

[8] Wu, F; Kan, E.; Xiang, H.; Wei, S.; Whangbo, M. & Yang, J. (2009). Magnetic states of zigzag graphene nanoribbons from first principles . *Applied Physics Letters*, Vol. 94, No. 22, 223105, ISSN: 0003-6951

Track-4

Technical Session 3

MATHEMATICS

Method for Extracting Simple Descriptions of High Dimensional Data Sets in the Form of Simplicial Complexes

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Abstract:**The said method is called Mapper which is based on the idea of partial clustering of the data guided by a set of functions defined on the data. The proposed method is not dependent on any particular clustering algorithm. We implement this method and present a few sample applications-Mapper on Torus, Mapper on 3D Shape Database in which simple descriptions of the data present important information about its structure.**

Keywords: Simplicial Complex, Mapper, Topology, Reeb graph

I. INTRODUCTION

The purpose of this paper is to introduce a new method for the qualitative analysis, simplification and visualization of high dimensional data sets, as well as the qualitative analysis of functions on these data sets. In many cases, data coming from real applications is massive and it is not possible to visualize and discern structure even in low dimensional projections. As a motivating example consider the data being collected by the Oceanic Metagenomics collection [1], [7], which has many millions of protein sequences which are very difficult to analyze due to the volume of the data.

Another example is the database of patches in natural images studied in [5]. This data set also has millions of points and is known to have a simple structure which is obscured due to its immense size. We propose a method which can be used to reduce high dimensional data sets into simplicial complexes with far fewer points which can capture topological and geometric information at a specified resolution. We refer to our method as Mapper in the rest of the paper. The idea is to provide another tool for a generalized notion of coordinatization for high dimensional data sets.

Coordinatization can of course refer to a choice of real valued coordinate functions on a data set, but other notions of geometric representation (e.g., the Reeb graph [6]) are often useful and reflect interesting information more directly. Our construction provides a coordinatization not by using real valued coordinate functions, but by providing a more discrete and combinatorial object, a simplicial complex, to which the data set maps and which can represent the data set in a useful way. This representation is demonstrated in Section 3.1,. Our construction is more general than the Reeb graph and can also represent higher dimensional objects, such as spheres, tori, etc.

In the simplest case one can imagine reducing high dimensional data sets to a graph which has nodes corresponding to clusters in the data. We begin by introducing a few general properties of Mapper. Our method is based on *topological* ideas, by which we roughly mean that it preserves a notion of nearness, but can distort large scale distances. This is often a desirable property, because while distance functions often encode a notion of similarity or nearness, the large scale distances often carry little meaning.

The method begins with a data set X and a real valued function

$$f : X \rightarrow \mathrm{R},$$

to produce a graph. This function can be a function which reflects geometric properties of the data set, such as the result of a density estimator, or can be a user defined function, which reflects properties of the data being studied. In the first case, one is attempting to obtain information about the qualitative properties of the data set itself, and in the second case one is trying to understand how these properties interact with interesting functions on the data set. The functions determine the space to which we produce a map. The method can easily be modified to deal with maps to parameter spaces other than R, such as R^2 or the unit circle S_1 in the plane.

In the first of these cases, one produces a two dimensional simplicial complex, together with a natural map from the data set to it. In the second case, one constructs a graph with a map from the graph to a circle. In the case where the target parameter space is R, our construction amounts to a stochastic version of the *Reeb graph* (see [6]) associated with the filter function. If the covering of R is too coarse, we will be constructing an image of the Reeb graph of the function, while if it is fine enough we will recover the Reeb graph precisely. The basic idea can be referred to as *partial clustering*, in that a key step is to apply standard clustering algorithms to subsets of the original data set, and then to understand the interaction of the partial clusters formed in this way with each other. That is, if U and V are subsets of the data set, and $U \cap V$ is

non-empty, then the clusters obtained from U and V respectively may have non-empty intersections, and these intersections are used in building a simplicial complex. This construction produces a "multiresolution" or "multiscale" image of the data set. One can actually construct a family of simplicial complexes (graphs in the case of a one-dimensional parameter space), which are viewed as images at varying levels of coarseness, and maps between them moving from a complex at one resolution to one of coarser resolution. This fact allows one to assess the extent to which features are "real" as opposed to "artifacts", since features which persist over a range of values of the coarseness would be viewed as being less likely to be artifacts. We do not attempt to obtain a fully accurate representation of a data set, but rather a low-dimensional image which is easy to understand, and which can point to areas of interest. Note that it is implicit in the method that one fixes a parameter space, and its dimension will be an upper bound on the dimension of the simplicial complex one studies. As such, it is in a certain way analogous to the idea of a Postnikov tower or the coskeletal filtration in algebraic topology [3].

II. TOPOLOGICAL DATA ANALYSIS

Topological Data Analysis (TDA) represents data using topological networks. A topological network represents data by grouping similar data points into nodes, and connecting those nodes by an edge if the corresponding collections have a data point in common. Because each node represents multiple data points, the network gives a compressed version of extremely high dimensional data.

Many network representations do not afford this compression, and so produce a complex network that can be difficult to interpret. What is interesting is that the topological network can be constructed off of the results of machine learning techniques, and can therefore produce a representation of the scatter plot that is easier to understand and interact with, in addition it often provides more resolution of the data. Topological networks allow individuals to easily interrogate machine learning outputs in a way that highlights high value segments of the data.

A Simplicial Complex **(K)** is a set of simplices that satisfies the following conditions:

A Any face of a simplex from K is also in K.

B The intersection of any two simplices of K is a face of both simplices.

A simplicial complex is a topological space of a certain kind, constructed by gluing together points, line segments, triangles and their n- dimensional counter parts. Simplicial complexes should not be confused with the more abstract notion of a simplicial set appearing in modern simplicial homotopy theory. The purely combinatorial counterpart to a simplicial complex is an abstract simplicial complex.

III. FUNCTIONS

The outcome of Mapper is highly dependent on the function(s) chosen to partition (filter) the data set. In this section we identify a few functions which carry interesting geometric information about data sets in general. The functions which are introduced below rely on the ability to compute distances between points.We assume that we are given a collection of N points as a point cloud data X together with a distance function $d(x, y)$ which denotes the distance between $x, y \in X$.

A. DENSITY

Density estimation is a highly developed area within statistics. See [8], for a thorough treatment. In particular for $\epsilon > 0$ consider estimating density using a Gaussian kernel as:

$$f_\epsilon(x) = C_\epsilon \epsilon_y \exp(-d(x, y)^2 \quad (1)$$

Summation is running for y, where $x, y \in X$ and C_ϵ is a constant such that $\int f_\epsilon(x)dx = 1$. In this formulation ϵ controls the smoothness of the estimate of the density function on the data set, estimators using large values of ϵ correspond to smoothed out versions of the estimator using smaller values of this parameter. A number of other interesting methods are presented in [8] and many of them depends only the ability to compute distance between members of the point cloud. As such, they yield functions which carry information about the geometry of the data set.

B. ECCENTRICITY

This is a family of functions which also carry information about the geometry of the data set. The basic idea is to identify points which are, in an intuitive sense, far from the center, without actually identifying an actual center point. Given p with $1 \leq p < +\infty$, we set

$$E_p(x) = \{(\epsilon_{y \in X} d(x, y)^p) / N\}^{1/p} \quad (2)$$

where $x, y \in X$. We may extend the definition to $p = +\infty$ by setting\

$$E_\infty(x) = \max_{x' \in X} d(x, x') \quad (3)$$

In the case of a Gaussian distribution, this function is clearly negatively correlated with density. In general, it tends to take larger values on points which are far removed from a "center".

C. GRAPH LAPLACIANS

This family of functions originates from considering a Laplacian operator on a graph defined as follows (See [4] for a thorough treatment). The vertex set of this graph is the set of all points in the point cloud data X, and the weight of the edge between points $x, y \in X$ is:

$$W(x, y) = k(d(x, y)) \quad (4)$$

where d denotes the distance function in the point cloud data and k is, roughly, a "smoothing kernel" such as a Gaussian kernel. A (normalized) graph Laplacian matrix is computed as

$$L(x, y) = w(x, y) / \sqrt{\epsilon_z w(x,z)} . \sqrt{\epsilon_z w(y, z)} \quad (5)$$

Now, the eigenvectors of the normalized graph Laplacian matrix gives us a set of orthogonal vectors which encode

interesting geometric information, [4] and can be used as filter functions on the data.

IV. SAMPLE APPLICATIONS

In this section, we discuss a few applications of the Mapper algorithm using our implementation. Our aim is to demonstrate the usefulness of reducing a point cloud to a much smaller simplicial complex in synthetic examples and some real data sets. We have implemented the Mapper algorithm for computing and visualizing a representative graph (derived using one function on the data) and the algorithm for computing a higher order complex using multiple functions on the data.

Our implementation is in MATLAB and utilizes GraphViz for visualization of the reduced graphs. We use the following definitions in this section. Mapper reduces an input point cloud Y to a simplicial complex C. Let the vertex set of this complex be X, and the 1-skeleton of C be G. All vertices in the set X represent clusters of data. Let C_i be the cluster of points in Y associated with Xi. Let Ni be the cardinality of the cluster associated with X_i. Recall, that we have a distance matrix D for points in the set Y. By using it, we can also associate a metric between the members of X. We define two notions of distance as:

$$D_H(X_i,X_j) = \text{Max}\ \{(\in_y \min_x d(x,y) / N_j), (\in_x \min_y d(x,y) / N_i)\}, \quad (6)$$

where $x \in C_i, y \in C_j$.

Informally, this is a smooth approximation to the Hausdorff distance between two sets.

We construct an adjacency matrix A for G, where

$$A(i, j) = D_H(X_i, X_j) \quad (7)$$

if there is an edge between X_i and X_j in G.

Now, computing graph distance using Dijkstra's algorithm gives us an "intrinsic" distance on the output. Let this be D_I .

We scale both D_H and D_I such that the maximum distance is 1 so as to normalize them.

1) Mapper On Torus

We generated 1500 points evenly sampled on the surface of a two dimensional torus (with inner radius 0.5 and exterior radius 1) in R^3. We embedded this torus into R^{30} by first padding dimensions 4 to 30 with zeros and then applying a random rotation to the resulting point cloud. We computed the first two non-trivial eigen functions of the Laplacian, f_1 and f_2 (see Section 2.3) and used them as filter functions for Mapper. Other parameters for the procedure were as follows. The number of intervals in the range of f_1 and f_2 was 8 and any two adjacent intervals in the range of *fi* had 50% overlap. The output was a set of 325 (clusters of) points together with a four dimensional simplicial complex. The 3-D visualization shown in Figure 1 was obtained by first endowing the output points with the metric D_H as defined above and using Matlab'sMDS function mdscale and then attaching 1 and 2-simplices inferred from the four dimensional simplicial complex returned by Mapper. The three dimensional renderings of the 2-skeleton are colored by the functions f_1 and f_2. These experiments were performed only to verify that the embedding produced by using the inferred distance metric actually looked like a torus and to demonstrate that the abstract simplicial complex returned by Mapper has the correct Betti numbers: $b_0 = 1$, $b_1 = 2$, $b_2 = 1$.

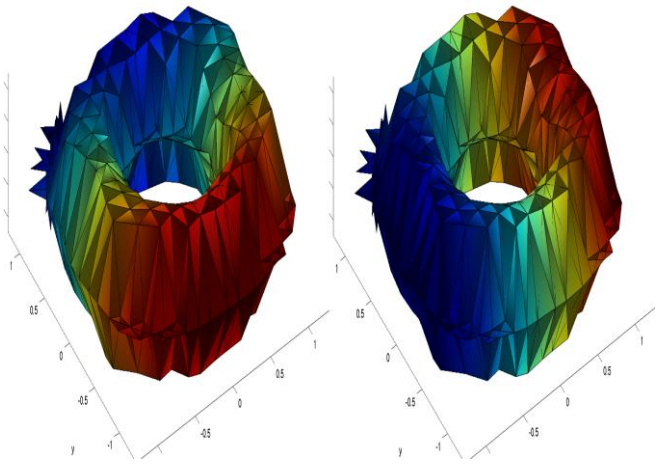

Figure 1: *Refer to Section 4.1*

2) Mapper On 3d Shape Database

In this section we apply Mapper to a collection of 3*D* shapes from a publicly available database of objects [9]. These shapes correspond to seven different classes of objects (camels, cats, elephants, faces, heads, horses and lions). For each class there are between 9 and 11 objects, which are different *poses* of the same shape, see Figure 2. This repository contains many 3D shapes in the form of triangulated meshes. We preprocessed the shapes as follows.

Let the set of points be P. From these points, we selected 4000 *landmark* points using a Euclidean maxmin procedure as described in [2]. Let this set be $Y = \{P_i, i \in L\}$, where L is the set of indices. In order to use this as the point cloud input to Mapper, we computed distances between the points in Y as follows. First, we computed the adjacency matrix A for the set P by using the mesh information e.g. if P_i and P_j were connected on the given mesh, then

$$A(i, j) = d(P_i,P_j) \quad (8)$$

where $d(x, y)$ is the Euclidean distance between $x, y \in P$. Finally, the matrix of distances D between points of Y was computed using Dijkstra's algorithm on the graph specified by A. In order to apply Mapper to this set of shapes we chose to use $E_1(x)$ as our filter function (setting $p = 1$ in equation 2), see Figure 2.

In order to minimize the effect of bias due to the distribution of local features we used a global threshold for the clustering within all intervals which was determined as follows. We found the threshold for each interval by the

histogram heuristic and used the median of these thresholds as the global threshold.

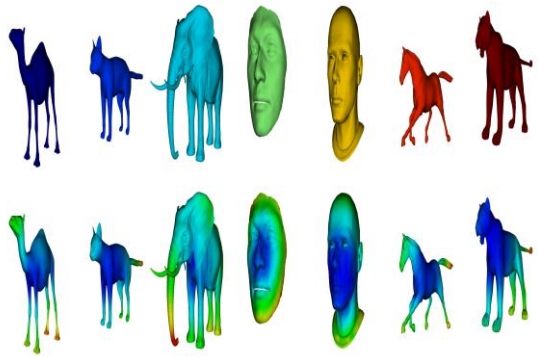

Figure 2: *The top row shows the rendering of one model from each of the* 7 *classes. The bottom row shows the same model colored by the E*1 *function (setting p* = 1 *in equation 2) computed on the mesh.*

The output of Mapper in this case (single filter function) is a graph. We use Graph viz to produce a visualization of this graph. Mapper results on a few shapes from the database are presented. A few things to note in these results are:

- Mapper is able to recover the graph representing the skeleton of the shape with fair accuracy. As an example, consider the horse shapes. In both cases, the three branches at the bottom of the recovered graph represent the font two legs and the neck. The blue colored section of the graph represents the torso and the top three branches represent the hind legs and the tail. In these examples, endowing the nodes of the recovered graph with the mean position of the clusters they represent would recover a skeleton.
- Different poses of the same shape have qualitatively similar Mapper results however different shapes produce significantly different results. This suggests that certain intrinsic information about the shapes, which is invariant to pose, is being retained by our procedure. The behavior exhibited by Mapper (using $E1$ as filter) suggest it may be useful as a tool for simplifying shapes and subsequently performing database query and (pose invariant) shape comparison tasks. We briefly explore this possibility in the next section.

V. CONCLUSIONS

We have devised a method for constructing useful combinatorial representations of geometric information about high dimensional point cloud data. Instead of acting directly on the data set, it assumes a choice of a filter or combination of filters, which can be viewed as a map to a metric space, and builds an informative representation based on clustering the various subsets of the data set associated the choices of filter values. The target space may be Euclidean space, but it might also be a circle, a torus, a tree, or other metric space. The input requires only knowledge of the distances between points and a choice of combination of filters, and produces a multi resolution representation based on that filter. The method provides a common framework which includes the notions of density clustering trees, dis connectivity graphs, and Reeb graphs, but which substantially generalizes all three. We have also demonstrated how the method could be used to provide an effective shape discriminator when applied to interesting families of shapes. An important direction for future work on the method is improving the method for performing the partial clustering, specifically for choosing a reasonable scale on the clusters. Our current method, while ad hoc, performs reasonably well in the examples we study, but a more principled method, perhaps including some local adaptivity, would doubtlessly improve the results.

REFERENCES

[1] DB R., AL H., G S., KB H., ET AL. W. S.: The sorcerer ii global ocean sampling expedition: Northwest atlantic through eastern tropical pacific. *PLoS Biology 5*, 3 (2007).

[2] DE SILVA V., G. C.: Topological estimation using witness complexes. In *Symposium on Point-Based Graphics* (2004), pp. 157–166.

[3] HATCHER A.: *Algebraic topology*. Cambridge University Press, Cambridge, 2002. [Hub85] HUBER P. J.: Projection pursuit. *Ann. Statist. 13*, 2 (1985), 435–525.

[4] LAFON S., LEE A. B.: Diffusion maps and coarse-graining: A unified framework fors dimensionality reduction, graph partitioning, and data set parasmeterization. *IEEE Transactions on Pattern Analysis and Machine Intelligence 28*, 9 (2006), 1393–1403.

[5] LEE A. B., PEDERSEN K. S., MUMFORD D.: The nonlinear statistics of high-contrast patches in natural images. *Int. J. Comput. Vision 54*, 1-3 (2003), 83–103.

[6] REEB G.: Sur les points singuliers d'une forme de Pfaff complètement intégrable ou d'une function numérique. *C. R. Acad. Sci. Paris 222* (1946), 847–849.

[7] S Y., G S., DB R., AL H., ET AL. W. S.: The sorcerer ii global ocean sampling expedition: Expanding the universe of protein families. *PLoS Biology 5*, 3 (2007).

[8] SILVERMAN B. W.: *Density estimation for statistics and data analysis*. Monographs on Statistics and Applied Probability. Chapman & Hall, London, 1986.

[9] SUMNER R. W., POPOVIC J.: Mesh data from deformation transfer for triangle meshes .http ://people .csail.mit.edu/sumner/ research /deftransfer /data.html.

Uniform Asymptotic Stability of Non-Autonomous System by using Lyapunov Function

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***Abstract*: This paper deals with the investigation of uniform asymptotic stability of zero solution of non-autonomous system of differential equations by using continuous Lyapunov fuction. One theorem is presented in which some conditions are modified which are more convenient to apply as compared to some existing results in literature.**

***Keywords :* Uniform Asymptotic Stability , Lyapunov function , non- autonomous system .**

I. INTRODUCTION

The ordinary differential equations represent a framework for mathematical modeling of real life situations. A differential system of the form $x' = f(x)$ in which the right hand side does not involve independent variable i.e. time is called autonomous system , , but the more general form of this system in which the right hand side is dependent on both x and t is called non-autonomous system. In this paper we will consider the non-autonomous system of the form $x' = f(t, x)$ with initial condition $x(t_0) = x_0$ .In this paper we investigate uniform asymptotic stability of zero solution of system (1) passing through (t_0, x_0) by using continuous Lyapunov fuction . the major advantage of this method is that stability behavior can be discussed without any prior knowledge of the solution . In last few decades his method have been extensively exploited and applied in many problems of Physics ,Engineering , control systems ,dynamical systems etc. This method is extensively described in Ahmad and Rao [1], ,Lakshmikantham and Leela [2] , Yoshiwara [3] , Antosiewicz [4], Hahn [6], and many more . We replaced some of the conditions for uniform asymptotic stability existing in literature [1]. The new conditions are more general and convenient to apply in many fields.

This paper is organized as follows. In section 2 preliminaries and some basic definitions that are to be used in the paper are given . In section 3 one Theorem related to uniform asymptotic stability is proved . . Finally conclusion of all the results is given.

II. PRELIMINARIES AND DEFINITIONS

Consider the non-autonomous differential system

$$x' = f(t, x) \qquad (1)$$

Along with initial condition $x(t_0) = x_0$

Where $f(t, x)$ is smooth enough to ensure the existence and uniqueness of solution (1) through (t_0, x_0)

$f \in C[J \times S_\rho, R^n]$, $J = [t_0, \infty)$, $t_0 \geq 0$ and $S_\rho = \{x \in R^n : \|x\| < \rho\}$

Also , $f(t,0) = 0$ so that it admits zero solution.

For any $V \in C[J \times S_\rho, R^+]$, the derivative $V^*(t, x)$ along any solution of (1) is defined by

$$V^*(t,x) = \lim_{h \to 0^+} \sup \frac{1}{h}(V(t+h, x+hf(t,x)) - V(t,x))$$ for $(t, x) \in J \times S_\rho$.

If V is Lipchitzian in x and $x(t)$ is solution of (1) ,then

$$V^*(t,x) = \lim_{h \to 0^+} \sup \frac{1}{h}(V(t+h, x(t+h)) - V(t,x))$$

Definition 1 :- The zero solution $x(t) \equiv 0$ is said to be :

(a*) stable* if , for every $\varepsilon > 0$, there exists a $\delta = \delta(\varepsilon) > 0$ such that for any solution $x(t) = x(t, t_0, x_0)$ of (1) the inequality $\|x_0\| \leq \delta$ implies $\|x(t)\| < \varepsilon$ for all $t \geq t_0$.

(b) *uniformly stable* if , for every $\varepsilon > 0$, there exists a $\delta = \delta(\varepsilon) > 0$ such that for any solution $x(t) = x(t, t_0, x_0)$ of (1) the inequalities $t_1 \geq t_0$ and $\|x(t_1)\| \leq \delta$ implies $\|x(t)\| < \varepsilon$ for all $t \geq t_1$.

(b) *asymptotically stable* if it is stable and if , there exists a $\delta_0 > 0$ such that $\|x_0\| \leq \delta_0$ implies $\|x\| \to 0$ as $t \to \infty$.

(d) *uniformly asymptotically stable* if it is uniformly stable and there is a $\delta_0 > 0$ and for each $\eta > 0$, there exists a

$T = T(\eta) > 0$ such that the inequalities $t_1 \geq t_0$ and $\|x(t_1)\| \leq \delta_0$ implies $\|x(t)\| < \eta$ for all $t \geq t_1 + T$.

Definition 2 :-

Class K = { $a \in C[R^+, R^+]$: a(u) is strictly increasing and such that a(0) =0 }

Main results:

Lemma 1:- Assume that there exists a function V (t,x) such that

- $V \in C[J \times S_\rho, R^+]$ and there exists $a, b \in K$ such that $a(\|x\|) \leq V(t,x) \leq b(\|x\|)$ and V is locally Lipchitzian in x and
- $V^*(t,x) \leq 0, (t,x) \in J \times S_\rho$,

Then zero solution of (1) is uniformly stable .

Proof:- The proof of this Lemma can be found from Ahmad and Rao [1].

Theorem 1 :- Assume that there exists a function V (t,x) such that

(i) $V \in C[J \times S_\rho, R^+]$ and there exists $a, b \in K$ such that $a(\|x\|) \leq V(t,x) \leq b(\|x\|)$

(ii) V is locally Lipchitzian in x

(iii) $V^*(t,x) \leq -\alpha V(t,x)$ on $J \times S_\rho$ where $\alpha > 0$ is a constant

Then zero solution of (1) is uniformly asymptotically stable.

Proof :- Let $0 < \varepsilon < \rho$ be given. Now assumption (iii) implies that $V^*(t,x) \leq 0$

Therefore by Lemma1the zero solution of (1) is uniformly stable . Hence for every $\varepsilon > 0$, there exists a $\delta = \delta(\varepsilon) > 0$ such that for any solution $x(t) = x(t, t_0, x_0)$ of (1) the inequalities $t_1 \geq t_0$ and $\|x(t_1)\| \leq \delta$ implies $\|x(t)\| < \varepsilon$ for all $t \geq t_1$.

From assumption (iii) , we have $V^*(t,x) \leq -\alpha V(t,x) \leq \alpha . b(\|x\|)$

Integrating this inequality between t_1 to t ,we get

$$V(t,x) \leq V(t_1, x_1) - \alpha \int_{t_1}^{t} b(\|x(s)\| ds \qquad \text{.....(2)}$$

Now , let $0 < \eta < \rho$ and choose $\delta_0 = \delta(\rho)$ and $T(\eta) = \dfrac{b(\delta_0)}{\alpha . b(\eta)}$

We claim that inequalities $t_1 \geq t_0$ and $\|x(t_1)\| \leq \delta_0$ implies $\|x(t)\| < \eta$ for all $t \in [t_1, t_1 + T]$.

Suppose that is not true then there exists a $\bar{t} \in [t_1, t_1 + T]$ such that $\|x(\bar{t})\| \geq \eta$

Therefore for $\bar{t} \in [t_1, t_1 + T]$ and by inequality (2) ,we get

$$V(\bar{t}, x(\bar{t})) \leq V(t_1, x_1) - \alpha . b(\eta)(t - t_1)$$
$$\leq b(\delta_0) - \alpha . b(\eta)(t - t_1)$$

when $\bar{t} = t_1 + T$

the above inequality becomes

$$0 < a(\eta) \leq V(t_1 + T, x(t_1 + T))$$
$$\leq b(\delta_0) - \alpha . b(\eta)(t_1 + T - t_1)$$
$$\leq b(\delta_0) - \alpha . b(\eta)(T)$$
$$= 0$$

where $T(\eta) = \dfrac{b(\delta_0)}{\alpha . b(\eta)}$

Hence our supposition is wrong .Thus at some $t_2 \in [t_1, t_1 + T]$

we must have $\|x(t_2, t_1, x_1)\| < \eta$

Hence uniform stability implies $\|x(t)\| < \eta$ for all $t \geq t_2$

In particular for $t \geq t_1 + T$

Therefore $t_1 \geq t_0$ and $\|x(t_1)\| \leq \delta_0$ implies $\|x(t)\| < \eta$ for all $t \in [t_1, t_1 + T]$ where T depends only upon η

Thus zero solution of (1) is uniformly asymptotically stable.

III. CONCLUSION

In this paper we proved that if there exists a function which is positive definite , decrescent and locally lipchitzian then we can discuss uniform and asymptotic stability of zero solution. It is natural to guess that if derivative of such function is negative definite on some region then the zero solution is asymptotically stable . This result can further be extended to differential system with impulse effect and can be applied in many real life problems .

REFERENCES :

[1] Ahmad S, and Rao ,M.R.M. ,Theory of Ordinary Differential Equations , East west Press ,1999 .

[2] Lakshmikantham,V. and Leela ,S., Differential and integral Inequalities ,Vol.1 ,Academic Press ,New York ,1969.

[3] Yoshizawa ,T.,The Stability Theory by Lyapunov's Second Method ,Mathematical Society of Japan ,Tokyo ,1966 .

[4] Antosiewicz ,H.A., A survey of Lyapunov 's Second method ,*Contributions to the Theory of Nonlinear Oscillations* , 4,141-66, 1958.

[5] Khalil ,H.K.,Nonlinear Systems Analysis (Third Edition) ,Prentice-Hall,Englewood Sliffs ,NJ,2002 .

[6] Hahn ,W., Stability of Motion ,Springer ,1967.

Applications of Mathematics in Engineering and Technology: A Study

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***Abstract*--Mathematics is an important part of most of engineering branches. It is considered as the base for all sciences and has application in almost all the fields of scientific as well as non scientific study. The field of application of mathematics is continuously expanding with the development of society. Further, engineering is one of the most important professions for mathematics discipline. Now development in engineering and technology has simulated new areas of mathematical research. Also, engineering, information technology and almost all areas of human activity are intimately related with mathematics, more significantly, they use all branches of mathematics. In the present paper, some application areas where mathematics play a vital role, are discussed with the help of some examples.**

Keywords--Mathematics, Engineering, Technology, Application, Non scientific

I. INTRODUCTION

The word "Mathematics" comes from the Greek word, “Mathema”. The meaning of this word is 'science, knowledge or learning. It is also derived from Mathematiko's meaning of which is 'fond of learning' (Simonson and Goouvea,2007). Mathematics is often defined as the study of topics such as quantity, structure, space and change [1](Agwagah(2008)). These topics provide the major sub divisions of mathematics into: arithmetic, algebra geometry and analysis.

The word "Engineering" comes from the Latin word 'Ingenium', meaning "cleverness" and "Ingeniare" meaning, "to contrive device". Engineering has been existing since ancient times as humans devised fundamental inventions such as the wedge, lever, wheel and pulley. Now these days, engineers use knowledge of mathematics, logic and appropriate experience or tacit knowledge, to find suitable

solutions to a problem by developing and analyzing the mathematical model for the problem.

The word “technology” comes from the Greek word "Technologia" having meaning ‘systematic treatment’. The human being use technology after changing natural resources into simple tools. Technology can be broadly defined as the

entities, both materials and immaterial, created by the applications of mental and physical effort in order to achieve something valuable. In its usage, technology refers to tools and machines that may be used to solve real world problems.

The distinction between engineering and technology is not always clear. Engineering is the goal oriented process of designing and making tools and systems to exploit natural phenomena for practical human means, often (but not always) using results and techniques from science. Whereas the development of technology may draw upon many fields of knowledge including scientific, engineering, mathematical, linguistic and historical knowledge to archive some practical results.

One of reason for studying mathematics in the field of engineering and technology, to the extent of advanced level is that it is interesting and enjoyable. Engineers and technologists like its challenge, its clarity and the fact that they know when they are right. The solution of a problem has an excitement and a satisfaction. They should also be aware of the wide importance of mathematics, and the way in which it is advancing at a spectacular rate.

Engineering can be treated as a specialized branch of science which constantly monitors the changing needs of the world .Technology often consequences of science and engineering. The three fields are often considered as one for the purpose of research and reference.

II. APPLICATIONS OF MATHEMATICS IN ENGINEERING

Mathematics is used in various engineering branches as mentioned below

Mathematical Branch	**Engineering Branch**	**Engineering Applications**
Complex analysis	Electrical Engineering	Resistors, inductors Capacitors, Power Engineering, Analysis of electric and magnetic fields for example: calculating the voltage
	Electronics	Digital signal processing , Image processing
	Mechanical/Civil Engineering	Fluid flow, stress analysis
	Sports and Exercise Engineering/ Bio medical Engineering.	Signal processing and analysis, Power meters, heart rate monitors for example: sports watch
	Systems Engineering	Design of control systems to protect ocean energy converters at sea.
Vector Analysis & Trigonometry	Mechanical Engineering	Design of airplane landing gear, design of gear(e.g. in cars)
	Civil Engineering	Surveying, traffic engineering, geotechnical engineering

	Electrical and Electronics Engineering	Oscillating waves (circuits, signal processing), electric and magnetic fields, radio frequency systems and antenna design
Mathematical Branch	Engineering Branch	Engineering Applications
	Energy system Engineering	Design of Heliostats
Statistics and Probability	Civil Engineering	Water/waste water treatment, flood modeling
	Electronic Engineering and IT	Designing and modeling the internet, Image analysis, data compression, digital communication techniques and error correction
	Biomedical Engineering	Measuring performance of drugs etc.
	Energy system Engineering/civil Engineering	Wave height prediction, wind energy generation
Linear Algebra	Civil engineering	Transport modeling, structural engineering
	Electrical Engineering	Electrical networks
	Electronic Engineering and IT	Google search algorithms,1 computer graphics like: zoom, rotation, transformations, animation etc.
	Mechanical Engineering	Mechanics, stress and strain representations
Mathematical Branch	Engineering Branch	Engineering Applications
Diff. Equation	Mechanical Engineering	Fluid flow, dynamics, heat transfer, combustions
	Civil Engg	Air pollution models, predicting quantities of material necessary for constructions, waste water and water treatment, hydraulics
	Electrical & Electronic Engg	Design of semi conductors, image analysis, calculation of current in circuits
	Energy systems Engineering	Wave equation for water and seismic waves, modeling of air flow in buildings
	Civil Engineering	Modeling and forecasting of ocean currents, waves and the effects of climate on these
	Mechanical Engineering	Determination of centre of mass of objects, simple harmonic motion
Integration	Biomedical Engineering	Modeling of internal organs for example model and test medical hypothesis of kidney functions to aid treatment
	Electrical and Electronic Engineering	Design of thyristor firing circuits used in power supplies, alarm systems, robotics
	Energy system Engineering	Forecasting the effects of renewable energy on reducing green house gas emissions into the future
Mathematical Branch	Engineering Branch	Engineering Applications
Laplace Transformations	Electrical Engineering	Circuits , power systems
	Civil Engineering	Structural design
	Mechanical Engineering	Mechanics of vibrations, fluid flow
	Energy system Engineering	Control of battery charging and discharging
Linear Eqs, Inequalities, Logarithms, Euclidean geometry, functions, polynomials	Almost all branches of engineering	Software design, computer graphics, curve fitting, kinetics, optimization of industrial process, stress analysis, determining the shape and size of almost all engineered parts, engineers use geometry to determine the optimal shape of explosives that can minimize the transport costs.

From the above, we say that mathematics is an important tool for engineers and technologists. Almost all people need mathematics as an important tool for their occupation, no matter what it is. Obviously, mathematics plays a very significant role in daily use. It is an integral part of our civilization.

According to research of Alexander (2011), he stated that "mathematic i seen not as static Skelton of science but, instead, as a dynamic and historically evolving field in its own right-just like science itself.

III. APPLICATIONS OF MATHEMATICS IN TECHNOLOGY

The mathematics of multimedia encompasses a wide range of research areas which include computer vision, image processing, speech recognition and language understanding, computer aided design, and new modes of networking. The mathematical tools in multimedia may include stochastic processes, Markov fields, statistical patterns, decision theory, PDE, numerical analysis, graph theory, graphic algorithms, image analysis and wavelets, and many others. Computer aided design is becoming a powerful tool in many industries. All this technology is a potential area for research in mathematics. The future of the World Wide Web (WWW) will depend on the development of many new mathematical ideas and algorithms, and mathematicians will have to develop ever more secure cryptographic schemes and thus new developments from number theory, discrete mathematics,

algebraic geometry, and dynamical systems, as well as other fields [2].

IV. POTENTIAL CONTRIBUTION OF MATHEMATICS

As evident from the inventions and discoveries of the last half of the 20th century, mathematics can contribute much not only to the field of physics and the other physical sciences, but also to the area of medicine and the biomedical sciences, engineering and technology. It can also play a vital role in such practical matters as how to speed the flow of traffic on the internet or sharpen the transmission of digitized images, how to better understand and possibly predict patterns in the stock market, how to gain insights into human behavior, and even how to enrich the entertainment world through contributions to digital technology. Through mathematical modelling, numerical experiments, analytical studies and other mathematical techniques, mathematicians can make enormous contributions to fields of engineering and technology [3].

V. INCREASING RESEARCH ACTIVITIES

With the rapid use of mathematics in the field of engineering and technology, there is continuous development in its research activities. As all these fields are inter related, so development in one field is not far away from the development in other fields.

The number of mathematical publications (along with publications in other sciences) has increased exponentially in the last 50 years. Mathematics has outgrown the small and close-knit community of nerds that it used to be; with increasing size, the profession is becoming more diverse, more structured and more complex.

VI. RECENT TRENDS IN ENGINEERING RESEARCH

- Steganography
- Digital signal processing
- Prediction analysis
- Image compression
- Financial decision making
- Optimization of real life problems
- Bioengineering
- Security and related features in Networks
- Cryptography
- Coding theory
- Sensors analysis in Espionage
- Weather forecasting

Developments in modern mathematics have been driven by a number of motivations that can be categorized into the solution of a difficult problem and the creation of new theory enlarging the fields of applications of mathematics [4]. More mathematicians are working toward the extension of existing mathematical methods, thus contributing to the development of both pure and applied mathematics [5]. In the last decades we have witnessed an explosion of knowledge in mathematical field, leading to a tremendously increasing need of engineering tools.

VII. CONCLUSION

Mathematics has been playing a vital role in the development of civilization from ages. From ancient to modern times, Mathematics has been instrumental in the advancement of engineering and technology. Developments in mathematics have been driven by a number of motivations that can be categorized into the solution of a difficult problem and creations of new theory, enlarging the field of its applications in engineering and technology. With the huge exposure of mathematical application in engineering and technology; mathematics remains the base support. The modern approach of applications of mathematics in engineering and technology resulted in new powerful mathematical models, tools, more developed mathematical language, make application areas so vast and varied. Tremendous use of application fields of mathematics in engineering and technology motivate youngsters to be a part of this field. Mathematics is a constant guide and help for engineer and technologists, without exact knowledge of which, they cannot proceed even one step in coming to grips with any complicated problem.

In the end, we conclude that, the application of mathematics in the field of engineering and technology is so vast and varied that it is not possible to summarize them and

athematics has become an indispensable tool for engineers and technologists.

REFERENCES

[1]. Agwagah,U.B.V. (2008) . " Mathematics Beyond Calculation aesthetic Values" ABACUS. The journal of the Mathematics Association of Nigeria(MAN), 33(1) 70-79

[2]. Uveruveh, F.O. and Perekeme,P., "Mathematics Education For National Competitiveness And Prestige," International Journal Of Science And Technology (STECH) Vol.4(1), S/no. 9,(Feb-2015):152-158

[3]. Masanja, Verdiana Grace, "Mathematics and Other Disciplines: The Impact of Modern Mathematics in Other Disciplines". In : Proceeding of the International Conference on the Teaching of Mathematics (at the under graduate level). (2nd, Heronissos, Crete, Greece, July 1-6, 2002).

[4]. Monastyrsky, Micheal, 2001, "Some Trends in Modern Mathematics and the Fields Medals". NOTES- de la SMC , Volume 33, Nos 2 and 3.

[5]. Sazhin,S.S., "Teaching Mathematics To Engineering Students,"International Journal Engineering Education, Vol.14, No.2, page 145-152 (1998).

[6]. Van den Berg, R., Sleegers, P., Geijsel, F., & Vandenberghe, R., "Implementation of an Innovation: Meeting the Concerns of Teachers". Studies in Educational Evaluation, 26 (4), 331–350.

[7]. Andrew Rechnitzer,("Mathematics by Experiment:plausible resoning in 21st century" by J.Borwein and D.Bailey) AK Peters Wellesley MA 2003.

[8]. Andrew Rechnitzer, ("Experimentation in Mathematics:computational paths to Discovery"by J.Borwein, D.Bailey and R.Girgensohn) AK Peters Wellesley MA 2004.

[9]. R. W. Douglass and J. D. Ramshaw," Perspective: future research directions in computational fluid dynamics", Trans. ASWE, 116, pp. 212±215 (1994).

[10]. Avner, Friedman (1998). Reflections on the Future of Mathematics: We are on the threshold of ever expanding horizons. Berlin intelligencer, ICM, August 1998, pp.6-8.

[11]. B. Aurell, T. Ganelius, W. Kilborn and L. Skoogh, Mathematics for the Upper Secondary School,Natural Sciences and Technology, Almqvist och Wiksell, Stockholm (in Swedish) (1970).

[12]. Hoyningen-Huene, P., Weber M. & Oberhem, E. (1999). Science for the 21st century: A new commitment. Background Paper Presented at The World Conference on Science, 26th June – July 1999, Budapest.

[13]. Hoyningen-Huene, P., Weber M. and Oberhem, E. (1999), "Science for the 2lst century: A new commitment", Background Paper Presented at The World Conference on Science, 26th June -1st July1999, Budapest.

Halley's Method As a Better Alternative to Newton Raphson's Method

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***Abstract* : In this paper halley's method is described to find the root of non linear equation Which has the higher rate of convergence as compared to bisection method,newton raphson method and secant method.halley's method is most effective and fastest technique to find the root this study aims at comparing the rate of convergence with the help of an example which proves that halley's method is the best alternative for newton raphson method**.

I. INTRODUCTION

Numerical approximation is a tehchnique for finding the solution of equation which is difficult to solve with factor method or discriminant method.for last few decades this technique has grown into one of the largest branches of mathematics.there are so many numerical techniques having different rate of converegence with their own advantages and disadvantages in this paper we have described two of the main techniques one is called newton raphson and another is halley's method.Another method named as modified halley's method is used to overcome one of the disadvantage of halley's method.

II. HALLEY METHOD

In numerical analysis , Halley's method is root finding algorithm used for function of real variable with a continuous second derivative . It is named after its inventor Edmond Halley.In this case the function f has to be a function of one variable . This method also consists sequence of iterations $x_{n+1} = x_n - \frac{2f(x_n)f'(x_n)}{2[f'(x_n)]^2 - f(x_n)f''(x_n)}$; Beginning with initial guess x_0 .if f is a three times continuously differentiable function and 'a' is zero of f but not of its derivative , then in a nhd. of 'a' the iterates x_n satisfy.

$I x_{n+1}-a I \leq K I x_n-a I^3$ for some k>0.

This means that the iterates converge to the zero if the initial guess is sufficiently close and that the convergence is cubic. The following alternative formulation shows similarity between Halley and newton raphson Method.The expression $\frac{f(x_n)}{f'(x_n)}$ is computed only once it is particularly useful when

$\frac{f''(x_n)}{f'(x_n)}$ can be simplified

Derrivation of halley's method from newton's method:-

Consider the function $g(x)= \frac{f(x)}{\sqrt{f'(x)}}$

Any root of f which is not a root of it's derivative is a root of g and any root of g is a root of f . Applying Newton's method to g gives

$$X_{n+1}= x_n - \frac{g(x_n)}{g'(x_n)}$$

with $g'(x) = \frac{2[f'(x)]^2 - f'(x)f''(x)}{2f'(x)\sqrt{|f'(x)|}}$

And the result follows . Notice that if f'(c) =0 , then one cannot apply this at c because g(c) would be undefined.

A. Advantages and disadvantages of halley's method

The biggest advantage of halley's method over other methods is that its order of convergence is better then linear and quadratic convergence i.e it passeses cubic convergence.also the calculation part becomes less iterative under halley's method. The biggest drawback of the Halley's method and its improvement involves the second derivative of the function. we construct a new modified Halley iteration without the second derivative. The advantage of the new method is that it is of higher order convergence and does not require to evaluate the second derivative.

III. MODIFIED HALLEY'S METHOD:

Consider the nonlinear equation of the type f(x) = 0. Compute the approximate solution xn+1 by the iterative scheme:

step 1:- $\mathbf{y_n=x_n} - \frac{f(x_n)}{f'(x_n)}$

step2:- $\mathbf{x}_{n+1} = \mathbf{y}_n -$

$$\frac{2f(x_n)f(y_n)f'(y_n)}{2f(x_n)f'(y_n)^2 - f(y_n)f'(x_n)^2 + f(y_n)f'(x_n)f'(y_n)}$$

Table 1: Data used for iterations in Halley's Method for cubic polynomial $f(x) = x^3 - 3x - 5$

Step	x_k	$f(x_k)$	$f'(x_k)$	$f''(x_k)$
0	2	-3	9	12
1	2.2727	-0.0793	12.494	13.6362
2	2.2790	-.000236	12.58152	13.674
3	2.2790	-	-	-

IV. NEWTON RAPHSON METHOD

Newton-raphson method is an iterative method to solve non-linear equation . it is also called newton-raphson iterative method or newton's method of tangents.

V. DERIVATION

Let f(x)=0 is a non-linear equation whose real root is to be found using newton-raphson method.

Let $\mathbf{\mathcal{E}}$ be the exact root of f(x)=0

Thus f(Ɛ)=0

Let X_0 be the initial approximation to the root and let h is the difference between X_0 and h

i.e $h = \mathcal{E} - X_0$

$\Rightarrow \mathcal{E} = X_0 + h$

$\therefore$ f(Ɛ)=0

$\Rightarrow f(X_0 + h) = 0$

Applying taylor's theorem on above expansion we have;

$f(X_0) + hf'(X_0) + \frac{h^2}{2!}f''(X_0) +$_____=0

Since h is small thus ignoring terms containing h and its higher order we have,

$f(X_0) + h\,f'(X_0) = 0$

$$\Rightarrow h = -\frac{f(x_0)}{f'(x_0)} \quad \text{provided} \quad f'(x_0) \neq 0$$

$\therefore X_1 = X_0 + h$

$$\therefore X_1 = X_0 - \frac{f(x_0)}{f'(x_0)}$$

Similarly next approximations are given by

$$X_2 = X_1 - \frac{f(x_1)}{f'(x_1)}$$

$$X_3 = X_2 - \frac{f(x_2)}{f'(x_2)}$$

$$X_{n+1} = X_n - \frac{f(x_n)}{f'(x_n)}$$

Which is required Newton's Raphson formula

VI. ADVANTAGES OF NEWTON RAPHSON

Newton raphson method is most popular method to solve the non-linear equation due to the many reasons.It is the best method to solve the non-linear equations. As compared to othermethods .it is very much less time consuming.It can also be used to solve the system of non-linear equations, non-linear differential and non-linear integral equations.The order of convergence of newton raphson method is quadratic i.e of second order which makes this method as fast as compare to other methods.It is very easy to implement on computer.

VII. DISADVANTAGES OF NEWTON-RAPHSON

This method becomes complicated if the derivative of the function f(x) is not simple one.This method also fails if f'(x)=0 for some x i.e if the curve of given equation is horizontal or nearly horizontal.This method requires a great and sensitive attention regarding the choice of its initial approximation .If the initial approximation is not being approximately choosen ; then this method invloves many iterations or some times, can fall in an endless iterations.In each iteration ; we have to evaluate two quantities f(x) and f'(x)for some x.

VIII. ALGORITHM OF NEWTON-RAPHSON METHOD:SSSS

Step1-Start

Step2-set i=1

Step3-read x1//initial approximation

Step4- set x2=x1

Step5-read epsilon

Step6-repeat step 6 while|x1-x2}>=epsilon then set x1=x2

Set x2=x1-(f(x1)/df(x1)) //df is derivative of given ssequationss

write x2

end while

Step7-write "the approximate root is ",x2

Step8-EndTable 2: Data used for iterations in Newton Raphson's Method for cubic polynomial $f(x) = x^3 - 3x - 5$

Step	x_k	$f(x_k)$	$f'(x_k)$
0	2	-3	9
1	2.333	.69926	13.3286
2	2.281	.62495	12.60888
3	2.279	-.000236	12.58152
4	2.279	-	-

REFERENCES

[1] Biswa nath Datta (2012),lecture notes on numerical solution of root finding problems.www.math.niu.edu/dattab.

[2] Iwetan,C.N,Fuwape,I.A,Olajide,M.S and Adenodi,R.A(2012),Comparative study of the bisection and Newton methods in solving for zero and extremes of a single variable function.

[3] wikipedia,the free encyclopedia.

[4] Allen ,M.B and isaacson E.L (1998),Numerical analysis for applied science.john wiley and sons Pp188-195.

Different Types of Theories in Elasticity

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Abstract: **Micro polar theory is useful in investigating materials like glass fiber, granular materials and certain type of rocks where materials consist of bar like molecules which exhibits micro rotational effects and which can support body forces and body couples. In the present paper I have discussed difference between classical elasticity, thermoelasticity ,generalized thermoelasticity , micropolar elasticity and generalized micropolar thermoelasticity. Some special deformations of elastic bodies due to internal and external forces are discussed.**

I. INTRODUCTION

Cosserat and Cosserat [1] gave a unified theory in which every particle is capable of both linear displacement and rotation during the deformation of the material. Eringen[2] introduced the theories of micro elastic solids and micro fluids. Yang and Lakes [3] suggested with a reasonable degree of confidence that human bone can adequately be used as a model for theory of micropolar elasticity. The generalized theory which involves temperature rates among the constitutive variables developed by Green and Lindsey[4] have been generalized to micro polar elastic materials by Boschi and Iesan[5]. The generalized theory of micropolar thermo elasticity has been formulated by Chandrasekhariah[6] by including heat flux among constitute variables.

II. CLASSICAL ELASTICITY

Classical study of elasticity deals with the study of the behavior of those substances that possesses the property of recovering their size and shape when the forces producing deformations are removed. In this theory it is assumed that the action across an infinitesimal surface element inside a material is equivalent to a force only. It is assumed that displacement gradients are infinitesimal small. In general the action across a hypothetical plain within material should be statistically equivalent to force and couple.

III. DEFORMATION

Deformation of body is due to both external and internal forces. These forces may be chemical, electrical and mechanical if $F=F(x,v,t)$ force acts on the body then for a collection of particles , force acts on each particle may be taken as $F_n=F_n(x_n,v_n,t)$ where $n=1,2,\ldots$, x is position of particles, v is velocity, t is time. If in the volume of a continuum, large no. of particles interconnected with each other then the particles themselves balance each other in pairs by inter-particle forces. Then the numbers of independent forces are smaller than the free collection of particles. The forces acting in the body are resolved into resultant force and resultant couple.

IV. SOME DIFFERENT TYPES OF DEFORMATION

If the body is allowed to move and deform under some external loads then, following types of deformations are seen under the assumption of indestructibility and impenetrability of matter, each material point in un-deformed body will occupy a unique position in the deformed body.

- Rigid Deformation: If the distance between every pair of points in the body remains unchanged then the body is called Rigid Body.
- Isochoric deformation : If microsss volume of the material remains unchanged then that type of deformation is isochoric deformation
- Mini isochoric deformation: If mini volume after deformation remains unchanged then that type of deformation is mini isochoric deformation
- Homogeneous strain: When the deformation is linear and homogeneous in the position vectors of the material points then that strain is homogeneous strain
- Plain strain: When the deformation of the body is identical in a family of parallel planes and vanishes in the direction of their common normal, then that state is called plain strain
- Extrinsic body load: These forces and couples act on the mass points of the bodies. These arise from external forces and, the forces and couples appeared considered as per unit mass of the body
- Internal loads: These forces arise from the mutual action of pair of particles located inside the body. As according to Newton's third law ,resultant of inter particles forces is zero because inter particles forces cancel each other. In continuum mechanics, the internal forces can be determined by isolating a small micro element from rest of the body and determine the effect of rest of the body as forces and couples on the surface of the macro element. Internal forces give rise to stress and couple stress.

V. THERMO ELASTICITY

It is the study of equilibrium of bodies, treated as thermo dynamic system, whose interaction with surroundings are restricted to the mechanical work, external forces and heat exchange.

In general the change of the body temperature is caused not only by the external and internal heat sources, but also

by the process of deformation itself. The heat flux produced by deformation gives rise to unsteady heating under normal conditions of heat exchange. I n classical theory if change of the temperature is small the corresponding terms in field equation , inertia terms in elastic equations of motions and coupling terms in heat conduction equations are neglected. If the temperature undergoes a large and sudden change then it is not possible to neglect inertia terms in elastic equations of motions and coupling terms in heat conduction equations. In such cases the inertia terms must be included in equations of motion.

VI. MICRO POLAR THEORY

This theory concerned with materials whose constituents are dumbbell molecules. Here, microstructure of the materials is also taken into account. This theory is useful in investigating materials like glass, granular materials and certain types of rocks etc., where materials consists of bar like molecules which exhibit micro rotational effects and which can support body forces and body couples. A micropolar elastic solid is different from elastic solid by the fact it can support body as well as surface couples. These materials undergo macro deformation as well as micro rotations. Micro polar materials are more realistic than classic materials in studying earth science problems. Thermo elasticity consists of the wave type (hyperbolic) equation of motion and diffusion type (parabolic) equation of heat conduction.

VII. GENERALIZED THEORY OF THERMO ELASTICITY

If an isotropic, homogeneous, elastic medium is subjected to thermal or mechanical disturbances, the effects in the temperature and displacement fields are felt at an infinite distance from the source of disturbance. This shows that a part of disturbance has an infinite velocity of propagation, which is physically impossible. To overcome this drawback Fourier law was modified to get hyperbolic differential equation of heat conduction. These equations include the time needed for acceleration of the heat flow in the heat conduction equation and the coupling term between the temperature and strain fields are taken into account. Then this theory is called generalized theory of thermo elasticity. It eliminates the paradox of an infinite velocity of propagation. Relationship between the heat flow and the temperature gradients are taken into account.

VIII. GENERALIZED MICROPOLAR THERMO ELASTICITY

Boschi and Iran[5] has extended generalized thermoelasticity to micro polar elastic material. Chandrasekhariah[6] developed a heat flux dependent generalized theory of micropolar thermo elasticity by including heat flux among the constitutive variables.

IX. DISCUSSION

In the present paper I have seen that if I neglect micro polar effects then I get the result of the generalized theory of thermo elasticity. If I neglect relaxation time that is the time needed for acceleration of heat flow in the heat conduction equation then I get the equations of thermo elasticity. If thermal effect is neglected then the equations of motion becomes the equations of motion of classical theory. Different types of deformations are discussed. This new theory of heat flux dependent micropolar thermo elasticity is beneficial to find the solution of many elastic problems.

REFERENCES

[1] Cosserat and Cosserat: Theorie des corps deformable , Paris, A. Herman et Fills(1909).

[2] Eringen[2]: Simple microfluids,Int.J.Engg.Sci,189-203,389-404,2(1964).

[3] Yand and Lakes: J.Bio. Mech.15,91(1982)

[4] Green and Lindsey: J.elasticity,2.I(1972)

[5] Boschi and Iesan: Mechanica 3,154(1973)

[6] Chandrasekhariah: Int. J.Engng.Sci. Vol 24(1986).

Track-5

Technical Session 1

MANAGEMENT AND EDUCATION

A Commentary on Anomalies in Financial Reporting: A Challenge to Profession and Governing Bodies

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Abstract*-This article is a commentary on the some of the instances of anomalies in financial reporting. The concept 'corporate' has contemplated in it a deep meaning, which can be summarized as in one word as 'stewardship role'. The modern times have witnessed a great deal of scams in guise of the term 'corporate'having feature like 'separate legal status'. The company is definitely a legal person having separate legal entity, power to make contract, sue and be sued. The things emerge like a veil in the ownership and the management .The board in context, elected to govern has absolute responsibility in term of representation to the interest of the people electing them .The voice of the voters (shareholders etc.)is to be reciprocated for the ideals, by the elected representatives. So, what if the elected members breach their expected role? Secondly, what will happen if the professional who are the members of the professional bodies, fail to perform their role, as to the custodian of trust of the state for their inspector roles?**

Keywords: directives; veil; standard setting; frauds; professional; manipulation; Governing bodies

I. INTRODUCTION

The financial statements are the substantive papers, which report the results of the reporting entity. Legally, every corporate has to report to concerned about the statement of the affairs of the company as to operations for the period, generally one year and the position of the sources and applications as on a particular date ,say at the end of the reporting year. The question is the authencity of the reports, compulsorily audited by the qualified auditor? It may be like some of the manipulative practices adopted by the entity and collusively allowed by the certifying authorities. So, such practices definitely poses a risk to the information content of the stakeholders, loss of revenues to the state, accumulation of wealth in the hands of the vested, and mismanagement of the funds of the contributories etc.

A. Some of the existing literature on the topic:

Orton W Boy D(1926)
Article 'Accounting problems of the Florida real estate boom' by Orton W Boy D, university of Florida, (P.73), 'The Accounting Review', vol.1 1926,In conclusion, the number and variety of real estate transactions in Florida called for a specialized type of a real estate account based upon the sectional book case … one is enabled to gather or collect upon a page all details of the transactions affecting the purchase and sale of the property. This not only facilitate a proper accounting of the transactions to the participants but also the preparation of the detailed report required for the annual income tax return.

Robert .E Payna (1935)
In journal 'The Accounting Review; volume X, June, 1935, page 94' in article 'The effect of Recent laws on Accountancy' 'by Robert .E .Payna', it is written that, these new laws with their drastic liabilities should certainly result in some improvements in work done and thus will be of great benefit to reputable accounts .

R.S.O Wallace(1988)
In the Journal Accounting and Business Research, autumn 1988,in the article 'Corporate Financial Reporting in Nigeria' by R.S.O Wallace,(p.p362),other notable features of the Nigerian reporting practice were the poor compliance with the disclosure requirements, and the relatively low importance attached to the needs of the users……..many of these unlisted companies do not file their accounts with the registrar of companies as required by the law and those that do, probably do not meet the minimum disclosure requirements. If NSE listed companies fail to comply with financial reporting requirements, it is more than likely that unlisted companies would disregard the rules. It seems obvious therefore that there are a number of areas where preparers and regulators can improve the quality of their disclosure in CARs (company annual reports.)

ALAN REINSTEIN, GERALD ALCVIN AND RICHARD G.VANGERMEERSCH (2008)

'A true representation is deemed to be one that corresponds to reality as it exists in its own right' (Macintosh,2002.p.116)For example, the statement 'it is raining' is true if and only if it is actually raining .Coherence theory states that the truth of a proposition consists in its coherence with some specified set of proposition, focusing in the consistency of relation between propositions and their truth conditions .

John Christensen (2010)
In the journal 'Accounting and Business Research' vol.40,No.3,2010 in article, 'Conceptual frameworks of Accounting from Information Perspective 'by 'John Christensen'(p.298), The globalization of business has led

to a call for harmonization of accounting standards around the globe and as a result, the FASB and IASB have joined forces to make one set of accounting standards. One of their joint projects is a common conceptual framework (FASB/ASSB, 2006, 2008).Consequently; the present interest in the development of a new framework is seen.

II. ANALYSIS AND FINDINGS

The investor needs protection from the manipulative tendencies of the governing board of corporate. The irony lies in the face that the major contribution of the minorities shareholders, who are scattered, seldom wisely and honestly managed by the concerned top management of the companies. The recent times has seen major scams, which clearly prove the failure of the established 'statutory control mechanism' by concerned state.

- Excerpts from SEC AAERs by Fraud Type

A. Fictitious Revenues

Anicom Inc.AAER No.1554/May6,2002

From January 1, 1998 through March 30, 2000, Anicom Inc. carried out massive financial frauds at the now –bankrupt company. During this period, the defendants falsely reported millions of dollars of non-existent sales, including sales to a fictitious customer, and used other fraudulent techniques to inflate Anicorn's revenue by over US$38 million and net income by over US$20 million.

B. Premature Revenue Recognition

Legato Systems Inc. ,AAER No. 1557/May 20,2002

Legato Systems ,Inc. overstated its financial results due in large part to side agreements with customers by its former sales staff. The side agreements granted rights of return or other terms that made the sales contingent and ,thus ,made it improper for Legato to recognize revenue on those transactions .These transactions were contingent because they permitted the reseller to rotate or return software if it could not ultimately be sold to an end-user.

C. Misclassifications

Ashford.com,AAER No.1573/June 10,2002

Ashford.com misclassified a material portion of the expenses arising under a second contract with Amazon.com. Under this agreement, Ashford.com issued new Ashford.com stock to Amazon.com in exchange for advertising placements and an page 432, agreement not to compete. Ashford.com, however, classified 100% of the expenses under this contract as "depreciation and amortization", materially understating its true marketing expenses each quarter and improving its *pro forma* results.

D. Fictitious Assets

Centennial Technologies, AAER No.1311/September 26,2000

Centennial made material misstatements about its revenues, assets and net income in public announcements and in documents filed with the commission …..Misstatements about its financial conditions resulted from multiple fraudulent practices including overstating inventory values and levels in a variety of ways. It falsified invoices to support inflated inventory pricing, manipulated inventory counts, understated the cost of sales and included phony inventory….also overstated the value of fixed assets in several ways. Non-existent additions to fixed assets were reported on the company's books and cost of bona fide asset additions was padded to inflate their reported value.

E. Overvalued Assets and Undervalued Expenses/Liabilities:

American Italian Pasta, AAER No.2877/September 15,2008

The commission's complaints allege that AIPC executives engaged in a variety of fraudulent accounting from AIPC's fiscal year, 2002 through the second quarter of its fiscal year 2004 to inflate AIPC's reported earnings. This caused period costs to be fraudulently capitalized in order to meet AIPC's external targets….also manipulated trade promotion accounting; failed to write off obsolete or missing spare parts; structured fraudulent round tripling of cash transactions; and recorded false receivables…..errors arising from inadequate internal controls, resulted in the overstatement of AIPC's pre-tax income for the relevant period by approximately US$59million, or 66%.

F. Omitted or Undervalued Liabilities

Clarent Corporation,AAER No.2117/September 30,2004

The complaint alleges that ,in June 2001,Jerry Chang,the former CEO of Clarent, directed the unauthorized release of US$35 million from Clarent,s Asia Pacific office to the entity related to the other [unnamed]Clarent executive and his family. Chang also arranged an additional US$11 million loan guarantee for this entity. Neither …cash disbursements nor..loan guarantee was disclosed to Clarent's financial personnel or management. These improper payments caused Clarent to overstate its cash and to fail to disclose a liability.

G. Omitted of Improper Disclosures

AVON,AEER No.1595/July 17,2002

In the first quarter of 1999,Avon failed to properly value costs that it had capitalized in connection with an internal –use software development project. Avon also made page 433, misleading disclosures and omissions in its financial statements concerning the nature of the write-downs. The disclosure was also misleading because it suggested that the software was in "use" and stated that the software was not "consistent with the strategic direction of the company". In addition, Avon omitted from the disclosure other information concerning FIRST which was required by GAAP. Avon did not provide a description of the impaired assets, the facts and circumstances leading to the impairment, or how fair value was determined for the asset kept on its books, all of which was required by SFAS 121.

H. Equity Frauds

AremisSoft,AAER No.1465/October,2001

AermisSoft Corporation ,overstated the value of the Company's contracts ,revenues and recent acquisitions ,and two former officers engaged in massive insider trading during the period of the reporting fraud. AermisSoft, through its Emerging markets Group, acquired three private software companies during 2000:e-nnovations.com;e-ChaRM India Pvt Ltd.;and Denon International Ltd. The value of US$32.7 million that AremisSoft reported for these acquisitions, however, was many times that actually paid by AermisSoft for the three companies.

I. Related Party Transactions:

TYCO ,AAER No.1627/September 12,2002

Tyco international Ltd. violated the federal securities laws by failing to disclose to shareholders the multi-million dollar law interest and interest free loans they took from the company. L.Dennis Kazloski ,the former chief executive officer and chairman of Tyco's board of directors ,and Mark H.Swartz, the former chief financial officer and a director, granted themselves hundreds of millions of dollars in secret low interest and interest- free loans from the company that they used for personal expenses. In addition, they and others engaged in other undisclosed related party transactions that cost shareholders hundreds of thousands, if not millions of dollars.

J. Frauds Going the "Wrong Way"

Kimberly-Clark Corp., AAER No.1533/March 27,2002

Kimberly –Clark filed incorrect statements for the years ended December 31,1995,through December 31,1998 in connection with a US$1.44 billion charge for restructuring and other unusual charges ("restructuring charge")that Kimberly –Clark recorded after its merger with Scott Paper Company(Scott) in December 1995…materially overstated this restructuring charges by accruing US$354 million of merged-related expenses(about 25% of the US$1.44 billion charge).During this time period, Kimberly-Clark did not record changes in estimates for the individual programs on its income statement. Instead, in certain cases Kimberly-Clark reallocated changes in estimates to the numerous merger and integration programs and transferred any excess amounts to a restructuring reserve sub-account.

K. Illegal Acts.

Syncor International Corporation,AAER No.1687/December 10,2002.

Several of Syncor's foreign subsidiaries made at leastUS$600,000 in illicit payments to doctors employed by hospitals controlled by foreign authorities….these illicit payments were made with the purpose and effect of influencing the doctor's decisions so that Syncor could obtain or retain business with them and the hospitals that employed them. Moreover, the payments were made with the knowledge and approval of senior officers of the relevant Syncor subsidiaries, and in some cases with the knowledge and approval of Syncor's.

III. CONCLUSION AND SUGGESTIONS

To conclude, it can be said that the quality of the financial statement matters and matters to such an extent that it must fulfill all the objectives in an optimized way. The stakeholders must get accurate, proper and timely reports as generally envisaged and contemplated by the state laws. The role of professionals and professional bodies must and should change to contemporary challenges. The ethics on the part of professionals are of utmost importance, because ethics are necessarily not only statutory regulations but conscientious too. In journal of human values, volume 19, number 2, October, 2013, management centre for human values-Indian Institute of Management, Calcutta-page 183 it is written that –the corporate social responsibility can be discharged by following the *Chatur-Dharma* by the corporation and the people of that corporation. If we move from the micro to the macro level, the corporation and its members are to follow the four dharma according to the conceptual framework of *Svadharma*(individual)and ashram dharma(stages of life)and *varna dharma*(position hold in the corporation) and finally the *rita* dharma (cosmic order).We can interpret the dharma to understand the different aspects of corporate social responsibility as INDIVIDUAL SOCIAL RESPONSIBILITY includes PERSONAL SOCIAL RESPONSIBILITY+CORPORATE SOCIAL RESPONSIBILITY+GLOBAL SOCIAL RESPONSIBILITY. This *dharmas* are the karmas to be performed by the individuals and corporate leaders. The BG *(Bagwat Gita)* therefore provides a model for researchers to explore corporate social responsibility from individual, corporate and global perspectives.

In a nutshell, the BG concepts of '*dharm* 'and '*karma*' provide an inside-out approach to CSR, which is development of the individual leader's self conscience. The leaders and the role they play in corporations are crucial in ensuring transparency, good conduct and governance towards the ultimate aim of achieving CSR. Future studies can explore other aspects of corporate management, such as corporate governance, corporate ethics and human resource management from the perspectives of BG philosophy. To conclude, it can be stated that there is appealing need to the professional members and the concerned governing bodies to act in a manner conducive to the things, to avoid things which undermine professional propriety. If the members of professional bodies have achieved things through sheer hard work and sincerity then it also becomes resultantly that the practices too demand that level of sincerity and hard work to prove the challenges ahead, to the profession pursued!

REFERENCES

[1.] R.S.O Wallace, 'Corporate Financial Reporting in Nigeria' *,Accounting and Business Research, autumn 1988,* page.362.

[2.] E.L.Kohler, 'Tendencies in balance sheet construction', *The Accounting Review,vol.1,December,1926 number 4*,page 9, North Western University.

[3.] Robert .E .Payna, 'The effect of Recent laws on Accountancy', *The Accounting Review; volume X, June, 1935*, page 94.
[4.] Roy.B.Kester,'Education foe professional accountancy',*The Accounting Review; volume XI June,1936,no.2*,page 99.
[5.] Donal Byard, Ying Li & Yong Yu ,'The Effect of Mandatory IFRS Adoption on Financial Analyst' Information Environment' , *Accounting Research ,Vol.49 No. 1 March, 2011*, page 70.
[6.] John Christensen, 'Conceptual frameworks of Accounting from Information Perspective', *Accounting and Business Research, vol.40, No.3, 2010*, page.298.
[7.] Qianhua Lei, Bingxuan Lin, Minghai Wei, 'Types of agency cost, corporate governance and liquidity In journal ,*The Journal of Accounting and Public Policy ; volume 32, Issue 3,May/ June, 2013* ,page 152.
[8.] By Praveen P Gupta; Thomas R. Weirich and Lynn E.Turner, 'Sarbanes-Oxley and Public reporting on Internal Control: Hasty Reaction of Delayed Action?', *Accounting Horizons' vol.27,No.2, June 2013*, ,page.375
[9.] Susan M.Young and Emma y.Peng, 'An Analysis of Accounting Frauds and the Timing of Analyst Coverage Decisions and Recommendation Revisions: Evidence from the US', *journal of Business Finance & Accounting, April /May 2013,* page 399.
[10.] John Christensen, 'Conceptual frameworks of Accounting from Information Perspective'*, Accounting and Business Research' vol.40, No.3, 2010*, page 298
[11.] Orton W BoyD, university of Florida, Accounting problems of the Florida real estate boom', *The Accounting Review*, vol.1 1926, page 73

Economic Growth with Sustainability- A Great Need of Time

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***Abstract*— The Sustainability is a process which is related to the fulfilment of the needs of present generation without compromising the needs of future generation. To become economically developed we are using resources in vital manner, which is harmful not for present but for future generation also. Economic growth is concerned with present generation but environmental problems of resource consumption are concerned with coming generations. The major issues of present and future generation can only be solved with the help of sustainable economic growth. The focus of this paper is to suggest various methods that are helpful to attain sustainability. The present time needs such type of strategies which bring sustainable economic growth. A lot of challenges are there but growth process cannot be stopped in fact it will be followed by sustainable measures, which establishes balance between society, economy and environment. Sustainability is not a country specific concept but it is related to the entire world in equal manners.**

Keywords—Sustainability; environment; growth.

I. INTRODUCTION

In modern era every nation try to achieve faster economic growth. Inorder to acheive this target many of the world's most valuable finite resources are being extracted at rapid rate that is why growth with sustainability is become a need of time. Growth of economy is measured by the increase in country's national income which can be caused by an increase in quality and quantity of resources, improvement in technology or increase in value and volume of goods and services produced by the various sectors of economy. This growth concept is not concerened with depletion of natural resources which might lead to pollution, degradation, congestion and diseases. These enviornvental effects causes global warming, the major problem faced by the governments of world nations[4]. So economic growth is necessary but become sufficient with sustainability.

II. WHAT IS SUSTAINABILITY?

The best definition of sustainability was first appeared in 1987 from 'World's Commission on Environment and Development's Report' (The Brundtland Commission)- "Sustainability means development process that meets the needs of present generation without compromising the ability of future generation to meet their own needs [2]." The report describes three mutually dependent, interrelated areas of sustainability: Economy, Environment and Society. A change in one area may disturb the other two, thus their effects overlap. So societies are required to manage these three types of capital i.e (economic, social and natural) in well manners to attain sustainable economic growth, which can maintain the trade–off between today's rapid economic growth and growth in future. Today's rapid growth may exhaust natural resources and create environmental problems for future generations like soil degradation, air and water pollution, global warming, poverty, unemployment, inequality and many more[2]. The concept of sustainability suggests that, meeting the needs of future depends on how well we balance social, economic and environmental objectives of our present life.

III. WHY SUSTAINABLE GROWTH IS REQUIRED ?

The world's resources are finite and economic growth is limitless that is unmanaged and unsustained, which will lead to increased poverty and decline of environment. In order to preserve the future, we must understand the interdependence between human and nature at all levels. Only Sustainable practices helps to do this balance. Balancing between these two aspects are little bit difficult because the daily needs and deeds of human beings are inter-conflictionary in nature. Some examples are:-

- We need fresh and clean air to breathe but also required personal car for travelling, we don't prefer public transportation.
- To increase agricultural production more pesticides, chemicals and irrigational facilities are used, which causes soil and air pollution and shortage of water.
- One country's need for electricity results acid rain that damages other country's lakes and rivers.
- Companies and corporate houses need cheaper labour but workers required livable wages.
- To produce more Industrial output might conflicting with preserving natural resources.

It is obvious that well balancing is required to achieve the target of sustainability. If we don't balance our short term objectives than how can we expect sustainability in long run?

The achievement of sustainability can be distinguished in following two operational ways:-

- Economic Sustainability: - It ensures that economic growth means not only increase in physical capital but also increase in natural capital [9].
- Ecological Sustainability: - It considers the objective to reduce the pressure of material and waste flows from the economy on the carrying capacities of natural system [9].

IV. MAJOR THREATS TO SUSTAINABILITY

With faster economic growth the limited natural resources are being depleted because of over consumption, which causes destruction of rain forests, over exploitation of fish stocks and loss of natural habitats because of construction of roads, railway lines, shopping malls, hotels, industrial estates etc. The major environmental threats that hinder sustainability are discussed as follows:-

A. Limitless Economic Growth:

Economic growth derieved from different technological process, where consumer demands increases at great extent. For faster economic as well as technological growth, the economy exploits more natural resources and emits waste that pollutes air and causes problems to delicate climate on which life relies.

B. Over population :

Rise in population directly affects the consumption or demand patterns. More population means more exploitation of resources and lowers down the quality of life, attainment of which is the main motive of sustainable growth.

C. Human health:

The flow of waste materials create soil, water and air pollutants that causes a lot of diseases and unfavourable climate conditions which has adverse effect on death rate, infant mortality rate, maternal mortality rate and life expectancy ratio.

D. Shortage of drinking water:

The existence of life on earth without water is not possible. In the current time period it is expected that every second person will suffer from water shortage by year 2025[8].

E. Deforestation:

World's forest diminishes mainly because of the expansion of residential and agricultural areas.

F. Energy and Petrol consumption :

Day by day demand for energy and petrol increases because of modernization, industrialization and urbanization. This over consumption gives birth to the problem of emission of green house gases.

G. Global warming:

The major problem faced by the governments of world nations is global warming. It is detrimental for human and other species of world. Global warming severely effect environmental conditions which result changed demand patterns that causes imbalance in the society.

H. Waste materials:

The huge waste material flows of households, industrial and agricultural sectors creates decomposition problems and spread pollutants in environment.

V. USEFUL METHODS TO BRING SUSTAINABILITY

Sustainability is not an easy task. Yet, it is an unavoidable responsibility which becomes achievable with proper planning, stronger policies and effective implementations. To avoid destabilization of planet, it is essential to include sustainability in economic growth agenda both in public and private spheres [3]. Following are the methods that are used to achieve sustainability in a society:-

A. Sustainable living:

In the beginning of 19^{th} centaury the concept of sustainable living is emerged. Solar panels, geothermal energy and renewable energy sources were even thought about; farmers began to realize that agricultural production patterns depleted air and soil. Crop rotation is a only way to maintain land. It is a need of time, where cities began to grow and resources began to diminish in quality and quantity both. Economic growth is achieved through technological efficiency, innovations and competitiveness. Achieving these goals by improving living conditions of every person of present and ensuring favorable conditions for future generations are considered as sustainable living [7].

Sustainability needs to be developed and implemented by the community itself, it cannot be developed and imposed by someone outside of that community. For sustainable living it is essential to understand the mutual interdependency among society, nature and economy. The attainment of sustainability is possible through these three aspects, which is depicted as in figure Fig.1.

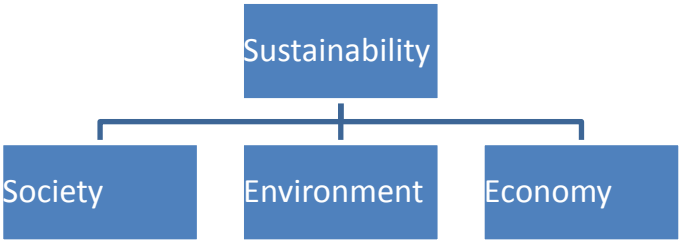

Fig.1 Possible Three aspects of Sustainability

To live sustainably, following few questions should be considered-

1) How we make use of earth resources such as forests, water, minerals, gems, wildlife etc?
2) How much resource are we using?
3) What processes we used to get these resources?
4) Are enough resources going to be left for our grand children [8]?

B. Sustainable Ecology:

It brings relationship between humans and their natural, social and built environment. Basic human needs such as food, shelter, quality of air and water are also ecological foundations for sustainability [7].

C. Sustainable Agriculture:

The agriculture contributes a lot in country's growth. So it is essential to increase agricultural production and productivity. Sustainable agriculture helps nations to gain their targets because it consists environmental friendly techniques that produce output without causing damage to

human and natural structures. It prevents the adverse effects to soil, water, biodiversity, surroundings and downstream resources [1].The various techniques used in sustainable agriculture is described as in figure Fig.2.

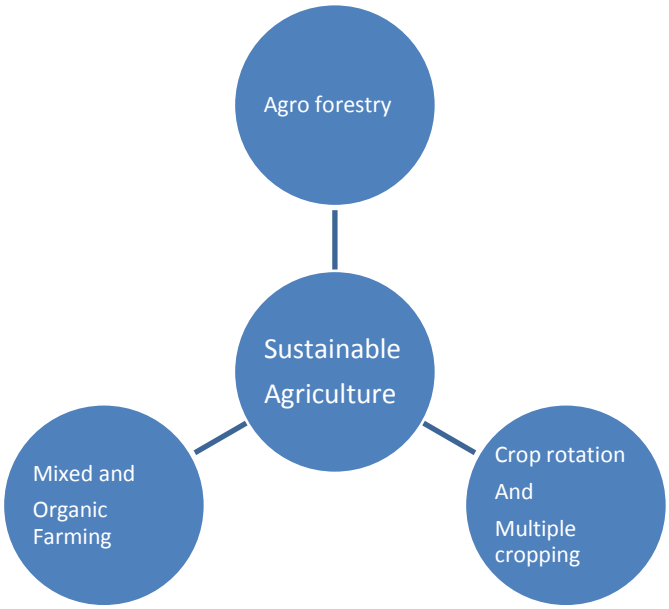

Fig.2 Sustainable Agricultural Techniques

D. Sustainable Power supply:

Sustainable power supply refers to the provision of energy sources that are clean and long lasting. To become sustainably developed, renewable energy resources can be used. The most common types of Sustainable energy resources are-

1). Solar panels

2). Wind energy

3). CNG and LPG eco friendly fuels.

4). Household electronic equipments with energy star logos.

E. Green Growth :

Green growth strategies are important for inclusive growth in modern unequal world. It gives importance to making links between social justice, economy and environment. The main implications of Green growth strategies are-

1) It suggests governments to improve their investment policy framework to reduce risk and uncertainty and also attract long term private finance in support of green growth.

2) It encourages the efficient and sustainable use of natural resources [10].

F. Environmental Sustainability:

Environmental Sustainability requires a society to frame activities in such a manner that it will meet human needs while preserving life support systems of the earth. This type of framework includes eco friendly techniques which increases human ability and efficiency to survive in nature [8].

G. Corporate and Economic sustainability:

Corporate sustainability refers to the efficient use of natural capital by firms and corporate houses. It is achieved and analyzed by 'eco-efficiency' and 'socio-efficiency'. Eco –efficiency means availability of competitively priced goods and services that satisfy human needs and bring a quality of life. Achieving the targets by progressively reducing ecological impacts and maintains earth's carrying capacity.

Socio-efficiency describes the relationship between a firm's total production and its social impacts. It can be assumed that mostly corporate impacts on environment are negative but it is not true. These impacts can either be positive or negative. Socio-efficiency concept emphasized to minimize negative social impacts and maximize positive social impacts of corporate sector [5].

Both eco-efficiency and socio-efficiency concepts are primarily concerned with increasing economic sustainability.

H. Sustainable Transportation:

It is one of the fact that one third of all gases are produced by vehicles. The various types of transportation facilities are the main source of green house gas emissions. In most of the country's 80% of travelling involves personal vehicles. More vehicles mean more emission of green house gases [4]. In order to reduce such kind of problems governments have to make policy frameworks which are helpful to reduce number of vehicles. Some examples of policy framework are mentioned as follows-

1) Improve public transportation facilities and enhance the coverage area.

2) Encourage walking and cycling and make provisions of wider pedestrian pathways.

3) Increase parking fee and toll taxes and encouraging people to drive more fuel efficient vehicles. These extra collected revenues are used to improve public transportation.

I. Sustainable Architecture:

New urbanism and new classical architecture are the recent movements which promote sustainability towards construction. These both trends started from 1980's.It appreciate and develops smart building growth with architectural tradition and classical design which ensures comfort and security [5].

J. Equality in Income distribution:

Over many thousand years "the stronger" (economically or physically) tried to exploit or eliminate "the weaker" section of the society. Due to which there is emergence of poverty and inequality problems. It is well known fact that "Poverty anywhere is a great challenge to prosperity everywhere". These problems of poverty and inequality can be solved through sustainable economic forces like balanced budget, environmental living conditions and equitable distribution of national income.

VI. CONCLUSION

It is concluded that growth in today's context is a critical phenomenon with multiple crises(food, finance and energy) which compelling us to re-assess the economic paradigm of our present time and evaluate how better we address the unfilled promises that we currently leaving to future generations in areas of employment, quality of life ,social development and respect for nature. There is need of integration between economic, social and environmental aspects of sustainability that implies the implementation of coordination in different sectors which results economic growth. The above mentioned methods are useful to attain social objectives without compromising the limited resources of earth. Now one thing is clear that there is paradox between economic growth and sustainability. We must find ways to balance these two and allow them to co-exist. This balance may be possible not only by developing alternative energy resources but by reducing population growth rate and depletion of resources.This act of balancing must be accompanied by deep understanding of the nature of problem, which is the root cause between short term growth and long term survival.

REFERENCES

[1] Barbour, Elissa and Elizabeth A. Deakin. 2012. "Smart Growth Planning for Climate Protection".

[2] Brundtland Commission(1987). "Report of the World Commission on Enviornment and Development". United Nations

[3] National Research Council (1999) Our Common Journey (Natl. Acad. Press, Washington, DC).

[4] Pezzey,John C. V.; Michael A., Toman (2002). " The Economics of Sustainability: A Review of Journal Articles". Resources for the future. Retrieved April 8, 2014.

[5] DeSimone, L. & Popoff, F. 1997. Eco-efficiency: The business link to sustainable development. Cambridge: MIT Press.

[6] Clark, W. C., Lebel, L., Gallopin, G., Jaeger, J., Mabogunje, A., Dowdeswell, E., Hassan, M., Juma, C., Kates, R., Corell, R., et al. (2002) in Science and Technology for Sustainable Development (Int. Council for Science, Paris), pp. 12-29.

[7] Kates, R. W., Clark, W. C., Corell, R., Hall, J. M., Jaeger, C. C., Lowe, I., McCarthy, J. J., Schellnhuber, H. J., Bolin, B., Dickson, N. M., et al. (2001) Science 292, 641

[8] http://www.sustainabledevelopmentinfo.com/category/sustainable-development/

[9] Peter Bartemus "A special issue of Ecological Economic" (2007 61/4) Reviews critically the revised SEEA.

[10] http://www.oecd.org/greengrowth/ggsd-2013.htm.

ICT In Education: A Digital Divine

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ABSTRACT

- **Purpose – Education is the powerful tool which can change one's life. Aid of ICT can do the miracle in the swift and affective change. The aim of this study is to traces the divine role of ICT in education potential and potency wise.**

- **Design/methodology/approach - To portray accurately the role of ICT in education sector the author has made use of the available literature and other relevant publications to findz out the theoretical cum conceptual framework and also to know what early research mentioned regarding selected topic. The study is based on a close (textual) reading of editorials in the European journal of education, international journal of education and development, International Journal of learning technology, International journal of information and communication technology education 1990 to 2014.**

- **Findings – There are various benefits of ICT on learning and learners, such as motivation and skills, concentration, cognitive processing, independent learning, critical thinking and teamwork. ICT can benefit likewise academically strong and weak students as well as students with special needs. Studies also reveal that the benefits can not only remain technology driven but should be more intentionally exploited following a pedagogical approach.**

- **Originality/Value – The paper improves the external validity of similar findings related to the ICT and their impact on education.**

- **Practical Implication – Management of the various educational institutions whether public or private could design appropriate ICT strategies towards achieving their mission and would culminate in enhanced stakeholder's performance.**

Keywords–Information, Communication, Technology, Education

I. INTRODUCTION

Education is the powerful tool which can change one's life. It is also an affective driver of an economic development. The traditional educational system can't suits to the challenge of education to all in a country like India. Where most of the population is living in rural areas along with deter economic conditions. Aid of ICT can do the miracle in the swift and affective change. Presently, Information communication technologies (ICT) are influencing every aspect of human life. One can recognize it in the figure of change. In the early 80's various academic stakeholders have taken up the challenge of inserting ICT in education with speckled accomplishment.

A. Prospectives Of Information And Communication Technology:

ICT is not just the internet, computer equipment, devices and many other gadgets it refers to that technology which is used to transmit information from one person to another. In the modern era, we are associated with many media such as telephone, fax, radio, computer, tablets etc. these all are comes under the single shed i.e. ICT

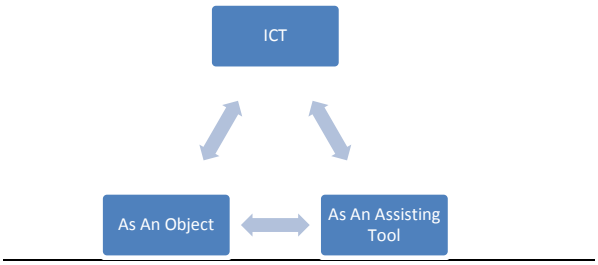
1) Defination of Ict's

ICT (information and communications technology – or technologies) is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning. ICTs are often spoken of in a particular context, such as ICTs in education, health care, or libraries. The term is somewhat more common outside of the United States. (Margaret Rouse 2005) ICT is the digital processing and utilization of information by the use of electronic computers. It comprises the storage, retrieval, conversion and transmission of information. (Ifueko Omoigui Okauru, 2011). According to United Nations Development Programme (UNDP): 'ICTs are basically information-handling tools- a varied set of goods, applications and services that are used to produce, store, process, distribute and exchange information. All the above definitions shares a similar conception that, the role of ICT is not revolves around only to the computers its rage is farther than that and it includes other communication equipments like telephone, mobiles, radio, television, printer, fax machines, scanner, tablets and projectors etc. The main motto of ICT is the creation and sharing of digital information with the aid of above said communication equipments and various software programmes in order to generate, design, store, share and manipulate information in various formats. Various definitions also focused on its evolution forms from analogue to digital. Digital ICT simply differentiate on the notions of Novice, Innovation, and Nano etc.

2) ICT and Education

Do ICTs have any role in Education? According to Watson (2001) ICTs have revolutionized the way people work today and are now transforming education systems.

The literature has described the role of ICT in education which is given below:



Sources: (SER, 1998, Moonen and Kommers, 1995, Pilot, 1998).

1) *ICT* AS AN OBJECT

It refers to learning about ICT. Before using it as an assisting tool firstly we need to recognize its role. It is possible only through education. What is being learned depends on the type of education and the level of the students? Country like India where fifty percent graduates is good for nothing because of its conventional educational system. In this situation the role of ICT in education can be proven as panacea. Education prepares students for the use of ICT in

- education,
- future occupation &
- social life.

2) ICT AS AN ASSISTING TOOL

ICT is used as an assisting tool by the stakeholders in the field of academia. The beneficiaries can be students, teachers and management too.

1. PRUDENT LEARNERS I.E. STUDENTS USED ICT AS A TOOL FOR:
   - searching and collecting data,
   - making assignments,
   - summer / winter projects
   - special projects
   - documentations
   - conducting research &
   - communication etc.
2. TEACHERS USED ICT AS A MEDIUM FOR TEACHING AND LEARNING IN MANY WAYS SUCH AS IN :
   - searching and collecting data,
   - simulation projects
   - minor projects
   - major projects
   - special projects
   - documentations
   - conducting research &
   - communication etc.
3. EDUCATIONAL ORGANIZATIONS CAN ALSO USE THE ICT AS A MANAGEMENT TOOL FOR:
   - documentations
   - communication
   - internal feedback
   - external feedback
   - resources analysis &
   - payroll practice etc.

B. Overview Of Traditional Versus Emerging Pedagogy:

Aspect	Traditional pedagogy	Emerging pedagogy for the information society
Active learning	Activities prescribed by teacher	Activities determined by learners
	Whole class instruction	Small group
	Little variation activities	Many different activities
	Pace determined by the programme	Pace determined by learners
Collaborative	Individual	Working in teams
	Homogenous groups	Heterogeneous groups
	Every one for him/herself	Supporting each other
Creative	Reproductive learning	Productive learning
	Apply known solutions to problems	Find new solutions to problems
Integrative	No link between theory and practice	Integrating theory and practice
	Separate subjects	integration between subjects
	Discipline based	Thematic
	Individual teachers	Teams of teachers
Evaluative	Traditional pedagogy	Emerging pedagogy for the information society

Active learning is a model where the responsibilities of learning are on learners end. It was popularized in the 1990s by its appearance on the Association for the Study of Higher Education (ASHE) report (Bonwell & Eison 1991) They cite literature which indicates that to learn, students must do more than just listen: They must read, write, discuss, or be engaged in solving problems. ICT increases learning by enhancing the individual engagements into it.

Collaborative learning is different from individual learning. Under this form two or more persons attempts to learn together by using or capitalizing each another's skills as well as resources. Further, it is that learning where various members in a group share their trait and explicit knowledge. ICT encourages the learning by the active collaborations of the between students, teachers & experts etc.

Creative learning it is the creation of an invention or real world products rather manipulation or duplication of received information.

Integrative learning is a learning theory describing a movement toward integrated lessons helping students makes connections across curricula. ICT insert and enhance integrations between theory and real practices.

Evaluative learning is a process of reviewing and analyzing data in order to make informed decisions about the effectiveness. ICT-enhanced learning recognizes the presence of different learning pathways to explore and discover rather than merely listen and remember.

II. PROS AND CONS OF ICT USE IN EDUCATION

ICT provides a great deal of advantages in the field of education to its various stakeholders.

A. Benefits of ICT are given below:

1) From the view point of students
   - ICT ensures higher quality through collaborative learning between students, teachers and experts.
   - Provides flexibility of content and its distribution

- Self but active, independent but novice learning prospects
- Anytime, anywhere access flexibility
- Tailor made learning programmes as well as better learning prospects after assessing strengths as well as weaknesses of the students
- Provide vast opportunities to access
- Opportunity to access remote learning resources
- Allows easy access to experts
- Development in various modules of language such as writing & listening etc.
- Opportunity to access own work technically and address the same to the externals
- Enhancement of morale and buzz on self realization
- Greater enthusiasm
- Prepares the individuals for the workplace
- Speedily and inexpensively updating

2) From the view point of teachers

- Easy to communicate lessons
- Better persuasion
- Better planning and preparation of study materials
- Quick self updating and effective pass to the students
- Professional image reflected amongst the students as well as to the colleagues.
- Pushing students psychologically more on task centric
- More gains in literary skills thought effective use of ICTs
- Effective contribution in knowledge creation process
- Serve multiple teaching

3) From the view point of parents

- Effective engagement or increased involvement in education of children's
- Easy but quick communication with the educators
- Better admittance to the student reports and related information
- Effectual check

4) General benefits

- Better image of the institution
- Industry centric skill development and learning's
- Uniform quality
- Better results in technical subjects
- High quality, cost-effective professional development
- Wide reach with low cost
- Developing a new culture of learning's
- Better co-ordination with co-operation
- Support and improve the quality and relevance of existing structures of education

B. 3.2 Dark Side of ICT

Every coin has two face i.e. head and tail. Similarly, ICT has its limitations despite its above said benefits.

The major limitations of the ICTs in education are given below:

- Burden of initial as well as running cost of the components
- Vague expectations from various stakeholders
- Lack of innovation in learning despite rapid change in technology
- Leads to tedium in the absence of effective creativity
- More preparation time requires for preparing lessons
- Mere its use don't assures about quality outputs
- Resistance to change by the latheriest
- Underutilization of resources
- Reduced willingness of the pastoral based students
- More expensive than the traditional education system
- Teaching effects are inferior as compared to the traditional system of education
- Scope of plagiarism
- Threat to the student privacy because of online activities. Teachers and parents can't supervise or monitor all the time
- Hard to access its impact
- Physical side effects to the health that is vision problem
- Students may be easily distracted from their learning and may visit unwanted sites
- Over-reliance on ICT limits students critical thinking and analytical skills,
- Students from the low income backgrounds may be disadvantaged

III. THE KEY CHALLENGES OF ICTS INTEGRATION IN EDUCATION

The following can be the challenges of ICTS for its integration in the education system:

- Idyllic infrastructure
- Proper planning and its implementation policy programmes
- Learning contents
- Language
- Finance
- Corruption
- Support from government as well as from the individual sides

IV. CONCLUSION

This article is an attempt to find the divine role of ICTs in education, its potential, limitations and challenges in education pasture.

Undoubtedly, ICTs role is considerable. It is presently working as a change agent in life of millions by touching every sphere of their life either personal, workplace or social including education. In the field of education ICTs giving new heights to the teaching and learning approaches. Despite its limitations like cost factor, adverse affect on psychologically as well as physically on the students, dubious outcomes etc. its impact is much more significant. Information communication and technology smooth the progress of active, collaborative, creative, integrative, and evaluative learning as an advantage over the traditional method. Well-designed ICTs can allow educators to reach new groups of potential students, particularly mature students, lifelong learners, and students with physical disabilities, students in employment and students who are far from education centres.

Finally, technology can never be a substitute for good teaching. Without effective teaching programmes, without loyal teachers ICTs can't deliver itself. But neither is possible with traditional education system. That's why we have ICTs system in place.

REFERENCES

[1] Alexander, T. (2003). ICT in Education.

[2] Bhattacharya, I., & Sharma, K. (2007). India in the knowledge economy-an electronic paradigm. *International Journal of Educational Management*, *21*(6), 543-568.

[3] Cairncross, F., & Pöysti, K. (2003). ICTs for education and building human capital. *Visions of the Information Society, Geneve: International Telecommunication Union, ITU*.

[4] Carnoy, M. (2004). ICT in education: Possibilities and challenges. *Lección inaugural del curso académico, 2005*.

[5] Haddad, W. D., & Jurich, S. (2002). ICT for education: Potential and potency. *Technologies for education: Potential, parameters and prospects. UNESCO and Academy for Educational Development*, 28-40.

[6] Hawkins, R. (2002). Ten lessons for ICT and education in the developing world.

[7] Jager, A. K., & Lokman, A. H. (1999). Impacts of ICT in education: The role of the teacher and teacher training.

[8] Livingstone, S. (2012). Critical reflections on the benefits of ICT in education. *Oxford review of education*, *38*(1), 9-24.

[9] Mikre, F. (2011). The roles of information communication technologies in education: Review Article with emphasis to the computer and Internet. *Ethiopian Journal of Education and Sciences*, *6*(2), 109-126.

[10] Ngwenyama, O., Andoh-Baidoo, F. K., Bollou, F., & Morawczynski, O. (2006). Is There A Relationship Between ICT, Health, Education And Development? An Empirical Analysis of five West African Countries from 1997-2003. *The Electronic Journal of Information Systems in Developing Countries*, *23*.

[11] Oliver, R. (2002). The role of ICT in higher education for the 21st century: ICT as a change agent for education. *Retrieved April*, *14*, 2007.

[12] Reddi, U. V. (2004). Role of ICTs In Education And Development: Potential, Pitfalls And Challenges. *Acedido em Junho*, *30*, 2014.

[13] Tella, A. (2011). Availability and Use of ICT in South-Western Nigeria Colleges of Education. *African Research Review*, *5*(5), 315-331.

[14] Voogt, J. A., & Oke, T. R. (2003). Thermal remote sensing of urban climates.*Remote sensing of environment*, *86*(3), 370-384.

[15] Wagner, D., Day, B., James, T., Kozma, R. B., Miller, J., & Unwin, T. (2005). Monitoring and evaluation of ICT in education projects. *A Handbook for Developing Countries. Washington DC: InfoDev/World Bank*.

[16] Watson, D. M. (2001). Pedagogy before technology: Re-thinking the relationship between ICT and teaching. *Education and Information technologies*, *6*(4), 251-266.

[17] White, G. (2008). ICT trends in education. *Digital Learning Research*, 2.

[18] Yusuf, M. O. (2005). Information and Communication Technology and Education: Analyzing the Nigerian National Policy for Information Technology. *International Education Journal*, *6*(3), 316-321.

A Study of Trend Analysis and Relationship Between Foreign Institutional Investors (FIIs) & Domestic Institutional Investors (DIIs)

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***Abstract*—The Institutional Investors are called the elephants of the stock market because of their money power. They are the movers and shakers of the stock markets. If we talk about emerging markets like India they have strong influence on the stock market. We have done some review of the literature and found that there are two type of institutional investor are available one are called Domestic Institutional Investor and others are called Foreign Institutional Investors. The purpose of this study is to find that what is the trend & pattern of the institutional investor's investment in the Indian Stock Market and what is the relationship between Foreign Institutional Investors & Domestic Institutional Investors. The study is conducted on the monthly data for the period April 2007 till March 2015 making it total 96 observations for the net investments of institutional investors.**

Keywords—Trend Analysis; Regression; FII; DII

I. INTRODUCTION

Institutional Investors are those organizations which collect large funds and then invest those in securities, financial, real estate & other investment assets. Institutional Investors are the most influential players in the stock market of any country because of their money power and they play crucial role in the movement of stock indexes. Generally it has been observed that when institutional investor buys heavily the stock market goes up and when they sell it goes down. Mutual Funds, Pension Funds, Hedge Funds, Banks, Insurance Companies & Investment Banks etc. are referred as Institutional Investors. These are further divided into two parts a) Domestic Institutional Investor (DIIs) b) Foreign Institutional Investor (FIIs). DIIs are those institutions who invest in their home country where they are based and FIIs they invest in the countries other than there base country. FIIs are allowed to invest in Primary and Secondary Capital Markets through Portfolio Investment Scheme (PIS). There is a ceiling of 24% investment for FIIs in Indian companies. FIIs if they want to invest in India they have to get themselves registered with Security Exchange Board of India (SEBI). They are allowed to participate in Indian Capital Markets after the liberalization policy adopted by Indian Government in 1992.

II. REVIEW OF LITERATURE

(Bhatnagar, 2011) analyzed the trend analysis of FIIs investment in India from January 2004 to August 2010. He has collected the annually and monthly data from the RBI's annual manual. He found that in the year 2009 FIIs have invested maximum money and in the year 2008 they have invested least money. He also found that FIIs have less impact on the Indian stock market there are other unexplained variables which are influencing the stock market. They used the charting techniques to analyze the trend on foreign investment flows.

(Kaur & Kaur, 2014) analyzed the role of FIIs in the development of economy. They collected the data for the net investment by FIIs for the period of 1992 to 2013. They used the simple method i.e. percent increase to previous year method to check the proportion and flows on investments. They used Compound Growth Rate, Descriptive Statistics & Time Series Regression Analysis with the help of Microsoft Excel and Statistical Package for Social Science (SPSS). They found that in 2020 the gross purchase and gross sales will increase but the Net Investment by FII's will show a negative trend.

(Nautiyal & Kavidayal, 2013) in their paper they made an attempt to find the causality between the FIIs flow and the Indian Stock Market (BSE). They used the monthly data from January 2000 to July 2012. They used Pearson's Correlation test and found that there is a possitive correlation between two variables taken. They also used the Pair wise Granger causality test to check the causal effect between FIIs and Sensex. They found that that FII does neither Granger cause stock price nor stock price Granger cause Net Foreign Investment.

(Shah, 2014) examined the trend and pattern of FIIs flow in India and relationship between FIIs and NSE. He has taken the daily data from 2001 to 2013 from the websites and reports of RBI, SEBI and NSE. He used the Correlation Coefficient & Regression Analysis to conduct his research. He found that net purchases in FIIs has increased during the period of study, moderate possitive correlationship exist between FIIs and NSE and FIIs flows has no significant impact on NSE.

(Gopinathan & Rau, 2009) they examined that whether the FIIs are the dominant investor of the Indian Stock Market or not. They collected the data from 1997 to March 2007. The statistical tools such as correlation analysis, regression analysis and trend analysis are used in this study. They found that the FIIs inflows will see an increasing trend in the coming years and FIIs flows can forecast the direction of Indian Stock Market.

(Maggo, 2014) analyzed the trend of FIIs flows to the Indian Stock Market. She used the annual data from the period 1993-94 to 2011-12. She used Multiple Regression Analysis to check the growth rate in the variable used. She found that the

trend in the FII flow shows positivity in all the years except 1998-99 and 2008-09. She also found that the growth rate of FIIs flows is higher in debt Market compared to Equity Market.

(Krishnan V, 2012) examined the trend of FIIs Investment in India for the period of January 2006 - October 2011. He found that FII investment behavior is dependent on stock market return, risk and economic factors.

III. OBJECTIVES OF STUDY

1. To study the trend and pattern for the Institutional Investments in India.
2. To study the relationship between the FIIs and DIIs.

IV. DATA COLLECTION & RESEARCH METHODOLOGY

The study is based on secondary data. We have collected the monthly data from the website of www.moneycontrol.com for the period of April 2007 till March 2015. This leads to 96 observations for 8 years. The charting technique is used to see the pattern of investment in FIIs and DIIs. The logarithmic trend line is fitted for next 24 period (2 years) to see the trend of the investments for FIIs, DIIs and Total Institutional Investment (FIIs + DIIs). To check the relationship correlation is used. All the analysis performed with the help of Microsoft Excel®. The logarithmic Trend Line uses the following equation to calculate the least squares fit through points:

$$y = c\ln x + b \qquad (1)$$

V. RESULTS & INTERPRETATION

1. The FIIs Net investment has been taken into consideration, which is calculated by Gross Purchase minus Gross Sales. From the **Figure 1** we can see that FII investment has increased sharply from April 2007 (Rs. 1734.54 cr.) till March 2015 (Rs. 6580.67 cr.) and when we see the trend line for the next 24 months it shows upward movement. So we can say that we will see the increase in next two years for the FIIs investments in India.
2. The DIIs Net investment has been taken into consideration, which is calculated by Gross Purchase minus Gross Sales. From the **Figure 2** we can see that DII investment has decreased sharply from April 2007 (Rs. 857.56 cr.) till March 2015 (Rs. 194.76 cr.) and when we see the trend line for the next 24 months it shows downward movement. So we can say that we will see the decrease in next two years for the DIIs investments in India.
3. The Net investment made by Institutional Investor (FIIs & DIIs) has been taken into consideration, which is calculated by Gross Purchase (FIIs & DIIs) minus Gross Sales (FIIs & DIIs). From the **Figure 3** we can see that total institutional investment by FIIs and DIIs has decreased sharply from April 2007 (Rs. 2592.20 cr.) till March 2015 (Rs. 6775.43 cr.) and when we see the trend line for the next 24 months it shows upward movement. This is because of heavy investment by FIIs compared to DIIs. So we can say that we will see the increase in next two years for the total institutional investments in India.
4. From **Table 1** we can see that correlation between the FIIs and DIIs investment shows the very strong negative correlation of **-.9095.** It means that if FIIs invest in the Indian Stock Market the DIIs withdraw their money out of the stock market and if FIIs withdraw their money, DIIs invest their money in Indian Stock Markets.

(SOURCE – AUTHOR'S OWN WORK, MICROSOFT EXCEL)

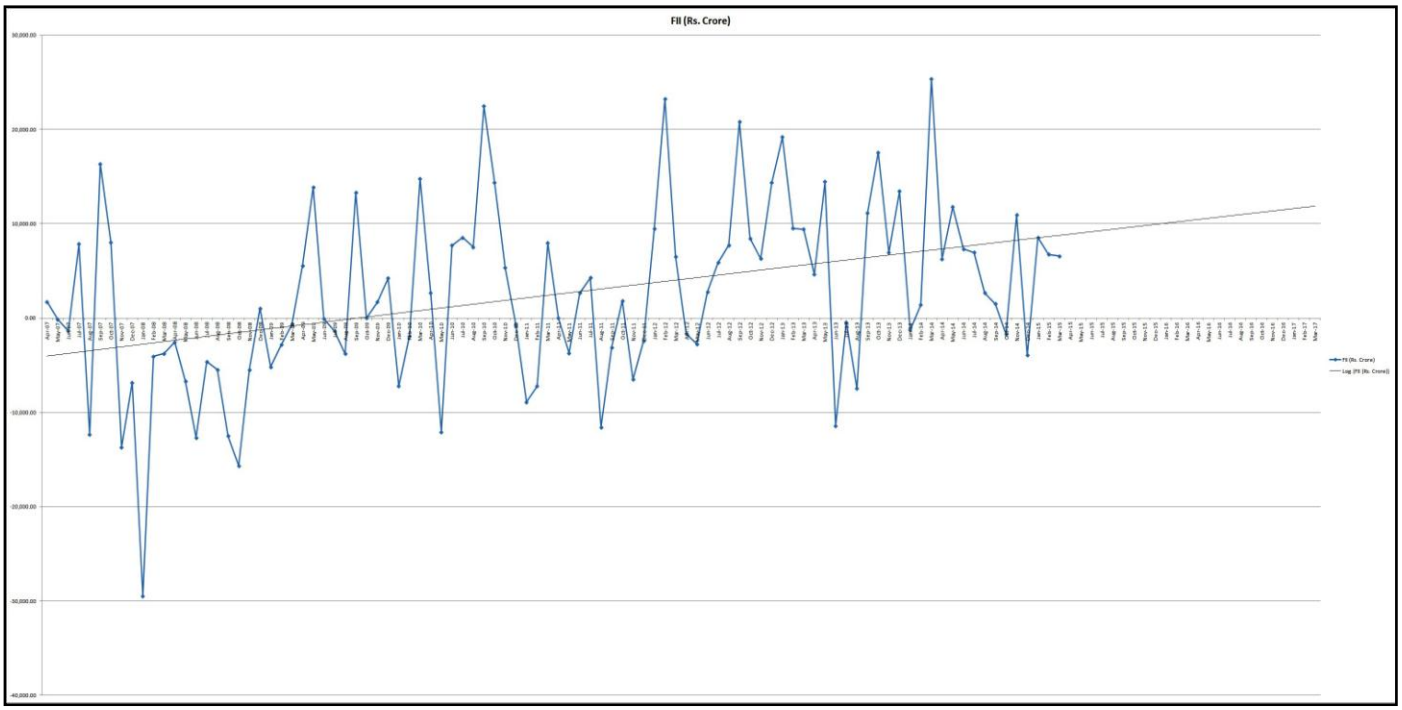

FIGURE 1 – FIIs NET INVESTMENT

(SOURCE – AUTHOR'S OWN WORK, MICROSOFT EXCEL)

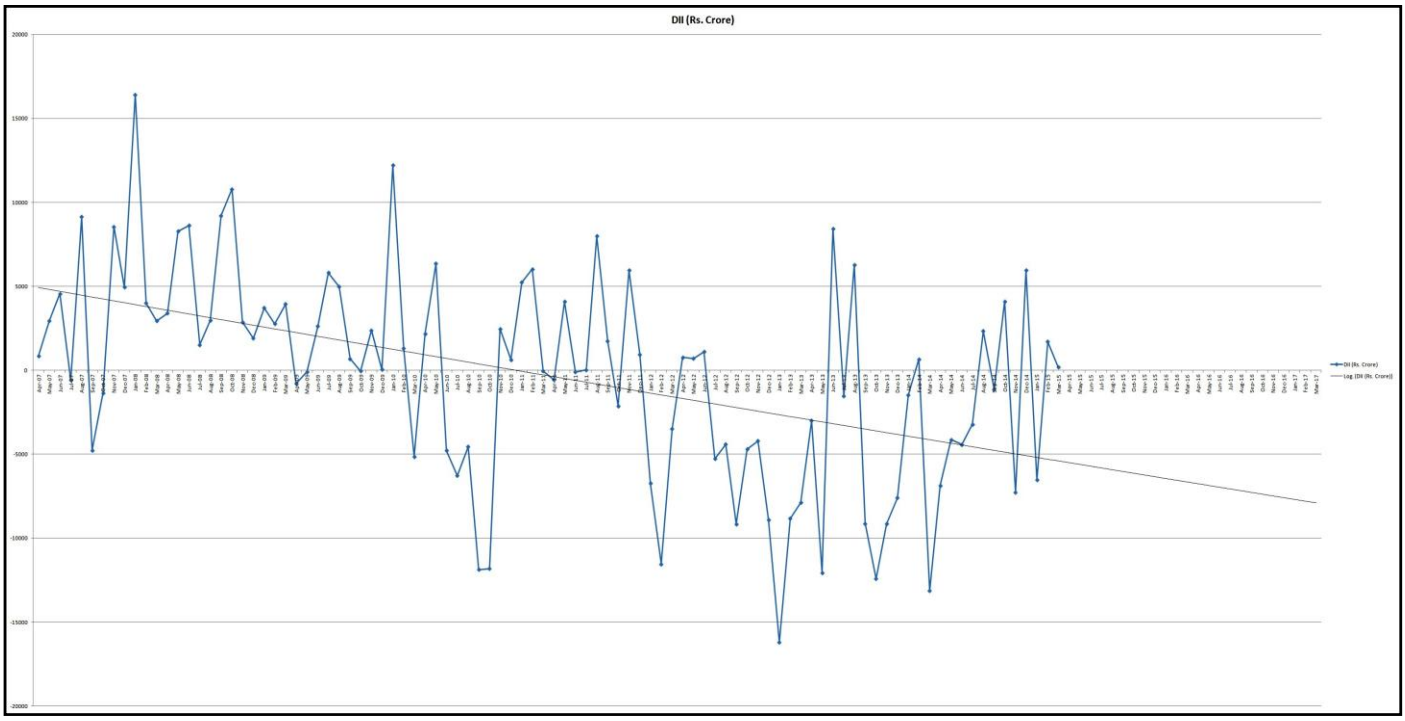

Figure 2 - DIIs Net Investment

(SOURCE – AUTHOR'S OWN WORK, MICROSOFT EXCEL)

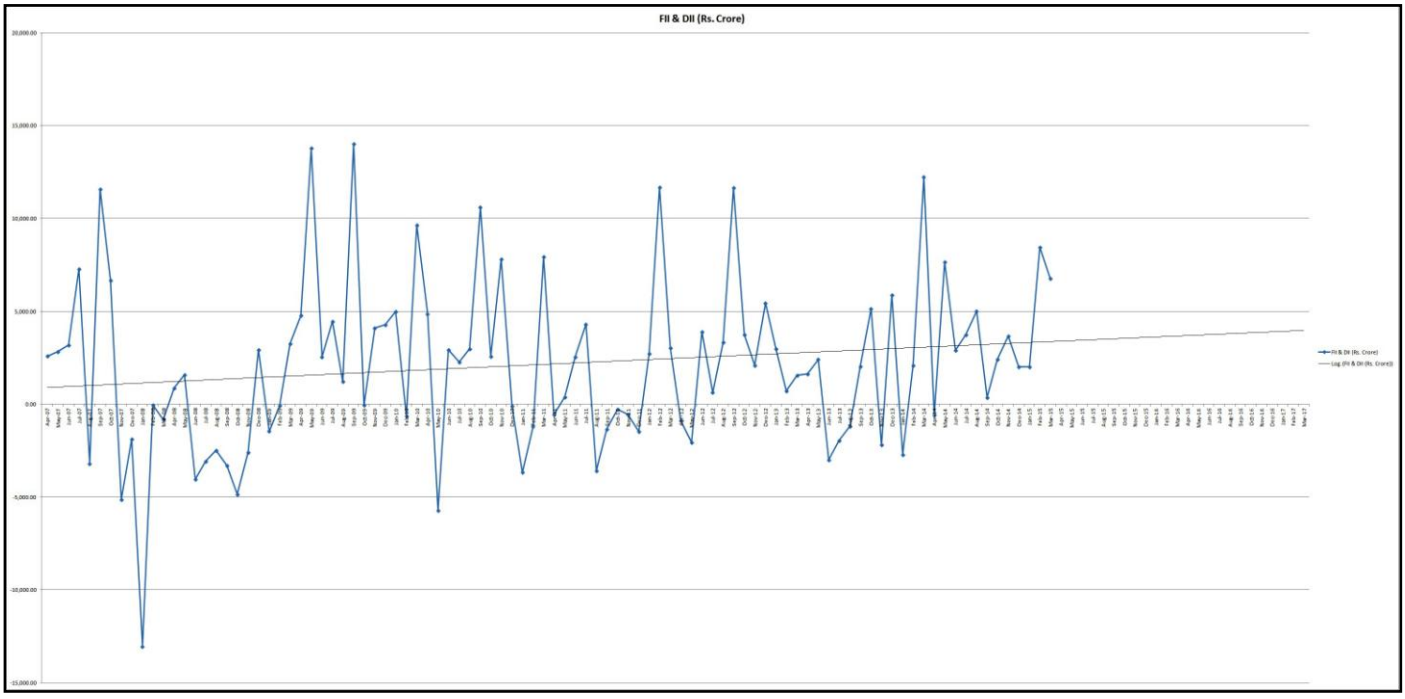

Figure 3 - FIIS & DIIS Net Investment

TABLE 1

CORRELATION		
	FII (Rs. Crore)	**DII (Rs. Crore)**
FII (Rs. Crore)	1	-0.909563682
DII (Rs. Crore)	-0.909563682	1

(SOURCE – AUTHOR'S OWN WORK, MICROSOFT EXCEL)

VI. CONCLUSION

The major finding of the study shows that there is a negative relationship between the Foreign Institutional Investors and Domestic Institutional Investors. If we take them together the FIIs investment influence the investment behavior because of their larger volumes. If we see the forecast of the investment behavior of institutional investor for the next 2 years i.e 24 months we can say the FIIs will show the upward movement and DIIs will show the downward movement in Indian Stock Market Investments. If we look at the total investment of Institutional investors we can see the upward movement because of the large volumes by FIIs investment in Indian Stock Market.

REFERENCES

[1] Bhatnagar, V. K., "Foreign Institutional Investors (FIIs) Investment In India: A Trend Analysis Of Monthly Flows During January 2004 - August 2010," International Journal Of Research In Commerce & Management , pp. 131-137, 2011.

[2] Gopinathan, N., & Rau, S. S., "A Study on the Role of Foreign Institutional Investors FII's in the Indian Capital Market," Journal Of Contemporary Research In Management , pp. 75-81, 2009.

[3] Kaur, S., & Kaur, G., "Foreign Institutional Investors: Trends & Inflows In Indian Stock Market," Sai Om Journal of Commerce & Management , pp. 1-9, 2014.

[4] Krishnan V, S., "Trend Analysis of Foreign Institutional Investors (FIIs) Investment in India of Monthly Flows During January 2006 - October 2011" International Journal of Marketing, Financial Services & Management Research , pp. 63-75, 2012.

[5] Maggo, S., "Trend Analysis of FII Flows in India," The International Journal Of Business & Management , pp. 244-249, 2014.

[6] Nautiyal, N., & Kavidayal, P., "Study Of Causality Analysis Between Indian Stock Market Index And FII Net Inflow," Madras University Journal Of Business And Finance , pp. 12-22, 2013.

[7] Shah, M., "Flows of FIIs and Indian Stock Market," Perspective 2014, Ahmedabad: Shri Chimanbhai Patel Institute of Management and Research, pp. 1-9, 2014.

[8] http://www.moneycontrol.com/ viewed on April 25, 2015.

[9] http://www.sebi.gov.in/sebiweb/ viewed on April 26, 2015.

[10] https://www.rbi.org.in/ viewed on April 26, 2015.

[11] http://www.nseindia.com/ viewed on April 26, 2015.

ANNEXURE 1 – FIIs & DIIs INVESTMENT DATA IN INDIAN STOCK MARKET

(Source - http://www.moneycontrol.com/)

DATES	FII (Rs. Crore)	DII (Rs. Crore)	FII & DII (Rs. Crore)	DATES	FII (Rs. Crore)	DII (Rs. Crore)	FII & DII (Rs. Crore)
Apr-07	1,734.54	857.66	2,592.20	**Apr-11**	4.4	-558.27	-553.87
May-07	-119.97	2,957.10	2,837.13	**May-11**	-3,705.37	4,093.21	387.84
Jun-07	-1,361.25	4,560.26	3,199.01	**Jun-11**	2,662.76	-99.66	2,563.10
Jul-07	7,868.85	-587.42	7,281.43	**Jul-11**	4,281.50	30.07	4,311.57
Aug-07	-12,338.47	9,149.27	-3,189.20	**Aug-11**	-11,559.20	7,991.11	-3,568.09
Sep-07	16,357.96	-4,763.67	11,594.29	**Sep-11**	-3,088.87	1,747.09	-1,341.78
Oct-07	8,016.24	-1,352.18	6,664.06	**Oct-11**	1,842.47	-2,116.64	-274.17
Nov-07	-13,689.26	8,553.41	-5,135.85	**Nov-11**	-6,508.71	5,960.74	-547.97
Dec-07	-6,819.80	4,952.14	-1,867.66	**Dec-11**	-2,387.14	928.01	-1,459.13
Jan-08	-29,447.51	16,414.69	-13,032.82	**Jan-12**	9,469.14	-6,729.82	2,739.32
Feb-08	-4,051.12	4,008.34	-42.78	**Feb-12**	23,236.38	-11,541.38	11,695.00
Mar-08	-3,763.80	2,947.51	-816.29	**Mar-12**	6,526.73	-3,490.73	3,036.00
Apr-08	-2,536.88	3,400.98	864.10	**Apr-12**	-1,663.36	783.01	-880.35
May-08	-6,695.59	8,278.03	1,582.44	**May-12**	-2,756.26	707.22	-2,049.04
Jun-08	-12,667.16	8,627.97	-4,039.19	**Jun-12**	2,794.68	1,102.75	3,897.43
Jul-08	-4,604.00	1,527.19	-3,076.81	**Jul-12**	5,902.95	-5,270.67	632.28
Aug-08	-5,456.12	2,972.38	-2,483.74	**Aug-12**	7,747.11	-4,408.63	3,338.48
Sep-08	-12,502.74	9,212.96	-3,289.78	**Sep-12**	20,807.81	-9,152.20	11,655.61
Oct-08	-15,653.50	10,796.30	-4,857.20	**Oct-12**	8,442.93	-4,695.11	3,747.82
Nov-08	-5,458.96	2,874.15	-2,584.81	**Nov-12**	6,291.51	-4,201.42	2,090.09
Dec-08	1,034.81	1,906.28	2,941.09	**Dec-12**	14,366.49	-8,903.11	5,463.38
Jan-09	-5,172.82	3,718.14	-1,454.68	**Jan-13**	19,197.88	-16,207.32	2,990.56
Feb-09	-2,833.43	2,774.56	-58.87	**Feb-13**	9,533.03	-8,818.50	714.53
Mar-09	-683.57	3,951.53	3,267.96	**Mar-13**	9,423.07	-7,872.45	1,550.62

Apr-09	5,560.10	-782.33	4,777.77	**Apr-13**	4,641.57	-2,998.27	1,643.30
May-09	13,886.09	-82.45	13,803.64	**May-13**	14,465.90	-12,052.43	2,413.47
Jun-09	-85.14	2,633.78	2,548.64	**Jun-13**	-11,425.41	8,427.42	-2,997.99
Jul-09	-1,364.60	5,818.98	4,454.38	**Jul-13**	-414.48	-1,540.85	-1,955.33
Aug-09	-3,767.03	4,984.71	1,217.68	**Aug-13**	-7,470.47	6,284.72	-1,185.75
Sep-09	13,331.43	696.04	14,027.47	**Sep-13**	11,176.05	-9,130.07	2,045.98
Oct-09	0.13	-47.51	-47.38	**Oct-13**	17,555.56	-12,410.71	5,144.85
Nov-09	1,708.07	2,391.04	4,099.11	**Nov-13**	6,956.37	-9,147.17	-2,190.80
Dec-09	4,240.86	49.67	4,290.53	**Dec-13**	13,465.99	-7,586.06	5,879.93
Jan-10	-7,216.67	12,222.03	5,005.36	**Jan-14**	-1,265.88	-1,455.47	-2,721.35
Feb-10	-1,943.47	1,311.95	-631.52	**Feb-14**	1,419.90	667.69	2,087.59
Mar-10	14,792.33	-5,135.85	9,656.48	**Mar-14**	25,376.45	-13,130.77	12,245.68
Apr-10	2,667.37	2,190.66	4,858.03	**Apr-14**	6,283.17	-6,859.04	-575.87
May-10	-12,071.12	6,361.19	-5,709.93	**May-14**	11,802.81	-4,136.04	7,666.77
Jun-10	7,713.95	-4,777.05	2,936.90	**Jun-14**	7,331.91	-4,412.68	2,919.23
Jul-10	8,541.06	-6,271.92	2,269.14	**Jul-14**	6,964.58	-3,216.53	3,748.05
Aug-10	7,537.30	-4,552.68	2,984.62	**Aug-14**	2,681.47	2,335.48	5,016.95
Sep-10	22,475.64	-11,866.63	10,609.01	**Sep-14**	1,503.09	-1,136.99	366.10
Oct-10	14,388.06	-11,812.90	2,575.16	**Oct-14**	-1,682.87	4,102.87	2,420.00
Nov-10	5,350.87	2,468.82	7,819.69	**Nov-14**	10,945.59	-7,271.34	3,674.25
Dec-10	-722.19	634.99	-87.20	**Dec-14**	-3,936.82	5,955.79	2,018.97
Jan-11	-8,903.60	5,237.14	-3,666.46	**Jan-15**	8,540.76	-6,531.75	2,009.01
Feb-11	-7,213.39	6,030.90	-1,182.49	**Feb-15**	6,746.20	1,711.88	8,458.08
Mar-11	7,976.89	-37.93	7,938.96	**Mar-15**	6,580.67	194.76	6,775.43

Contemporary Banking Practices and Applicability

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***Abstract*- At present, Indian economy is experiencing a fairly well developed banking system with different classes of banks –public sector banks, foreign banks, private sector banks – both old and new generation, regional rural banks and co-operative banks with the Reserve Bank of India as the fountain Head of the system. In the banking field, there has been an unprecedented growth and diversification of banking industry has been so astonishing that it has no parallel in the annals of banking anywhere in the world.**

The banking industry has witnessed a series of significant transformations in the last few decades. Among the most important of them is the change in the type of organizations that dominate the landscape. Since the eighties, banks have increased the scope and scale of their activities and several banks have become very large institutions with a presence in multiple regions of the country. The paper examines the trends in contemporary banking.

I. INTRODUCTION

Indian economic environment is witnessing path breaking reform measures. The financial sector, of which the banking industry is the largest player, has also been undergoing a metamorphic change. Today the banking industry is stronger and capable of withstanding the pressures of competition. While internationally accepted prudential norms have been adopted, with higher disclosures and transparency, Indian banking industry is gradually moving towards adopting the best practices in accounting, corporate governance and risk management. Interest rates have been deregulated, while the rigour of directed lending is being progressively reduced.

Today, we are having a fairly well developed banking system with different classes of banks – public sector banks, foreign banks, private sector banks – both old and new generation, regional rural banks and co-operative banks with the Reserve Bank of India as the fountain Head of the system. In the banking field, there has been an unprecedented growth and diversification of banking industry has been so stupendous that it has no parallel in the annals of banking anywhere in the world.

During the last 41 years since 1969, tremendous changes have taken place in the banking industry. The banks have shed their traditional functions and have been innovating, improving and coming out with new types of the services to cater to the emerging needs of their customers.

Massive branch expansion in the rural and underdeveloped areas, mobilization of savings and diversification of credit facilities to the either to neglected areas like small scale industrial sector, agricultural and other preferred areas like export sector etc. have resulted in the widening and deepening of the financial infrastructure and transferred the fundamental character of class banking into mass banking.

There has been considerable innovation and diversification in the business of major commercial banks. Some of them have engaged in the areas of consumer credit, credit cards, merchant banking, leasing, mutual funds etc. A few banks have already set up subsidiaries for merchant banking, leasing and mutual funds and many more are in the process of doing so. Some banks have commenced factoring business.

II. REVIEW OF LITERATURE

Diamond (1984) suggested that economic agents may find it worthwhile to produce information about possible investment opportunities if this information is not free; for instance surplus units could incur substantial search costs if they were to seek out borrowers directly. There would be duplication of information production costs if there were no banks as surplus units would incur considerable expenses in seeking out the relevant information before they commit funds to a borrower. Banks enjoy economies of scale and have expertise in processing information related to deficit units (borrowers).

Bhattacharya and Thakor (1993) contemporary banking theory suggests that banks, together with other financial intermediaries are essential in the allocation of capital in the economy. This theory is centered on information asymmetry, an assumption that "different economic agents possess different pieces of information on relevant economic variables, in that agents will use this information for their own profit" (Freixas and Rochet 1988)

Mahajan and Peterson (1985) defined an innovation as any idea, object or practice that is perceived as new by members of the social system and defined the diffusion of innovation as the process by which the innovation is communicated through certain channels over time among members of social systems

Rogers (1995) identified five critical attributes that greatly influence the rate of adoption. These include relative advantage, compatibility, complexity, triability and observability. According to Rogers, the rate of adoption of new innovations will depend on how an organization perceives its relative advantage, compatibility, triability, observability and complexity.

Santomero and Seater (1996), Prinz (1999) and Shy and Tarkka (2002) present models that identify conditions under which alternative payments substitute for currency. Most of these models indicate that there is at least a possibility for internet substitutes for currency to emerge

and flourish on a wide scale depending on the characteristics of the various technology and those of the potential users.

III. THE INDIAN BANKING SECTOR

The history of Indian banking can be divided into three main phases.

Phase I (1786- 1969) - Initial phase of banking in India when many small banks were set up

Phase II (1969- 1991) - Nationalization, regularization and growth

Phase III (1991 onwards) - Liberalization and its aftermath

With the reforms in Phase III the Indian banking sector, as it stands today, is mature in supply, product range and reach, with banks having clean, strong and transparent balance sheets. The major growth drivers are increase in retail credit demand, proliferation of ATMs and debit-cards, decreasing NPAs due to Securitization, improved macroeconomic conditions, diversification, interest rate spreads, and regulatory and policy changes (e.g. amendments to the Banking Regulation Act).

Certain trends like growing competition, product innovation and branding, focus on strengthening risk management systems, emphasis on technology have emerged in the recent past. In addition, the impact of the Basel II norms is going to be expensive for Indian banks, with the need for additional capital requirement and costly database creation and maintenance processes. Larger banks would have a relative advantage with the incorporation of the norms.

IV. PERSPECTIVES ON INDIAN BANKING

In 2009-10 there was a slowdown in the balance sheet growth of scheduled commercial banks (SCBs) with some slippages in their asset quality and profitability. Bank credit posted a lower growth of 16.6 per cent in 2009-10 on a year-on-year basis but showed signs of recovery from October 2009 with the beginning of economic turnaround. Gross nonperforming assets (NPAs) as a ratio to gross advances for SCBs, as a whole, increased from 2.25 per cent in 2008 - 09 to 2.39 percent in 2009 – 10. Notwithstanding some knock-on effects of the global financial crisis, Indian banks withstood the shock and remained stable and sound in the post-crisis period. Indian banks now compare favorably with banks in the region on metrics such as growth, profitability and loan delinquency ratios. In general, banks have had a track record of innovation, growth and value creation. However this process of banking development needs to be taken forward to serve the larger need of financial inclusion through expansion of banking services, given their low penetration as compared to other markets.

During 2010-11, banks were able to improve their profitability and asset quality. Stress test showed that banking sector remained reasonably resilient to liquidity and interest rate shocks. Yet, there were emerging concerns about banking sector stability related to disproportionate growth in credit to sectors such as real estate, infrastructure, NBFCs and retail segment, persistent asset-liability mismatches, higher provisioning requirement and reliance on short-term borrowings to fund asset growth\

V. TRENDS IN CONTEMPORARY BANKING

A. Electronic Payment Services – E Cheques

Now-a-days we are hearing about e-governance, e-mail, e-commerce, e-tail etc. In the same manner, a new technology is being developed in US for introduction of e-cheque, which will eventually replace the conventional paper cheque. India, as harbinger to the introduction of e-cheque, the Negotiable Instruments Act has already been amended to include; Truncated cheque and E cheque instruments.

B. Real Time Gross Settlement (RTGS)

Real Time Gross Settlement system, introduced in India since March 2004, is a system through which electronics instructions can be given by banks to transfer funds from their account to the account of another bank. The RTGS system is maintained and operated by the RBI and provides a means of efficient and faster funds transfer among banks facilitating their financial operations. As the name suggests, funds transfer between banks takes place on a 'Real Time' basis. Therefore, money can reach the beneficiary instantaneously and the beneficiary's bank has the responsibility to credit the beneficiary's account within two hours.

C. Electronic Funds Transfer (EFT)

Electronic Funds Transfer (EFT) is a system whereby anyone who wants to make payment to another person/company etc. can approach his bank and make cash payment or give instructions/authorization to transfer funds directly from his own account to the bank account of the receiver/beneficiary. Complete details such as the receiver's name, bank account number, account type (savings or current account), bank name, city, branch name etc. should be furnished to the bank at the time of requesting for such transfers so that the amount reaches the beneficiaries' account correctly and faster. RBI is the service provider of EFT.

D. Electronic Clearing Service (ECS)

Electronic Clearing Service is a retail payment system that can be used to make bulk payments/receipts of a similar nature especially where each individual payment is of a repetitive nature and of relatively smaller amount. This facility is meant for companies and government departments to make/receive large volumes of payments rather than for funds transfers by individuals.

E. Automatic Teller Machine (ATM)

Automatic Teller Machine is the most popular devise in India, which enables the customers to withdraw their money 24 hours a day 7 days a week. It is a devise that allows customer who has an ATM card to perform routine banking transactions without interacting with a human teller. In addition to cash withdrawal, ATMs can be used for payment of utility bills, funds transfer between accounts, deposit of cheques and cash into accounts, balance enquiry etc.

F. *Point of Sale Terminal*

Point of Sale Terminal is a computer terminal that is linked online to the computerized customer information files in a bank and magnetically encoded plastic transaction card that identifies the customer to the computer. During a transaction, the customer's account is debited and the retailer's account is credited by the computer for the amount of purchase.

G. *Tele Banking*

Tele Banking facilitates the customer to do entire non-cash related banking on telephone. Under this devise Automatic Voice Recorder is used for simpler queries and transactions. For complicated queries and transactions, manned phone terminals are used

H. *Electronic Data Interchange (EDI)*

Electronic Data Interchange is the electronic exchange of business documents like purchase order, invoices, shipping notices, receiving advices etc. in a standard, computer processed, universally accepted format between trading partners. EDI can also be used to transmit financial information and payments in electronic form.

VI. IMPLICATIONS

The banks were quickly responded to the changes in the industry; especially the new generation banks. The continuance of the trend has re-defined and re-engineered the banking operations as whole with more customization through leveraging technology. As technology makes banking convenient, customers can access banking services and do banking transactions any time and from any ware. The importance of physical branches is going down.

VII. CHALLENGES

It is becoming increasingly imperative for banks to assess and ascertain the benefits of technology implementation. The fruits of technology will certainly taste a lot sweeter when the returns can be measured in absolute terms but it needs precautions and the safety nets. The increasing use of technology in banks has also brought up 'security' concerns. To avoid any mishaps on this account, banks ought to have in place a well-documented security policy including network security and internal security. The passing of the Information Technology Act has come as a boon to the banking sector, and banks should now ensure to abide strictly by its covenants. An effort should also be made to cover e-business in the country's consumer laws. Some are investing in it to drive the business growth, while others are having no option but to invest, to stay in business. The choice of right channel, justification of IT investment on ROI, e-governance, customer relationship management, security concerns, technological obsolescence, mergers and acquisitions, penetration of IT in rural areas, and outsourcing of IT operations are the major challenges and issues in the use of IT in banking operations.

VIII. CONCLUSION

Indian banking system will further grow in size and complexity while acting as an important agent of economic growth and intermingling different segments of the financial sector. It automatically follows that the future of Indian banking depends not only in internal dynamics unleashed by ongoing returns but also on global trends in the financial sectors. Indian Banking Industry has shown considerable resilience during the return period. The second generation returns will play a crucial role in further strengthening the system. The banking today is re-defined and re-engineered with the use of Information Technology and it is sure that the future of banking will offer more sophisticated services to the customers with the continuous product and process innovations. Thus, there is a paradigm shift from the seller's market to buyer's market in the industry and finally it affected at the bankers level to change their approach from "conventional banking to convenience banking" and "mass banking to class banking". The shift has also increased the degree of accessibility of a common man to bank for his variety of needs and requirements. Adoption of stringent prudential norms and higher capital standards, better risk management systems, adoption of internationally accepted accounting practices and increased disclosures and transparency will ensure the Indian Banking industry keeps pace with other developed banking systems.

REFERENCES

Kamlesh Bajaj & Dehjaji ; E-Commerce,Tata McGraw hill publications Co. Ltd., New Delhi,2005

[1]. B.P.Gupta, V.K.Vashistha, H.R.Swami, Banking and Finance, Ramesh Book Depot, Jaipur-New Delhi (2008).

[2]. S.B. Verma ; E- Banking and Development of Banks, Deep & Deep Publications, New Delhi ,2008

[3]. Various issues of Business Week, The Economist, Business Today, The Economic Times and Financial Express.

[4]. http://www.moneycontrol.com/news/press-release/reporttrendprogressbankingindia-2010-11_617218.html

[5]. http://www.mbaknol.com/business-finance/recent-trends-in-indian-banking-sector/

[6]. http://www.articlesbase.com/information-technology-articles/it-emergence-recent-trends-in-banking-industry-of-india-1981838.html

[7]. http://www.vikalpa.com/pdf/articles/2003/2003_july_sep_83_99.pdf

[8]. www.icicibank.com

[9]. www.rbi.org.in

Causal Relation Between Macro Economic Variables and Indian Stock Market

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***Abstract*--In this study attempt has been made to explore the relation especially the causal relation between stock market index i.e. BSE Sensex and five key macro economic variables of Indian economy by using correlation, regression . Monthly data has been used for all the variables, like, BSE Sensex, Inflation Rate, Index of industrial production(IIP) and Exchange rate(Rs/$),Money supply, Rate of Interest . Money supply is taken from the RBI monthly bulletin and is in the millions of rupees. Money supply is the total money supply in India and m3 is taken for this project which is vey vast. Rate of interest is taken from the bank what they provide on the fixed deposits. Exchange Rate is taken of the dollars. Industrial production is to be take of 2004-05 year based index in which the production is consider 100 and changes is made in our years accordingly. Inflation rate is taken which is prevailing in India since our independence. Correlation is used because it defines the relation between them and at what degree they correlate with each other. Regression is used to find out the impact of economic variables on Sensex. All the economic variables taken as independent variables and Sensex take as dependent variables and then find out the impact. Regression Results showed that the stock market index, the industrial production index, money supply, and inflation rate have more impact on Sensex and other two variables have very little impact on the Sensex. Correlation result shows that 3 variables industrial production, money supply and inflation rate have the high degree of correlation between the Sensex and exchange rate has the negative correlation and rate of interest has the very low degree of positive relation. At last findings are given which are useful for the investors so they can consider this suggestion for these investment purposes.**

Keywords--Sensex; Exchange Rate; Inflation; Money Supply; Rate of Interest and Industrial Production.

I. INTRODUCTION

The movement of stock indices is highly sensitive to the changes in fundamentals of the economy and to the changes in expectations about future prospects. Expectations are influenced by the micro and macro fundamentals which may be formed either rationally or adaptively on economic fundamentals, as well as by many subjective factors which are unpredictable and also non quantifiable. It is assumed that domestic economic fundamentals play determining role in the performance of stock market. However, in the globally integrated economy, domestic economic variables are also subject to change due to the policies adopted and expected to be adopted by other countries or some global events. The common external factors influencing the stock return would be stock prices in global economy, the interest rate and the exchange rate. For instance, capital inflows and outflows are not determined by domestic interest rate only but also by changes in the interest rate by major economies in the world. Recently, it is observed that contagion from the US subprime crisis has played significant movement in the capital markets across the world as foreign hedge funds unwind their positions in various markets. Other burning example in India is the appreciation of currency due to higher inflow of foreign exchange. Rupee appreciation has declined stock prices of major export oriented companies. Information technology and textile sector are the example of falling stock prices due to rupee appreciation.

From the beginning of the 1990s in India, a number of measures have been taken for economic liberalization. At the same time, large number of steps has been taken to strengthen the stock market such as opening of the stock markets to international investors, regulatory power of SEBI, trading in derivatives, etc. These measures have resulted in significant improvements in the size and depth of stock markets in India and they are beginning to play their due role. Presently, the movement in stock market in India is viewed and analysed carefully by large number of global players. Understanding macro dynamics of Indian stock market may be useful for policy makers, traders and investors. Results may reveal whether the movement of stock prices is the outcome of something else or it is one of the causes of movement in other macro dimension in the economy. The study also expects to explore whether the movement of stock market are associated with real sector of the economy or financial sector or both. In this context, the objective of this study is to explore such causal relations for India as there is a little work for this period.

In this study the major economic variables are taken Exchange Rate, Inflation, Money Supply Rate of Interest and Industrial Production.

II. OBJECTIVES OF THE STUDY

To study the impact of major macro variables on stock market index Sensex

- Impact of Inflation on Sensex
- Impact of Exchange Rate on Sensex
- Impact of Money Supply on Sensex
- Impact of Industrial Production on Sensex
- Impact of Exchange Rate on Sensex

1. To examine the correlation between the stock market index of sensex and major economic variables.

III. RESEARCH METHODOLOGY

A. Research Design - Descriptive Research Design.

Data Sources: Secondary sources of data collection is used The information was collected and assembled from- Magazines, Annual reports & Journals, RBI'S guidelines, Trend & Progress reports of RBI journals, , Information from the various websites.

B. Research Tools Used

Correlation analysis, Regression Analysis

1. DATA ANALYSIS AND INTERPRETATION

CORRELATION ANALYSIS

Result of Correlation analysis of all 5 Economic Variables and Sensex together.
▼Correlation: Pearson

Number of Observations: 144

Pearson Correlation Matrix

	EXCHANGE	PRODUCTION	INFLATION	MONEY SUPPLY	INTEREST RATE
SENSEX	-0.355	0.934	0.751	0.889	0.157

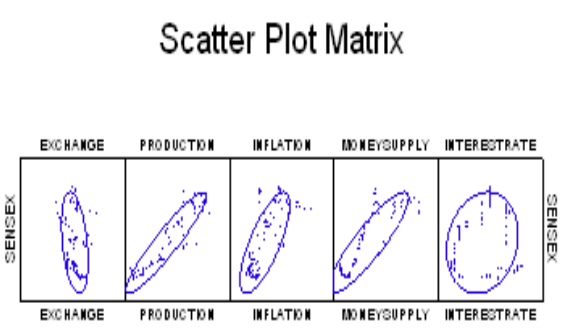


Figure 1.1 Sensex and All Macro Economic Variables

Interpretation: It is the collective view of correlation analysis between the all major 5 economic variables and the sensex. It can be analyses from the view that 3 factors that is industrial production, money supply and inflation has the moderate and high degree of correlation with the sensex and that defines as the change in the economic factor there is a positive change in the sensex. When there is a increase in economic factors rise in sensex and with the decrease in these major macro economic variables downfall in sensex. The two variables tend to increase or decrease together. Exchange rate has the indirect low degree of correlation i.e. one decrease with the increase in another. But the interest rate has the low degree of positive correlation as change in factor can't made change in another.

REGRESSION ANALYSIS

Individual Regression Analysis Figures

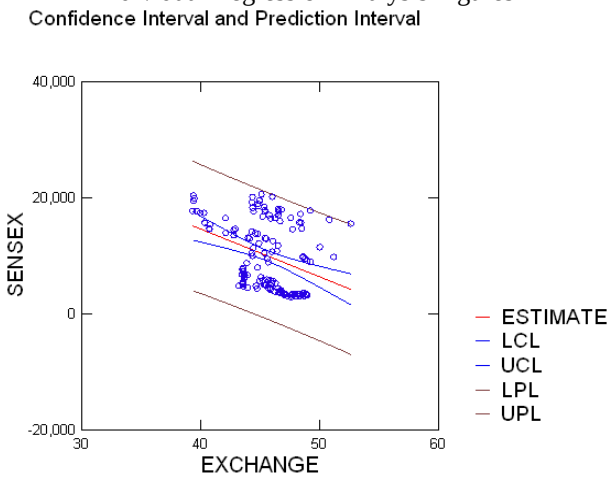


Figure 2.1.A Sensex and Exchange Rate

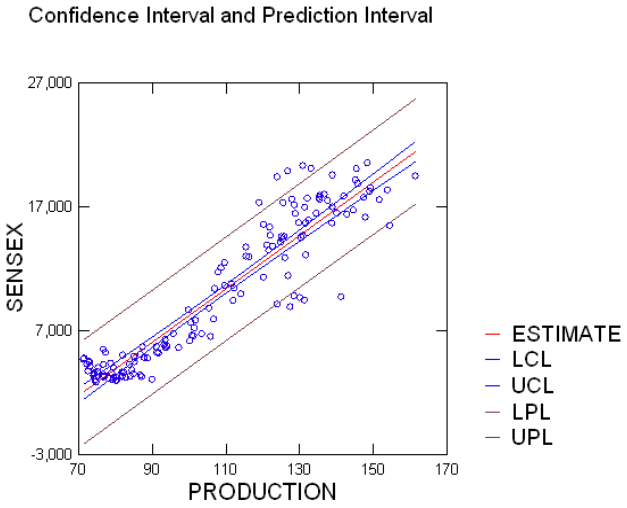


Figure 2.1.B Sensex and Industrial Production

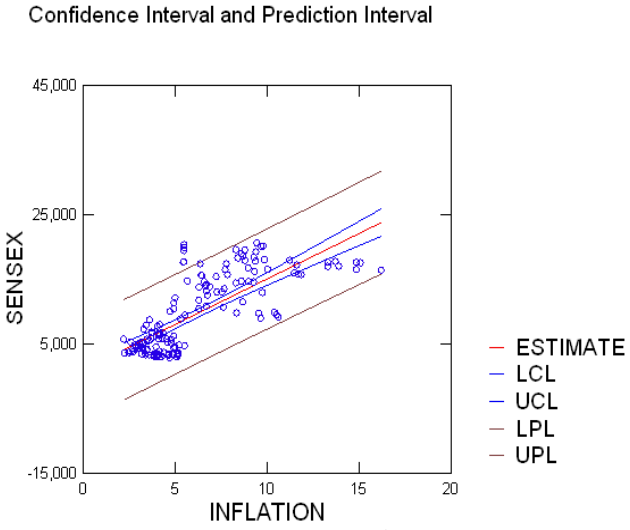


Figure 2.1.C. Sensex and Inflation Rate

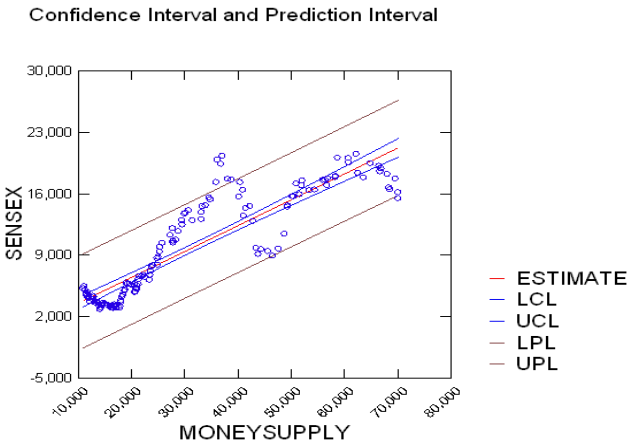


Figure 2.1.D. Sensex and Money Supply

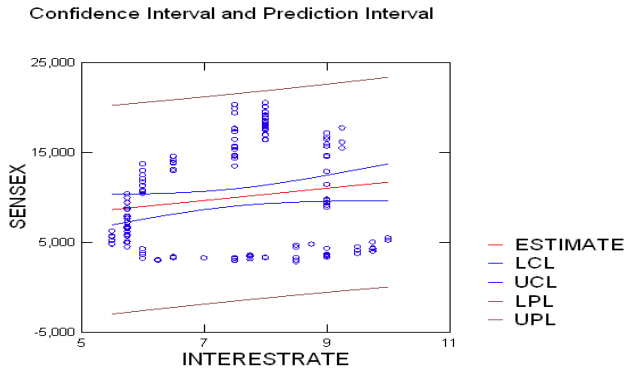


Figure 2.1.e. Sensex and Interest Rate

2. Result of Multiple Regression analysis between all the variables and Sensex

▼OLS Regression

Dependent Variable	SENSEX
N	144
Multiple R	0.970
Squared Multiple R	0.942
Adjusted Squared Multiple R	0.940
Standard Error of Estimate	1,440.528

Regression Coefficients B = $(X'X)^{-1}X'Y$

Effect	Coefficient	Standard Error	Std. Coefficient	Tolerance	t	p-value
CONSTANT	26,152.660	3,595.943	0.000	.	7.273	0.000
EXCHANGE Rt.	-740.407	58.280	-0.319	0.668	-12.704	0.000
PRODUCTION	95.113	19.436	0.413	0.059	4.894	0.000
INFLATION	208.294	72.135	0.111	0.285	2.888	0.005

Regression Coefficients B = $(X'X)^{-1}X'Y$

Effect	Coefficient	Standard Error	Std. Coefficient	Tolerance	t	p-value
MONEYSUPPLY	0.131	0.027	0.395	0.061	4.750	0.000
INTERESTRATE	246.690	105.721	0.057	0.706	2.333	0.021

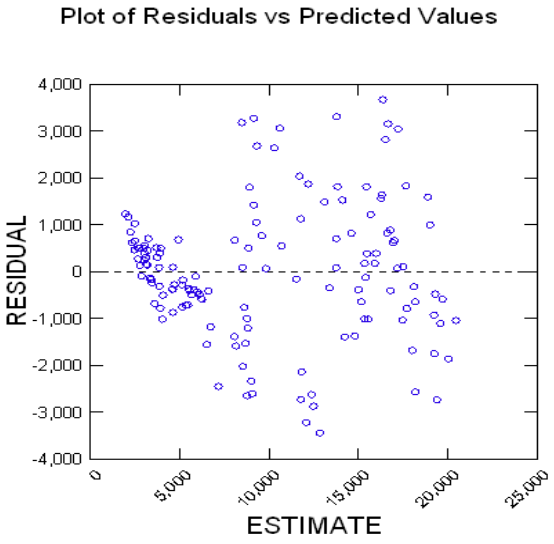
Analysis of Variance

Source	SS	df	Mean Squares	F-ratio	p-value
Regression	4631000000	5	926200000	446.330	0.000
Residual	2864000000	138	2,075,119.619		

Durbin-Watson D Statistic	0.548
First Order Autocorrelation	0.724

Information Criteria

AIC	2,511.082
AIC (Corrected)	2,511.905
Schwarz's BIC	2,531.871



Interpretation: It is analysed from the output of systat result that 94.2% of variability in the sensex market value is due to all economic variables. Coefficient of determination defines that sensex depend 56.4% on 5 major economic variables. Durbin-waston D static is .548 that defines the accuracy is 55%. In this model independent variable are 5 major macro variables and dependent variable is sensex. Here the p value is near to zero in all variable case that defines that the model is so much good and the result is not occurring by chance. The result is significant; the p value also defines the significance of the model. B coefficient tells the intercept and coefficient for independent variable. In this the b coefficient is 26152 that defines the A in the regression line and the B is -740 for exchange rate, 95 for industrial production,208 for

inflation, .131 for money supply, 246 for interest rate .so the regression line is A+BX i.e. 26152-740(X1)+95(X2)+208(X3)+.131(X4)+246(X5), X1 to X5 is used to fill the changes in the all 5 major economic variables together to estimate the value of sensex. The chance of error for each variable is different. Shrinkage in this case is the just .002 so the true impact of all 5 major economic variables on the sensex is 94%.

IV. CONCLUSION

This study was conducted to see the impact of major macro variables on the sensex. How they make impact on the Sensex when the changes occur in themselves. The data analysis of these factors reach to the conclusion that no doubt these variables make impact on the sensex but we can't forget the other things like market sentiment, global maket positions and demand supply effect on the sensex. There was recession in the market in 2000 and second part of recession in the year 2008 but sensex comes out from it very efficiently. 3 macro economic variables out 5 shows the high degree of correlation between them and sensex but other two shows negative and low degree of positive correlation. Regression analysis shows that 2 variables impact more to the sensex and one make more than average and other two have no much. With the results we can't say that sensex is working only with the changes in these variables there are many other thing which have impact on the sensex. we can say that these 5 major macro variables have impact on the sensex but sensex is a sensitive index which shows the impact not only these 5 variables but also many other factors sudden news , changes in the global market and the recession.

Industrial production, inflation rate and money supply can be used to make the prediction sensex performance but thjat can be chances of error also. At last we are on the conclusion that these 5 major macro variables impact the sensex to some extent and investor must consider the changes in these variables while making investment but they must consider the other factors such as demand and supply effect and sentiments in the market because sentiment effect the sensex more than these 5 economic variables.

REFERENCES

[1] Chowhan P. K. (2000), " Volatility in Indian stock market"

[2] L.M.C.S. Menike (2003), "The Effect of Macroeconomic Variables on Stock Prices in Emerging Sri Lankan Stock Market"

[3] Ray, Prantik and Vani, Vina (2004), "What Moves Indian Stock Market: A Study on the Linkage with Real Economy in the Post-Reform Era" available at

[4] Ahmed Shahid (2008), "Aggregate Economic Variables and Stock Markets in India"

[5] Robert D. Gay, Jr. (2008), "Effect Of Macroeconomic Variables On Stock Market Returns For Four Emerging Economies: Brazil, Russia, India, And China"

[6] Dr.Mrs. Pandian Punithavathy and Dr.Sr. Jeyanthi Queensly (2009), "Stock Market Volatility in Indian Stock Exchanges"

[7] Sahu Naresh Chandra and Dhiman Deepinder H. (2010), "Correlation and Causality between Stock Market and Macro Economic Variables in India: An Empirical Study"

[8] Mittal Ruhee and Pal Karam (2011), "Impact of macroeconomic indicators on Indian capital markets"

[9] Singh Dharmendra (2011), "Causal relationship between macro-economic variables and stock market: a case study for India"

WEBSOURCES

[10] http://rbidocs.rbi.org.in/rdocs/Bulletin/PDFs/10T_CS100112B.pdf

[11] http://www.gecodia.com/India-Industrial-Production_a671.html

[12] http://www.rbi.org.in/scripts/BS_ViewBulletin_Test.aspx?Id=12870

[13] http://www.bseindia.com/about/st_key/dollr_exg.asp

[14] http://www.bseindia.com/about/abindices/monthly_report/TheView_November_2011.pdf

[15] http://stockshastra.moneyworks4me.com/learn/stock-shastra-29-learn-to-read-the-signals-of-interest-rate-and-its-impact-on-stock-market/\

[16] www.inflation.eu/inflation-rates/india/...inflation/cpi-inflation-india.a..

[17] http://www.tradingeconomics.com/india/inflation-cpi

[18] www.graphpad.com/articles/interpret/corl_n_linear.../correlation.htm

Role of ICT in Education: Emerging Challenges and Concerns

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Abstract-***ICT has the potential to improve the quality of education and teacher training system to a great extent. We live in a world that is constantly changing and being populous, every individual need demands a different means of satisfaction. ICT enables each and every individual to excel through various tools in main timing different life style and careers. India being the second most populated and also the second largest democratic country in the world can implement various technologies of ICT in its teacher-training system since it has 50,000 teacher educators & benefit from it. Indian culture has always been rich and a teacher has always been the epitome of the utmost respect and reverence magnanimous in our country. ICT technology is quite affordable, accessible and relevant in improvisation of educational content and its delivery. The only need is for the teachers to realize the role they are expected to play in providing better leaders for the progress of the nation***

Keywords-Information Communication Technology (ICT), Education Technology, Education, Teaching-Learning.

I. INTRODUCTION

The term Educational Technology by nature is very inclusive which comprises wide range of conventional aids like maps, charts, diagrams and models, audio visual aids such as film projector, overhead projector; audio cassettes/radio and video cassettes/television. It also includes newer digital based media such as computer, fax, email, interactive multimedia, all forms of teleconferencing, online classroom, web based learning, blogs, pod cast, e-learning, etc. The purpose of newer digital based technologies is not to oppose the traditional technologies but to solve the teaching and learning related problems more prudently than earlier days. However, the traditional technologies merged with newer technologies and incarnated in new Avtar namely 'Information and Communication Technology' (ICT) because of its pervasive nature and increased learning opportunities as per the needs and convenience of the education system. Historically, ICT has been emerging on and of the concepts of ET. Advances in information and communication Technologies (ICTs) during the last 20 years in India have had a significant social and economic impact in general and educational domain in particular. ICT have potentially revolutionized the human thought, feeling and behavior by enabling any person anywhere in the world to exchange visual and aural experiences with any other person at any other place in the world. ICT is not confined to production of an audio, video or any form of media presentation. It is a holistic approach to the design, development, implementation, management and evaluation of learning environment which engage learners constructively. It refers to the process in which learning problems are analyzed and solutions are thought of through application of principles of communication, learning, instructional design and mediated pedagogy. These days the newer and more powerful technologies are being introduced to shape the future of education for delivery and managing extensive amount of information. Thus the development of technology and worldwide networking together with innovative pedagogical changes transformed conventional education to a new pedagogical paradigm namely IT supported and ICT enhanced learning. Thus the education has become highly interactive, engaging the student every 20 seconds or so far a response, much in contrast to present-day passive lecture methods; allow students to move independently between learning areas as necessary, managed by technology; give opportunity to students to develop valuable skills such as team work, self-organization and provide broader international context for approaching problems as well as being more sensitive response to local needs.

II. NATIONAL POLICY ON ICT IN SCHOOL EDUCATION (DRAFT):2012

A. Preamble:

The National Policy on Education1986, as modified in 1992, stressed upon employing educational technology to improve the quality of education. The policy statement led to two major centrally sponsored schemes, namely, Educational Technology (ET) and Computer Literacy and Studies in Schools (CLASS) paving the way for a more comprehensive centrally sponsored scheme– Information and Communication Technology @ Schools in 2004. Educational technology also found a significant place in another scheme on up-gradation of science education. The significant role of ICT in school education been highlighted in the National Curriculum Framework2005 (NCF) 2005. Use of ICTfor quality improvement also figures in Government of India's flagship programme on education, SarvaShikshaAbhiyan (SSA). Again, ICT figured comprehensively in the norm of schooling recommended by Central Advisory Board of Education(CABE), in its report on Universal Secondary Education, in 2005. With the convergence of technologies it has become imperative to take a comprehensive look at all possible information and communication technologies for improving school education in the country. The comprehensive choice of ICT for holistic development of

education can be built only on a sound policy. The initiative of ICT Policy in School Education inspired by the tremendous potential of ICT for enhancing outreach and improving quality of education. This policy endeavors to provide guidelines to assist the States in optimizing the use of ICT in school education within a national policy framework.

III. VISION, MISSION AND POLICY GOALS

A. *Vision:*

The ICT Policy in School Education aims at preparing youth to participate creatively in the establishment, sustenance and growth of a knowledgesociety leading to all round socio-economic development of the nation and global competitiveness.

B. *Mission*:

To devise, catalyze, support and sustain ICT and ICT enabled activities and processes in order to improve access, quality and efficiency in the school system

C. *Policygoals*:

To achieve the above, the ICT Policy in School Education will endeavor to Create.

- An environment to develop an ICT knowledgeable community
- An ICT literate community, who can deploy, utilize, benefit from ICT and contribute to nation building
- An environment of collaboration, cooperation and sharing, conducive to the creation of a demand for optimal utilization of and optimum returns on the potentials of ICT in education

IV. PROMOTE

- Universal, equitable, open and free access to state of the art ICT and ICT enabled tools and resources to all students and teachers
- Development of local and localized quality content and enable students and teachers to partner in the development and critical use of shared digital resources
- Development of professional networks of teachers, resource persons and schools to catalyze and support resource sharing, up gradation and continuing education of teachers; guidance, counseling and academic support to students; and resource sharing, management and networking of school managers and administrators, resulting in improved efficiencies in the schooling process.
- Research, evaluation and experimentation in ICT tools and ICT enabled practices in order to inform, guide and critically utilize the potentials of ICT in school education Motivate and enable
- Wider participation of all sections of society in strengthening the school education process through appropriate utilization of ICT.The infrastructure will be developed and managed with public private partnership. The national and state level agencies will develop curriculum, digital resources and capacity building programmes which will serve as models for adaptation and implementation across the system. The time line for basic IT literacy to the students for classes IX-XII and elementary will be complete by the end of 11^{th} and 12^{th} five year plan. Subsequently, induction training of teachers of all classes will be complete by 11^{th} plan. (GOI, Ministry of Human Resource Development, Department of School Education and Literacy Website (c)).

V. EMERGING CHALLENGES

While we glorify the role of ICT in the higher education sector, we also need to assess the problems and prospects in its implementation. ICT policy initiatives of Government of India for last two decades shows that India has made substantial improvement to integrate ICT in education. All stake holders of education such as learners, teachers, community, educational administrators, policy makers and so on should be fully aware of the policy parameters so that they can use the policy as the mechanism to systematize ICT enabled education. However, having much of the policy initiatives at governmental and non-governmental level, our educational institutions still encounter numerous challenges and issues.

VI. CAPACITY-BUILDING RELATED CHALLENGES

The barrier most frequently referred to in the literature is lack of effective training at pre-service and in-service level. One finding of Pelgrum's (2001) study found that there were not enough training opportunities for teachers in the use of ICT's in a classroom environment. Providing pedagogical training for teachers, rather than simply training them to use ICT tools, is an important issue (Becta, 2004).

VII. TECHNICAL SUPPORT RELATED CHALLENGES

Information and Communication Technology has no doubt brought about tremendous change in education, but we are yet to achieve the desired level of IT adoption in education in the country. The optimal utilization of opportunities arising due to diffusion of ICTs in education system presents enormous challenge. Nonetheless, it has become an indispensable support system for higher education as it could address some of the challenges facing higher education system in the country.

Pelgrum (2001) found that in the view of primary and secondary teachers, one of the top barriers to ICT use in education was lack of technical assistance. Technical support requirements of an institution depend ultimately on what and how technology is deployed and used, general competencies that the required would be in the installation, operation, and maintenance of technical equipment (including software), network administration, and network security. Without on-site technical support, much time and money may be lost due to technical breakdowns. Without both good technical support in the classroom and whole-school resources, teachers cannot be expected to overcome the barriers preventing them from using ICT.

VIII. LANGUAGE AND CONTENT RELATED CHALLENGES

English is the dominant language of the internet and major software produced in the world market; An estimated 80% of online content is in English. For Country like ours where English language proficiency is not high particularly at elementary and secondary level, especially outside metropolitan areas, this represents a serious barrier to maximizing the education benefits of the World Wide Web. Content development is a critical area that is too often overlooked. These are tasks for which content development specialists such as instructional designers, scriptwriters, audio and video production specialists, programmers, multimedia course authors, and web-developers are needed. Like technical support specialists, content developers are highly skilled professionals and are not historically employed by primary and secondary schools.

IX. CONCLUSION

Education has a wide area and introduction of ICT in it, is not an easy task. Since ICT has the potential to improve the quality of education and teacher training system to a great extent. We live in a world that is constantly changing and being populous, every individual need demands a different means of satisfaction. And ICT enables each and every individual to excel through various tools in main timing different life style and careers. India being the second most populated and also the second largest democratic country in the world, can implement various technologies of ICT in its teacher-training system since it has 50,000 teacher educators & benefit from it. Indian culture has always been rich and a teacher has always been the epitome of the utmost respect and reverence magnanimous in our country. ICT technology is quite affordable, accessible and relevant in improvisation of educational content and its delivery. The only need is for the teachers to realize the role they are expected to play in providing better leaders for the progress of the nation.

REFERENCES

[1.] Iding, M., Crosby, M.E., &Speitel, T.(2002). Teachers and technology: Beliefs and practices. International Journal of Instructional Media, 29(2), 153-171.

[2.] CIET (2004).*An Impact Evaluation Study of the Centrally sponsored Educational Technology Scheme of GOI.NCERT,* New Delhi (mimeo).

[3.] Cox, M., Preston, C., & Cox, K. (1996). What motivates teachers to use ICT? Paper presented at the British Educational Research Association Annual Conference. Retrieved August 2, 2008, from http://leds.ac.uk./educol/documents/00001329.htm.

[4.] GOI (2009), "National Policy on Information and Communication Technology (ICT) in School Education", Department of School Education and Literacy, Ministry of Human Resources Development, Government of India, New Delhi.

[5.] GOI (2008), "Eleventh Five Year Plan 2007-12 Vol. 11, Social Sector", Planning Commission, Government of India Oxford University Press, New Delhi. (Also available at – http"// planningcommission.gov.in/ plans/ planrel/ fiveryr/ 11th/ 11_v2/ 11th_vol2.pdf-accessed on Oct.01, 2009)

[6.] Grabe, M., &Grabe, C. (2007). Integrating technology for meaning learning (5thed.). Boston, NY: Houghton Mifflin.

Changing Aims of Education in the Context of Globalization

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***Abstract*- Globalization brings education to the front lines. An aim is a conscious purpose which we are apt to set before us. Education is one of the most important instruments that play their role in Human development. Globalization has created many opportunities as well as challenges only those nations can benefit from the opportunities which have acquired the required knowledge and skills. Relevant quality education and training, predominant in the new environment, promotes a productive and informed citizenry, and offers opportunities to the socially and economically underprivileged sections of society. Physical and mental well-being in a holistic and integrated approach towards human development is very much crucial. Global education is an education perspective which arises from the fact that contemporary people live and interact in an increasingly globalized world.**

Keywords: Globalization, Higher Education, Aims of Education, Role of Teacher

I. INTRODUCTION

Globalization means the movement of people and technology across international borders. Economies and human societies across the globe have progressively made closer contacts over many centuries, but the pace of interaction has rapidly increased after 1990. The reason has been attributed to emergence of world trade, liberalization policies, high immigration and emigration of people, development in high-tech transportation and communication. Money, technology and raw materials move ever more swiftly across national borders. Along with products and finances, ideas and cultures circulate more freely. As a result, laws, economies, and social movements are forming at the international level which is otherwise called as globalization. The society, which is the ultimate consumer of any change, faces all pros and cons globalization brings in. It has been agreed that globalization is a phenomenon which has brought fundamental changes within every society (UN,1998) .

Globalization has widely been defined and studied as economic phenomenon. Rather globalization covers social and tactical activities like culture, family institutions, corporate management, information, knowledge and innovation.

Two of the main bases of globalization are information and innovation, and they, in turn, are highly knowledge intensive (Carnoy, 2005).

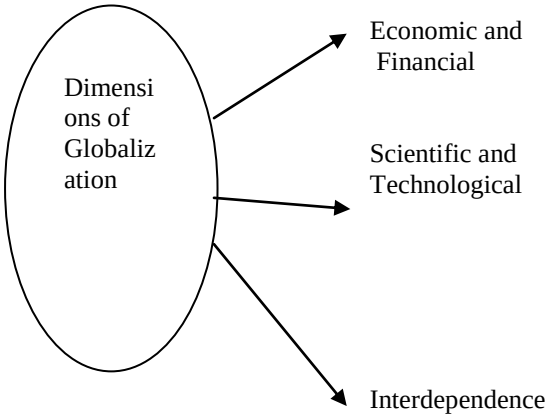

Fig 1: There are three dimensions of globalization

A. Economic and Financial Dimension:

The economy has global economic space at its disposal today in terms of the goods and services markets, the employment market, the capital market etc. All economic theories, company tactics and even economic policies must take into account all the aspects of this evolution in a global sense.

B. Scientific and technological dimension:

The rapid expansion of scientific and technological innovations in the fields of communication, bio technology and microelectronics stimulate the force of globalization technological innovation eases exchanges, speeding up production and allowing the sharing the ideas, goods all sorts and services across the world.

C. Interdependence of the dimensions of globalization:

The main characteristic of globalization is the interdependence of its different dimensions. Technological innovation has eased the increase in capital flows of such an extent that it has created a stock market which functions 24 hours a day by moving from place to place and increasing the volume of capital to such a point that it has weakened economic regions, effecting many countries. The increase in economic flows about all the factors of production has led to a growing interdependence of companies.

Internationalized and fast-growing information industries produce knowledge goods and services. If knowledge is

fundamental to globalization, globalization should also have a profound impact on the transmission of knowledge showing a robust relationship between globalization and education. Furthermore, globalization has intensified interdependence and competition among countries in the world market. As a result domestic developments are not determined entirely by domestic policies and market conditions. It is thus clear that a globalizing economy, while formulating and evaluating its domestic policy cannot afford to ignore the possible actions and reactions of policies and developments in the rest of the world (Balakrishnan, 2004). Higher educational policies are prone to fluctuation stemmed from globalization. Since 1990, the affects and changes on this social component have been greatly observed and noticed across the world (walia, 2011)

II. CHANGING AIMS OF EDUCATION IN THE CONTEXT OF GLOBALIZATION

Education in every country aims to develop people who are capable of, and have the commitment for contributing to the achievement of nation as well as international goals. So following points show the changing aims of education in the context of globalization.

A. Promotion of World Citizenship:

Education promotes co-operation and competition among individuals in changing society. It also transmit global culture from one generation to another which is helpful in developing peace, social harmony, community, family etc. It is helpful in developing secular society which promotes rights irrespective of race, gender, creed which is a base for global civil society.

B. Internationalizing Curriculum and Pedagogy:

The idea of internalization of curriculum can be seen as much more radical, referring to the integration of a global perspective in curriculum design, development and evaluation. What that means is that curriculum content should not arise out of a singular cultural base but should engage critically with the global plurality of the sources of knowledge. It should also address issues of pedagogy and cross cultural understanding.

C. Create Global Learning Networks:

To create global learning network person to person relationships are essential. It will support joint online curriculum planning and teaching among teachers in class rooms in different parts of the world and more extensive student exchange programs.

D. More Liberty for Individual in a Society:

Society must aim to allow every individual to develop freely. The individuals have to find his or her own points of reference in a society of constant change that generates short-lived values. Education must give the people the capacity to acquire the relevant knowledge and interpret new values that will intern guarantee them the ability to stay up to date with the evolution of their environment.

E. Rebuilding the Social Link:

Education should be the catalyst for the desire to live together at the heart of same society and in the same global village through the teaching of universal values such as tolerance in human rights, the diversity of culture, the respect for others and for the environment etc. It should create the right balance among the societies concern and the integrity of the individual.

F. More Equal Development of Society:

Education-as all social institutions must contributes to a more equal development of society where all members have a fair share in the production as well as in consumption. It should contribute to revitalizing a society of citizens who shares the values, issues and challenges of their community, country and the world.

G. A Society of Citizens:

Division in task at different levels and types of education is required to build a society of autonomous, productive, participated and committed citizens. Basic education for all will inevitably be the main concern of all policy makers.

H. An Outdated Traditional Tasks Assignment:

Traditionally we find in practically every system a three-tier structure. This traditional trilogy loses its relevance in a more global world which requires better educated citizens. Although the four pillar of education highlighted by the Delors Commission (‘learning to be, to know, to do, and to live together') apply to all the components of the education system. Different goals should be attached to different levels of education.

I. The Tasks of Basic Education:

The globalized world needs a society made up of citizens capable of acting and thinking autonomously about the rapid social evolution. It is therefore down to basic education to build the citizen at the heart of the "Global Village"

J. Reconciling the Old Dilemma between Terminal and Preparatory Education:

Education should give particular importance to the preparation of individual to take charge of their own lifelong learning. It would contribute to develop certain skills which are needed by the economy and the society i.e., learning to do and learning to learn.

K. Increase Level of Literacy of the World Population:

Increasing level of literacy of the world population so that all people can read, understand and use their own language. Language is only meant to express their view and help developing global integration. (Dhillion, 2011)

L. Promote Cross-Cultural Understanding:

To achieve this aim teacher and student exchange program should be encouraged. Education should foster the formation of international guidelines/standards for various occupations. It should ease the recognition of educational qualification and working experiences of pupils who have moved their place of origin to contribute to other countries.

III. ROLE OF TEACHERS IN HIGHER EDUCATION AND GLOBALIZATION

A. Variety of Roles:

In the education for globalization teacher must be ready to play a variety of roles in the classroom: (i) Educator (ii) Motivator (iii) Guide (iv) Counselor (v) Coach (vi) assimilator (vii) Generator (viii) Facilitator (ix) Communicator of Knowledge.

B. Dedicated to work:

Teachers must be having commitment (i) to the profession (ii) to the learner (iii) to the society (iv) towards basic values (v) to achieve excellence. He must be equipped with the modern competencies to work effectively to cater to the needs of the society to prove himself as a good teacher. He should be dedicated towards his duties.

C. Continuous Learner:

He must continually educate himself learning about new advancement in the education, new technologies and new ways to encourage their students to reach their full potential.

D. Competent and Skilled:

He must be competent and skilled because globalization is heavily rely on new information technologies hence generated additional demands for new teacher skills to be completed with two kind of skills:-

1.) Knowledge centered
2.) Transformation of information

E. National and International Outlook:

He should try to inculcate international understanding in the student. He should be capable of developing the spirit of world citizenship among the students. Sharma (2011)

IV. HIGHER EDUCATION CHALLENGES IN GLOBAL WORLD

Higher education is assuming an upward significance for developing countries, especially countries including India which is experiencing service-led growth. Higher education is all about generating knowledge, encouraging critical thinking and imparting skills relevant to this society and determined by its needs. Education general and higher education in particular, is a highly nation-specific activity, determined by national culture and priorities. The growth of India's higher educational institutions has indeed been outstandingly rapid. But this has been at the price of quality, increased rigidity in coarse design, poor absorption of knowledge, and growing lack of access to laboratory facilities, journals and opportunities for field work, etc.

Global education is an education perspective which arises from the fact that contemporary people live and interact in an increasingly globalized world. This makes it crucial for education to give learners the opportunity and competencies to show and share their own point of view and role within a global, interconnected society, as well as to understand and discuss complex relationships of common social, ecological, political and economic issues, to derive new ways of thinking and acting. However, global education should not be presented as an approach that we may all accept uncritically, since we already know there are dilemmas, tensions, doubts and different perceptions in an education process when dealing with global issues. There are many definitions of global education. Raw and Ready (2005) states:

"Global education is education that opens people eyes and minds to the realities of the globalized world and awakens them to bring about a world of greater justice, equity and Human Rights for all". Global education is understood to encompass Development Education, Human Rights Education, Education for Sustainability, Education for Peace and Conflict Prevention and Intercultural Education; being the global dimension of Education for Citizenship.

Globalization is interdependence. Globalization is neither good nor bad. It is exactly what we do that decides the ethical decisions made in higher education from both a macro and micro approach that decides our course of actions. Just as universities purged their holdings that were found to support transnational crimes, we now must continue to review our policies and implementation practices that impact the global humankind. Multiple voices must be present on our leadership teams to make sure all aspects are critically analyzed.

Globalization is a growing challenge to higher education institutions worldwide since it brings not only opportunities but also concerns to higher institutions and universities. Duderstadt, Taggart and Weber (2008) go so far that they argue that there is a serious imbalance between educational need and educational capacity-many of our universities are in the wrong place, where populations are aging and perhaps even declining rather than young and growing, driving major population migration and all too frequently the clash of cultures and ethnicity . They further argue that current estimates suggest that the number of students seeking university degrees will roughly double over the next two decades to as high as 250 million, with most of this growth in the developing world .And, there is no doubt that higher education institutions, especially research universities, are among the main agents of global convergence. Globalization breaks down barriers and connects institutions across the world making universities in every country visible to one another, easing knowledge flows, values on global learning, and creation of new opportunities for advanced graduates. Regarding the global spread of research universities, Sexton stated, "The evolving global dynamic will brings about the emergence of a set of world centers of intellectual, cultural, and educational strength; and recognition that researches universities will be key to the "idea capitals"

V. OBJECTIVES OF HIGHER EDUCATION

- To develop human values, World culture and society.
- To develop international understanding
- To develop feelings of world citizenship to acquaint the student with latest and new area of knowledge.

- To work out new methodologies for imparting instructions in higher education.
- To evolve and use new tactics and techniques of instructions to provide higher education and new generating new disciplines.
- To discover new attitudes regarding maintaining disciplines for acquisition of education.
- h. To exchange at world level the knowledge of science, technology and economic development of all the countries and to draw the benefit of the experience of others.

VI. CONCLUSION

For higher education faculty and administrators, our university policies can greatly impact our international and national students to help them explore innovative perspectives to educate humankind for future global citizenship. Education toward a future where global cooperation is the social norm and the notion of universal citizenship is the foundation of a globalized world. Universities, though pressured by market forces can and must lead in framing education policies to make sure that the common good of the world is the main focus.The objective of education is no longer simply to convey a body of knowledge, but to teach how to learn, problem-solving and synthesize the old with the new. The emphasis is less on community and equity, and rather more on individual advancement and the need to satisfy investors and influential consumers. Education has come to resemble a private, rather than public, good. Only focused aware actions by those in higher education can ensure the role of universities in the promise of a better life. Thus, there is an urgent need for setting up new agendas and curricula issues to address the challenges of higher education in a globalized world. Note that global processes are putting immense pressure on educational practices world-wide. Spring (2009) not only underscores the emergence of the global superstructures and multi-national corporations in the education sectors but also reminds us that we cannot simply ignore global processes in the evaluations of educational (including higher education) policies, practices, discourses, and curriculum in local contexts. Higher education institutions should consider in their tactical planning the world-wide forces from economic and social perspectives.

First, the challenge that most global educators are facing is to design visionary and new agendas to cultivate a re-vision of humankind with the view of generating the learners' intellect necessary to cope with the complexity of globalization as an evolving new reality. The emergence of globalization is making educators' task more challenging than ever it was.

Second, it must be the utmost priority of the higher institutes to cater the needs and demands of diverse population of the global world. Third, higher education institutions need to look for all possible avenues and to foster their quality of education.

Finally, in this evolving global context, higher education institutions need to operate creatively out-of-the-box attitudes and prepare themselves for new challenges of the 21st century and establish more networking, collaboration, cooperation and more importantly to embrace developing multidimensional scholarship.

REFERNCES

[1.] Dhillon, J. S. (2011), Changing Aims in the Context of Globalization. Education and Development.

[2.] Sharma K, Khanna R. K.,(2011), Globalization, Contemporary, Issues and Concerns in Secondary Education .

[3.] Walia, J. S. (2011), Education for Globalization. Philosophical and Sociological basis of Education (601-612)

[4.] Spring, H. J. (2009). *Globalization of education: An introduction.* New York: Routledge.

[5.] Duderstadt, J. Taggart, J. & Weber, L. (Eds.) (2008). The globalization of higher education. In Weber, L & H

[6.] Carnoy, M. (2005) Globalization, Education Trends and the Open Society, OSI Education

Conference 2005: .Education and Open Society: A Critical Look at New Perspectives and Demand, Stanford University, Stanford.

[7.] Raw, V. K. and Ready, R. S. (2005), Education and Development, New Delhi, Common Wealth Publisher,

[8.] Balakrishnan, C. (2004) Impact of Globalization on Developing Countries and India,

http://economics.about.com/od/globalizationtrade/I/aaglobalization.htm

[9.] United Nations (1998) Statement on Globalization, UN Committee on Economic, Social and Cultural Rights, Global Policy Forum, May 1998, United Nations, New York.

Integration of ICT in Education: Challenges and Issues

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***Abstract:*-These days the newer and more powerful technologies are being introduced to shape the future of education for delivery and managing extensive amount of information. Thus the development of technology and worldwide networking together with innovative pedagogical changes transformed conventional education to a new pedagogical paradigm namely IT supported and ICT enhanced learning. A teacher is a true nation builder and if he does justice to his job, then only can the education system be effective and the implementation of ICT can be a boon to it. Since ICT plays a vital role in the 21st century, it can only guarantee any nation's success.**

***Keywords*-ICT,Education, Pedagogical Issues, Teaching-Learning**.

I. INTRODUCTION

Advances in information and communication Technologies (ICTs) during the last 20 years in India have had a significant social and economic impact in general and educational domain in particular. ICT have potentially revolutionized the human thought, feeling and behaviour by enabling any person anywhere in the world to exchange visual and aural experiences with any other person at any other place in the world. ICT is not confined to production of an audio, video or any form of media presentation. It is a holistic approach to the design, development, implementation, management and evaluation of learning environment which engage learners constructively. It refers to the process in which learning problems are analyzed and solutions are thought of through application of principles of communication, learning, instructional design and mediated pedagogy.

II. ROLE OF TECHNOLOGY ENABLED EDUCATION

Several studies argue that the use of new technologies in the classroom is essential for providing opportunities for students to learn to operate in an information age. It is evident, as Yelland (2001) argued that traditional educational environments do not seem to be suitable for preparing learners to function or be productive in the workplaces of today's society. She claimed that organisations that do not incorporate the use of new technologies in schools cannot seriously claim to prepare their students for life in the twenty-first century. Iding, Crosby and Speitel (2002): Shamatha, Peressini and Meymaris (2004): Romeo (2006): Grabe and Grabe (2007) pointed out that technologies enabled classroom produces following observable changes: Facilitating learning for children who have different learning styles and abilities, including slow learners, the socially disadvantaged, the mentally and physically handicapped, the talented, and those living in remote rural areas; making learning more effective, involving more senses in a multimedia context and more connections in a hypermedia context.

Ultimately the education will become highly interactive, engaging the student every 20 seconds or so far a response, much in contrast to present-day passive lecture methods; allow students to move independently between learning areas as necessary, managed by technology; give opportunity to students to develop valuable skills such as team work, self-organization and provide broader international context for approaching problems as well as being more sensitive response to local needs.

III. NATIONAL POLICY ON ICT IN SCHOOL EDUCATION (DRAFT): 2009

The mission of ICT Policy in School Education is to devise, catalyse, support and sustain ICT and ICT enabled activities and process in order to improve access, quality and efficiency in the school system. The policy envisages three stages of ICT implementation at the school level-ICT literary and Competency enhancement, ICT enabled teaching-learning and introduction of ICT related elective subjects at senior secondary level across the country. There are two types of infrastructure required to implement the policy such as:

A. Core ICT infrastructure-

Computer, printer, scanner, projector, digital camera, audio recorders and each school will be equipped with at least one computer Laboratory with at least 10 network computers to begin with; at least one classroom will be equipped with appropriate audio visual facilities to support an ICT enabled teaching and learning; computers will be provided at the library, teachers common room and the school head office etc.

B. Enabling Infrastructure –

The enabling infrastructures are required for the maintenance and smooth functioning of the core ICT infrastructure such as supply of electricity, sufficient power backup, large room seize and other electronic apparatus for safe use of ICT.

IV. CHALLENGES

An overview of the ICT policy initiatives of Government of India for last two decades shows that India has made substantial improvement to integrate ICT in education. All stake holders of education such as learners, teachers, community, educational administrators, policy makers and so on should be fully aware of the policy parameters so that they can use the policy as the mechanism to systematize ICT enabled education. However, having much of the policy initiatives at governmental and non-governmental level, our educational institutions still encounter numerous challenges and issues.

V. INFRASTRUCTURE RELATED CHALLENGES

A country's educational technology infrastructure is based on top of the national telecommunications and information infrastructure. Several studies conducted on utilization of educational radio and television revealed the poor utilization of school broadcast programmes (Shukla, 1984; CIET, 1975; Biswal, 1980; Nagaraju, 1982; Goel, 1982; Muhkapadya, 1993; Sesharatnam, 1994; Basu, 1996; CIET, 2004; Rout, 2007). It may be the result of one of a number of factors such as poor organisation of resources, poor quality hardware, inappropriate software, or lack of personal access for teachers. Similarly, Cox et al. (1999) found that the majority of teachers agreed that insufficient ICT resources in the school and insufficient time to review software prevent teachers using ICT. According to Osborne and Hennessy (2003), the limitations on access to hardware and software resources influenced teachers' motivation to use ICT in the classroom.

VI. TEACHER RELATED CHALLENGES

A worldwide survey conducted by Pelgrum (2001) of nationally representative samples of schools from 26 countries, found that teachers ' lack of knowledge and skills is a serious obstacle to using ICT in primary and secondary schools. Further teacher's attitude, motivation, anxiety over being replaced by technology and inherited resistance to use technologies are the significant causes of non utilization of technologies for teaching and learning process. (Phutela, 1994; Rout, 2007). At a broader level, Becta (2004) argued that resistance to a change is an important barrier to teachers' use of new technologies in education. This can be alleviated only if teachers have a keen understanding and appreciation of their changing role.

VII. TECHNICAL SUPPORT RELATED CHALLENGES

Without both good technical support in the classroom and whole-school resources, teachers cannot be expected to overcome the barriers preventing them from using ICT. Pelgrum (2001) found that in the view of primary and secondary teachers, one of the top barriers to ICT use in education was lack of technical assistance. Technical support requirements of an institution depend ultimately on what and how technology is deployed and used, general competencies that the required would be in the installation, operation, and maintenance of technical equipment (including software), network administration, and network security. Without on-site technical support, much time and money may be lost due to technical breakdowns.

VIII. CONCLUSION

Indian history portrays magnificent portraits of its Gurus, known for their sincerity and devotion to their duty towards the society in general and their pupil in particular. Since, the times have changed the process and techniques of teaching and learning need the inculcation of new strategies and new gadgets to provide quality to these aspects. ICT technology is quite affordable, accessible and relevant in improvisation of educational content and its delivery. The only need is for the teachers to realize the role they are expected to play in providing better leaders for the progress of the nation. A teacher is a true nation builder and if he does justice to his job, then only can the education system be effective and the implementation of ICT can be a boon to it. Since ICT plays a vital role in the 21st century, it can only guarantee any nation's success.It may be the result of one of a number of factors such as poor organisation of resources, poor quality hardware, inappropriate software, or lack of personal access for teachers. Similarly, Cox et al. (1999) found that the majority of teachers agreed that insufficient ICT resources in the school and insufficient time to review software prevent teachers using ICT. According to Osborne and Hennessy (2003), the limitations on access to hardware and software resources influenced teachers' motivation to use ICT in the classroom.

REFERENCES

[1]. CIET (2004). An Impact Evaluation Study of the Centrally sponsored Educational Technology Scheme of GOI.NCERT, New Delhi (mimeo).

[2]. Cox, M., Preston, C., & Cox, K. (1996b). What motivates teachers to use ICT? Paper presented at the British Educational Research Association Annual Conference. Retrieved August 2, 2008, from http://ledsac.uk./educol/documents/00001329.htm.

[3]. Biswal, 1980; Nagaraju, 1982; Goel, 1982; Muhkapadya, 1993; Sesharatnam, 1994; Basu, 1996; CIET, 2004; Rout, 2007).

Impact of Globalization on Indian Education System

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***Abstract*-The term "Globalization" means integration of economies and societies through cross country flows of information, ideas, technologies, goods, services, capital, finance and people. Cross-border integration is multi-dimensional including cultural, social, economic and political dimensions. The emerging digitization concept has altered this perception. The ascent of information and communication technology has given rise to e-commerce, e-banking, e-learning, e-medicine and e-governance. So, it is argued that government finds it increasingly difficult to cope up with technology-driven activities. Because of that Nowadays Education has turned out to be a commodity of international trade. It is no more a public good on domestic scale, but a private good on global scale. Globalization brings education to the front lines. In the prevailing discourse, education is expected to be the major tool for incorporation into the 'knowledge society' and the technological economy. In this paper we are going to see the impact of globalization on knowledge, education systems, and equity policies.**

Keywords: Globalization, Indian Education, Educational Implications and Challenges.

I. INTRODUCTION

"Globalization" is a historical process, the result of human innovations and technological progress. It refers to the increasing integration of economies around the world, particularly through trade and finance flows. Globalization is in fact, a combination of the free exchange of goods, services and material. The continuous modernization of international exchange process during the 20th century and it's ratification through international agreements have maintained and paced an increasing globalization of our society. Bitter experiences from East India Companies & British rule makes Indian little bit cautious for adventures of globalization. This has been the root cause for delay in liberalization in India. (Walia, 2008)

Globalization has been a historical process. During the Pre-World War-I period of 1870 to 1914, there was rapid integration of the economies in terms of trade flows, movement of capital and migration of people. The growth of globalization was mainly led by the technological forces in the fields of transport and communication. Indeed there were no passports and visa requirements and very few non-tariff barriers and restrictions on fund flows. Globalization, process was slow between the First and the Second World War. After World War II, all the leading countries resolved not to repeat the mistakes they had committed previously by opting for isolation.

II. IMPACT OF GLOBALIZATION ON INDIAN EDUCATION

The principal objective of education has been the development of the Over thousands of years, globalization has contributed to the progress of the world through travel, trade, migration, spread of cultural influences, and dissemination of knowledge and understanding. These global interrelations have often been very productive in the advancement of different countries. Globalization is viewed by somebody as westernization. But it is not so. The decimal system emerged and became well developed in India between the second and sixth centuries; it was used by Arab mathematicians soon thereafter. These mathematical innovations reached Europe mainly in the last quarter of the tenth century and began having an impact in the early years of the last millennium, playing an important part in the scientific revolution that helped to transform Europe. The agents of globalization are neither European nor exclusively Western, nor are they necessarily linked to Western dominance.

III. INDIAN EDUCATION SYSTEM

Education is important not only for the full development of one's personality, but also for the sustained growth of the nation. Education is an important investment in building human capital that is a driver for technological innovation and economic growth. It is only through improving the educational status of a society that the multi-faceted development of its people can be ensured Basically Indian Education system is composed of three components and they are Primary education, Secondary education and Higher education. Today, in the age of privatization, globalization and liberalization, India is exposed to the world in all spheres. In the present competitive world, expansion, excellence and inclusion are the three challenges of Indian education system. The age old system of education has to be reformed. Practical knowledge should be given more priority than theoretical knowledge. Indian education has its own history of development. In the earlier times, Gurukulas dominated the society, which emphasized the traditional and cultural education, which had its own restriction. McCauley's education policy is worthy of note. Scientific and technological education gained more importance than traditional and cultural education in this era. But in the post-independence period, our constitution made the education a fundamental right and enacted a law for compulsory education up to 14 years. Today higher education gives more importance to survival in this competitive world. (Sodhi & Suri, 2008)

IV. EDUCATIONAL IMPLICATIONS OF GLOBALIZATION

Globalization has led to a changed scenario on the educational whole individual. The minimum level of education that was necessary to achieve this goal in the agrarian society was basic or primary and in the industrial age, secondary. In the present borderless information society, education needs to be able to respond to additional demands of a rapidly globalizing world by raising awareness of environment, peace, cultural and social diversity, increased competitiveness, and the concept of a global village. Such education is to a knowledge or information society what secondary education was to an industrial economy. Education prepares the individual to connect - and live in harmony - with the environment around him. Globalization has changed the size, nature and quality of that environment. The challenge for higher education, therefore, is to reform, create and develop systems that prepare the individual to work in a borderless economy and live in a global society. In other words, our educational institutions need to produce global citizens. Gloabalization has transformed the world into a global village. Internationalization of education involves a complex of global processes concerning conceptions of knowledge, economic exchange, the change in nature of work and labour requirements and cultural diversity. It entails a complex interplay between history, politics, knowledge development and its use as well as teaching and learning. Internationalized curriculum involves the development of new skills, attitudes and knowledge among students and teachers alike. To create global learning networks, person to person relationships are essential. It is through education that the desire and the benefits of living together is learned at school and non-formal environment. Globalization also entails an increase in the tasks of basic education. The globalized world needs a society that is made up of citizens capable of acting and thinking autonomously about the rapid social evolution. (Dhillon, 2012). Education has always encouraged and represents openness, inquiry, diversity, research and limitless learning. The education in India is at a crossroads. Its liberal and secular character and content carefully nourished during the last fifty years.

A. Trends In Global Education Which Affects the Quality of Education Are:-

1) Fragmentation and compartmentalization of education
2) Alienation of knowledge from social ethos
3) Restriction of access through commercialization, privatization and competitive screening
4) Parallelization or hierarchical layering of school system

V. POSITIVE EFFECT OF GLOBALISATION OF EDUCATION IN INDIA

- Need based education
- Expansion of Education facilities
- Broadening of mental horizon
- Sharing of knowledge
- Innovations and instructional strategies
- Improvement in quality of Education
- Cultural Closeness
- International understanding

Globalization Poses Challenges Like: Faculty Shortage, Quality of education, Incentive structures,Sub-Standard Institutional qualities of Educational opportunities.

As the world moves on to forging an information society founded on education, India cannot remain behind as a non-competitive knowledge economy. India has to create an environment that does not produce industrial workers and labourers but fosters knowledge front:

Globalization And Aims of Education

a) To acquaint the students with new areas of knowledge.
b) To evolve and use new strategies and techniques of instruction.
c) To inculcate scientific temper among students.
d) To cultivate positive attitude towards learning.
e) To develop international understanding.

Globalization And Curriculum

a) Network and communications
b) Space technologies
c) Social and cultural studies.

Globalization And Methods of Teaching:

a) Learning through websites.
b) Project Work.
c) Experimental method.

Globalization And Discipline:

a) Liberation in atmosphere.
b) Encouragement of self discipline among students.

Globalization And Evaluation:

a) Formative evaluation.
b) Summative evaluation.
c) Institutional evaluation. (Dhillon, Sharma & Khanna, 2011)

VI. INDIAN EDUCATION: GAINT LEAP TO GLOBALIZATION

So what are we really looking at? – An Indian education system that needs a lot of improvement, and needs it fast. There is no doubt that the best of university education in India is comparable to the best anywhere in the world. However it is also well known that these form the cream and the rest of the education system in India is a far cry, even when it comes to the most basic standards. The great divide between the demand and supply only makes things worse.

And what are we aiming at? – Better quality and globalization, with the hope that just like it has worked in some of the other industries; it will work here as well. (Bhatia & Narang, 2002)

VII. CHALLENGES POSED BY GLOBALIZATION ON INDIAN EDUCATION

In the world of unequal opportunities, idea and knowledge are the emerging factors that decide development or lack of it, education cannot be left entirely to market forces.

Further, market needs should be kept in view while developing the curriculum. The element of productivity orientation should guide the formulation of curriculum framework. It is also necessary that while deciding about the fee structure and other student levies, the tendency towards commercialization of education should be guarded against.

India should decide about the nature and extent of globalization that can be constructively introduced in their socio-economic and educational systems. While it is difficult to resist the temptation of falling in line with the international community, it is necessary that while doing so, the paramountcy of national workers. Such people must be at the cutting edge of knowledge workers and, in turn, placing India in the vanguard in the information age.

This is not to argue that the opportunities opened up by information technology are to be shunned, but to suggest its creative incorporation in the system of education. At the same time it is necessary to recognize the fact that the educational conditions created by information technology are pregnant with the possibilities of intellectual colonization. The breaking of the geographical barriers and communication restrictions are indeed healthy attributes of knowledge dissemination, but it cannot be divorced from the economic and political contexts of knowledge production

Indian education system is one of the most tightly controlled in the world. The government regulates who you can teach, what you can teach them and what you can charge them. It also has huge regulatory bottlenecks. There are considerable entry barriers: Universities can be set up only through acts of legislation, approval procedures for starting new courses are cumbersome, syllabi revision is slow, and accreditation systems are extremely weak and arbitrary. The regulators permit relatively little autonomy for institutions and variation amongst them.

The shortage of quality institutions is a product of India's regulatory structures. Increased public investment that the government has promised is absolutely necessary to increase access quotas that has became a symbol of the state's power over Indian education: its propensity to hoist its own purposes upon academic institutions regardless of their impact on the quality of these institutions. Globalization requires two contradictory transformations in the state: On the one hand, successful globalization requires that the state invest heavily in increasing access to education. But in higher education, globalization also requires the state to respect the autonomy of institutions so that a diversity of experiments can find expression, so that institutions have the flexibility to do what it takes to retain talent in a globalized world and, above all, respond quickly to growing demand. Globalization demands a paradigm shift in the regulation of higher education.

VIII. CONCLUSION

The education system must ensure that students gain not just depth of knowledge in these subjects but a holistic perception and skills that will equip them to face the real world. At every stage, there must be opportunities to expand their boundaries, platforms for collaboration and learning and recognition for those who strive to excel. interests should be kept in view. This is more so in the field of education, which is intimately concerned with the development of human capital. Ultimately, any hasty involvement in the global educational market can end up in harming the vital interests of students, and particularly of poor and downtrodden for generations to come. Proper regulatory mechanisms to be established to ensure that the universities, in particular the privately funded ones, do not end up exploiting students.

Finally, it is about always trying to push the bar a little more, constantly innovating and never standing still. If the educational institutions believe in a value based education system, then their students will excel in all walks of life. At schools and colleges that believe in educational excellence, student enthusiasm and feedback is an important driver of change and evaluation. They create a vibrant, student community that continually innovative and excel in all spheres from academics to arts and sports. Globalization is a never ending process and Developing countries like India should utilize this properly to improve their national standard through their education system.

REFERENCES

[1]. Walia, J.S. (2008). Education for Globalization, Philosophical and Sociological Bases of Education.

[2]. Sodhi, T.S. & Suri, A. (2008). Education, Philosophical and Sociological Bases of Education.

[3]. Dhillon, J.S. (2012). Changing Aims of Education in the Context of Globalization, Education and Development.

[4]. Sharma, K. , Khanna, R.K. & Dhillon, K.K. (2011). Globalization, Contemporary Issues and concerns in Secondary Education.

[5]. Bhatia, K.K. & Narang, C.L. (2002). Aims of Education, Philosophical and Sociological Bases of Education.

ICT and Education

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Abstract **- In present era, technology is playing an important role in modernizing global education systems. The future classrooms integrated with information and communication technology will be synergistic, informative, and interactive and personalized to the needs of the students. With the assistance of technology, teachers and students can both improve their learning and refine skills necessary for tomorrow. But still there are some issues in adoption and pedagogical use of information and communication technology in teaching learning process. The purpose of this paper is to briefly describe the advantages of different technological tools in teaching learning process and to highlight certain issues in their use.**

Keywords - Information and Communication Technology; Education; Teacher; Learner.

I. INTRODUCTION

One of the pressing issues in education today is the integration of information technology into instruction. Today students of all ages need to learn about technology and learn with technology. Both the education community and the broader public community have long held great expectations for the role of technology in teaching. Technology has made a big impact in the classroom. As technology becomes more readily available in schools, the role of teacher changes to facilitator "through the thoughtful integration of student centered methodologies and computer based technology". As a facilitator of knowledge, teacher can teach students to become active 21st century learner and to "seek, find and assimilate data" from various sources. As an information rich society, schooling does not stop at the classroom or even the college lecture hall. Today's society continues to educate themselves beyond the classroom walls. By using technology as a teaching learning tool, research suggests that students will perform better, teacher's satisfaction and instruction will improve and our students will be competitive in a global workforce.

Information and Communication Technologies is defined as a *"Diverse set of Technological tools and resources used to communicate, and to create, disseminate, store and manage information"* (Blurton, 2010). The new digital ICT is not single technology but combination of hardware, software, multimedia, and delivery systems. These technologies include computers, internet, broadcasting technologies (radio and television), and telephony. The use of technology in education has brought drastic change in the concept of education. The innovation lies not in the introduction and use of ICT, but in its role as a contributor towards a student-centered form of teaching and learning. It has made teaching learning process very interesting and easy both for the teachers as well as the learners. ICT in education has the potential to bring about influential changes in ways of teaching. ICTs need to be seen as "an essential aspect of teaching's cultural toolkit in the twenty-first century, affording new and transformative models of development that extend the nature and reach of teacher learning wherever it takes place" (Leach, 2005).

II. INTEGRATION OF ICT IN EDUCATION

The integration of information technology into the teaching and learning strategy can only be successful if it is carefully planned, managed and supported. There are three phases in the successful integration of ICT into teaching and learning. The phase one consists of the establishment of institution-wide technological infrastructure and the bottom-up institution-wide adoption of ICT in teaching and learning activities. Second phase is the pedagogical use of the infrastructure and the effective integration of ICT into teaching and learning activities to improve learning. Third phase is the strategic use of ICT with a view to the different target groups of higher education. The goal in this stage is to integrate the different elements of the technological enterprise into a "seamless educational enterprise" (Collis and Vander Wende 2002).

III. ADVANTAGES OF USING ICT IN TEACHING AND LEARNING

ICT has become a very important part of the educational delivery, acquisition and absorption of knowledge. ICT is changing processes of teaching and learning by adding elements of vitality to learning environments. New technologies make it possible for complicated collaborative activities of teaching and learning by dividing it in space and time, with seamless connectivity between them. Due to its capability to offer anytime and anywhere, access to remote learning resources, ICT is a potentially powerful tool for offering educational opportunities.

Kler (2014) in a study explained benefits of using ICT in teaching learning process as under:

A. To motivate and engage learners:

Every individual learner has different needs. ICT fulfils the needs of individual learner. It helps them in their learning by externally motivating them to learn and in this way the learners learn better and in a more effective manner.

B. Assessment of learners:

ICT provides assessment of the learner side by side. It gives them feedback through feedback software which tells

them about their mistakes side by side during the learning process.

C. Effective presentation:

The learning material can be presented more effectively through ICT. It makes the material more presentable and hence enhances the interest of the learner and thus results in good learning. Also it saves time of the teacher as well as of the learner.

D. Communication channel between teacher and taught:

Use of ICT reduces the distance between the teachers and students. Distance never remains an issue as the learners and educators can share their views, ideas through emails, discussion groups and chat rooms.

E. Flexibility in teaching learning:

Use and selection of ICT is flexible and it can be adjusted according to the ages and abilities of the learners and also according to the skills and competence of the educator, which makes teaching learning process effective.

F. ICT opens up new opportunities in teaching and learning:

ICT provides an opportunity to the educators to develop new ways and methods for making learning more effective and provides the educators an opportunity to explore and learn new skills and polish their career more.

G. Autonomous learning:

The use of ICT will change the role of the teacher as well as the learner to a great extent. It develops the habit of self-study in students. ICT will provide students a wide choice regarding how they approach their study, without the direction of the teacher and hence minimal teacher management.

IV. TYPES OF TECHNOLOGIES TO BE USED IN FUTURE CLASSROOM

There are many new technologies being used in classrooms today: social networking, online teaching, class blogs and wikis, podcasting, interactive whiteboards, and mobile devices (Cuttance, 2001). We can benefit from the new technologies being developed today.

The use of word, Excel, Access, PowerPoint, Outlook and the Apple equivalent can all be implemented to enhance the learning of the content covered in class. Students use computers to complete their assignments, do their research, and connect with their classmates. Teacher use computers to keep track of their students, check on their work, and make grading easier and more transparent. The specific subject software such as Data Logging for Science, Mathematics software games, GIS for Geography, image manipulation software for Visual Art, special programs for Languages to name a few.

The invention of the internet only made the explosion of information even faster. Everything happens in real-time. The internet is the new consciousness in today's society. Now we can blog or tweet about anything and have it spread like wildfire in mere seconds. Blogs are like online journals with posts that date based, archived and enable a degree of interaction through the use of comments, pingbacks and trackbacks.

Open source software has enabled the development of Learning Management Systems (LMS) and content management systems such a Module which have capacity for forums, instant messaging and online submission of work and the marking of such work. There is a lot of potential to assist teachers with the management of their own work by using such a system.

A lot of people have heard of Wikipedia and increasingly students and teachers are aware that you can create your own and use them for teaching and learning. A wiki can be set up where groups of students can add information on a topic and different students writing their own chapter.

The use of audio files is not new but with the development of digital recorders, iPods and mp3 players it has become easier to create, stream and listen to audio files. Podcasts are the broadcasting of audio files using software supported by RSS feeds. When the audios have been made they are broadcasted by RSS feeds. Often a web page is associated with the podcasts and you can get them manually.

V. CONCERNS TEACHERS HAVE ABOUT THE USE OF TECHNOLOGY

There are various concerns and problems of integrating the information and communication technology with teaching learning process. Several concerns emerged from the interviews of teachers in a study by Scott (2002).

The problem most often noted by teachers was the maintenance of the equipment needed to operate a technologically enhanced school. Another frequently mentioned problem was the disparities between students who have access to computers at home and those who do not. Teachers provided evidence of the importance of the efforts in-school to promote professional development in integrating information technology into classroom teaching. The professional development days held and the flexible mentor type training available at the school was viewed as being very important by the teachers interviewed.

Teachers recognized that sometimes students are overwhelmed with the amount of information available and with the task of filtering through the information. Teachers have a hard time keeping up with the pace of change. One teacher raised the problem of increased plagiarism because technology was making it easy to reproduce and revise someone else's work.

Another emerging issue is the possible loss of control of the education process to business partners. Balancing the interests of these partners and that of the students might be an increasingly challenging role for administrators as business involvement in education becomes more common. Teachers stated that information technology was placing more demands on their time. Teachers noted that extra time was needed to learn new software and also to create new

things for teaching because greater expectations were being placed on them.

VI. CONCLUSION

There is accelerating natural evolution of ICT technologies. And all this has positively affected the learning of the students as the students show great enthusiasm in learning through ICT. But there is need to motivate teachers to use ICT in teaching learning process. The barriers can be checked through certain implications by the school and the teachers for making ICT a success in the teaching learning process.

REFERENCES

[1] B.Collis and M. Van der Wende, "Models of technology and Change in higher education : An international comparative survey on the current and future use of ICT in Higher Education", Twente : Center for Higher Education Policy Studies, 2002.http://www.utwente.nl/c.cumenten/ictrapport.pdf Retrieved on March, 2015

[2] P.Cuttance, "Information and Communication Technologies", School Innovation: Pathway to the Knowledge Society, Department of Education, Training and Youth Affairs, 2001, pp.73-100.

[3] S. Kler, "ICT Integration in teaching and learning: Empowerment of education with technology", Issues and Ideas in Education, Vol. 2(2) pp. 255–271, 2014.

[4] J. Leach, "Do new information and communication technologies have a role to play in achieving quality professional development for teachers in the global south?", Curriculum Journal, Vol.16(3), pp. 293-329, 2005.

[5] C. Blurton, "New Directions of ICT-Use in Education", UNESCO World Communication and Information Report, 1999.http://www.unesco.org /education/educprog/lwf/dl/edict.pdf Retrieved on April, 2010.

[6] R.Scott, "The integration of ICT into classroom teaching", Research In Ontario Secondary Schools, Vol.7(1), 2002.

Social Networking Sites and Its Impact on Education

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***Abstract*- Education is liberating force that takes individual from darkness to enlightenment. It is also a democratizing force, cutting across the barriers of caste and class, smoothening out inequalities imposed by birth and other circum stances. Social networking websites are very helpful in 21st century. These enables individuals and society to act, think, and relate to each other. Social networking has multiple implications in the field of education and these sites have deep impact on students, educators, administrators, and parents. SNS are web-based services that allow individuals to create a public profile, to create a list of users with whom to share connections and view and cross the connections within the system. Different social networking sites fill one or more niches to promote connection. For example, LinkedIn In this article, I have tried to discuss impact of SNS in education, its benefits and challenges. I have tried to find utilization of SNS in educational field especially in students' academic and personal development by analyzing its various aspects.**

KeyWords:- SNS- social networking service or social networking site, FB-Face Book

I. INTRODUCTION

The digital world is a marine of networks. It flows in all directions. Networks are the crucial structures of 21st centaury including social, political and economic and particularly information and knowledge network. A **SNS** , is a platform to build social networks or social relations among people who share interests, activities, backgrounds or real-life connections. With SNS, anyone can make social links by web based services and a variety of additional services through internet or intranet. E.g. e-mail and instant messaging. SNS are varied and they exchange new information and communication tools such as mobile connectivity, photo/video/sharing and blogging. In broader sense, online community services are sometimes considered a social network service. The main types of social networking services are:-usually with self-description pages and a recommendation system linked to trust. When **A teacher says, "I can accept my good students those who behave well and do good work, but I can't accept those who do not work, who have the wrong attitude and who make trouble."** This type of challenge can be handled with the help of SNS across the world. Popular SNS are- American-based services such as Facebook, Google+, LinkedIn, Instagram, Reddit, Pinterest, Vine and Twitter used widely worldwide; Nexopia in Canada, Badoo, Bebo, Vkontakte (Russia), Hyves (The Netherlands), Soup (Austria), Glocals in Switzerland, Uplike (France), Tagged, Tuenti (mostly in Spain), Myspace, Xanga and XINGin parts of Europe, Hi5 and Orkut in South America and Central America and Wretch in Asia and the Pacific Islands and many more sites can be considered.

II. RELATED SURVEYS

Various surveys are conducted in world to study use of SNS, in which October 2011 records about 250 million people log in to FB Every day. Twitter has 15 million regular users; they send 65 million messages each day. Every day, more than 90 percent of college students visit a social networking site. People watch more than 2 billion video clips on YouTube daily. Every hour, users upload an average of 24 hours of video content. Broadly used social media in education includes FB, Twitter, Google+ and LinkedIn. From a 61% usage in 2008-2009, it went up to 87% in 2009-2010 and reached 98% in 2010-2011, thus proving to be the most loved of al in messaging and sharing. Twitter has shown tremendous increase in its usage. Educational institutes have been majorly using micro blogging to update students and teachers with latest announcements. From 0% use in 2008-2009, the growth graph marked 59% in 2009-2010 and finally 84% in 2010-2011.LinkedIn, best used by admission professionals began with only 0% usage in 2008-2009, covered 16% in 2009-2010 and touched 47% in 2010-2011. The popularity of Blogging has remained constant over the years. It has had 48%, 46% and 47% usage in the years 2008-2009, 2009-2010 and 2010-2011 respectively. The Digital Youth Project study, conducted at the University of Southern California and the University of California at Berkeley, found that "that the digital world is creating new opportunities for young people to grapple with social norms, explore interests, develop technical skills and work on new forms of self-expression."

III. WHY SNS?

It is needed because of-

a) Innovation in its concept it is central concern of many educators, teachers and parents.

b) Due to flexibility and short term approach it has fulfilled demands of every person in any sphere.

IV. BENEFITS OF SNS IN EDUCATION

SNS is very beneficial for - Learner, Teacher, Parents and Administrators in any education system in following way-

a) Helpful in classroom work- Through Twitter, sharing of important announcements and discussions to keep members updated. It provides Hub for links to important resources/articles/information like blogs and other networking sites.

b) Pride for any Institution- SNS encourage participants, development of a learning spirit, motivation to students in their interactions via social media, institutes approach potential students via their online profiles.

c) Helpful in professional development-Websites provide information about one's own achievements and provide opportunities for professional development- .

d) Stay Connected – Active connection between students, professionals is possible, and cost free promotion can be done on virtual groups, pages and blogs, also allowing feedback and further interaction at the same time. Institute can even interact with parents and keep each other informed. Alumni groups can maintain connection.

e) Helpful for citizens - Maintaining contact with friends in different cities, states, and even in different countries, finding old friends and former classmates, debating or advocating for political, environmental, ethical, and religious issues.

f) Platform for communication- learning and collaborations, personally, social media have helped me a lot in both my learning and teaching experiences as i do share ideas on topics of interest with people of like passions across the globe. Example- a friend i have never met in person who is based in Japan taught me how to develop and package mobile apps through a popular social network, and being a teacher I can assist most of my students with their home work through social media, in as much as we do many constructive activities using social media.

g) Increased Awareness - Individuals can develop increased levels of awareness through SNS. This has created interaction environment where students can become more globally knowledgeable, tech-savvy, and even more self aware.

h) Useful in libraries**:** - For latest information, one can access library and latest information can be stored while sitting in. The use of online social networks by school libraries is also increasingly prevalent and they are being used to communicate with potential library users. Even extension services are provided by individual school libraries through SNS.

i) Reducing burden of Text Books:- A large amount of data is available in forms of blogs, social sites that can reduce burden of students. A survey conducted on the topic "Challenges and Opportunities for the Open Education Movement: A Connexions Case Study, Baraniuk (2008)" highlights the opportunities presented by the Connexions website. This site allows individuals to upload self-produced modules of information, and allows the public to access these modules. Connexions is a pertinent example of both social networking and its final product- community generated information. The site increases a learner's access to valuable knowledge, knowledge that may have otherwise been inaccessible to them.

j) Sharing of Curriculum - Students, teachers are increasingly using social networks to supplement teaching and learning in traditional classroom environments. it can provide new opportunities for enriching existing curriculum through creative, authentic and flexible, non-linear learning experiences.

k) Helpful in Conducting Research: - A researcher can get reliable information through SNS. Publication of research findings on established websites and by making blogs information can be disseminated. Related survey can be assessed. Tools and findings can be successfully used

V. CHALLENGES OF SNS

Undoubdtly, social networking sites are valid resources for students, educators and administrators due to their features and advanced technology. But it comes as a mixed blessing because of the challenges that social networking sites raise.

What are the Biggest Social Media Challenges?
Safety and security of the students = 39%
Trusting the students = 25%
Teachers need professional development/training around social media = 25%
Other = 11% (A survey conducted by Google)

a) Worries of Parents - Parents are worried about health challenge, proper age of child, bad effect of SNs on mind and Psychology of their children. Tina Barseghian in a Mind Shift blog post about children and media have given opinion- we've all heard the heart-wrenching news stories of adolescents being bullied online by their peers, sometimes with tragic results. She writes, "Parents worry about what's age-appropriate, what should be kept private, and exposure to cyber bullying, among many other issues,"

b) Miscommunication: - In certain cases it is found, when individuals cannot communicate in person, misunderstandings can occur much more frequently. Whereas interacting face-to-face allows individuals to perceive physical clues like tone, inflection, body language, in an online environment, these are lacking. People make their fake ids and give wrong information about him or herself.

c) Across cultures Communication- The disparity in communication styles can exacerbate relationship tensions between parents and young adults, the latter being so attuned to virtual communication that reaching them in-person proves difficult.

d) Time Wastage: -Students spend more time on internet while sharing videos, updating status, teasing and cheating sometimes. According to FB, users spend approximately 5 billion minutes a day on the site.

e) Subjective and False Knowledge:-In forums such as blogs, own view is given by author and moreover provision of editing or adding is there, such results subjective and false knowledge. such as Wikipedia

forum, the community is self-correcting. It does not have a hard and fast quality filter, but aims to regulate its content through a code of conduct.

f) Privacy concerns:- With social networking services the dangers of giving out too much personal information and the threat of sexual predators can be seen. Users of these services also need to be aware of data theft or viruses. However, large services, such as MySpace and Netlog, often work with law enforcement to try to prevent such incidents

g) Impact on employability: - Issues are created among employees of getting hired for jobs and losing jobs because of exposing inappropriate content. SNS are available on the Internet where users can update their statuses and express their personal opinions about life issues to their friends. Sometimes, employers can access their employee's profiles, and judge them based on their social behavior. According to Silicon Republic's statistics, 17,000 young people in six countries were interviewed in a survey. 1 in 10 people aged 16 to 34 have been rejected for a job because of comments on an online profile.

h) Unauthorized access: - This is very controversial issues where different forms use individual's data with unauthorized access. This data is usually updated without a user's permission. A study, highlighted that the most common incidents included inappropriate comments posted on SNS (43%), messages sent to contacts that were never authored (25%) and change of personal details (24%). The most incidents are carried out by the victim's friends (36%) or partners (21%) and one in ten victims say their ex-partner has logged into their account without prior consent. The survey found that online social network accounts had been subject to unauthorized access in 60 million cases in 2011.

i) Risk for child safety:- Other than parents, citizens and governments have been concerned with misuse of social networking services by children and teenagers, in particular in relation to online sexual predators. Overuse of social networking may also make children more susceptible to depression and anxiety.

j) Trolling: -SNS are used to make emotionally abuse to individuals by different users e.g. FB. Such actions are often referred to as trolling. Trolling can occur in many different forms, such as defacement of deceased person(s) tribute pages, name calling, playing online pranks on volatile individuals and controversial comments with the intention to cause anger and cause arguments.

k) Online bullying: - Online bullying, also called cyber-bullying, is a relatively common occurrence and it can often result in emotional trauma for the victim. Depending on the networking outlet, up to 39% of users admit to being "cyber-bullied". Danah Boyd, a researcher of social networks quotes a teenager in her article, "Why Youth (Heart) Social Network Sites". The teenager expresses frustration towards networking sites like MySpace because it causes drama and too much emotional stress. There are not many limitations as to what individuals can post when online. Individuals are given the power to post offensive remarks or pictures that could potentially cause a great amount of emotional pain for another individual. Students are addicted and victim of the same.

VI. CONCLUSION

SNS are putting on positive and negative effect on formal education, informal and non-formal education of students' .Keeping both the challenges and opportunities of social networking sites in mind, we have to trace a common path that can meet the challenges and provide opportunity to students, educators and administrators. Knowledge is used to be the domain of experts; it has now been handed over to anyone with access to the Internet such as e-mail and instant messaging. Adoption of social platforms has not been uniform globally; a study conducted by University of Massachusetts Dartmouth has revealed that 100% of studied colleges have opened up their arms for social platforms in one form or the other. Privacy, Fear of parents, cyber bulling, trolling can be treated with code of conduct and strict action of govt. Policies. Loading and uploading of data should be under strict rules and regulations.SNS is vital tool for learning on one side and though it could also be a source of distractions to students on other side. Most students are endeared to social media such as FB, so teachers and learners could take advantage of this fact. In a formal learning environment, goals or objectives are determined by an outside department or agency. Tweeting, instant messaging, or blogging enhances student involvement. Online Ethics and code of conduct can make SNS a hub of learning and experiencing practical skills. Objectionable sites must be banned. In nutshell it can be stated that SNS is a blessing to 21st centaury society especially to education.

REFERENCES

[1]. Aars, Jacob and Anne L. Fimreite. 2005. "Local Government and Governance in Norway: Stretched Accountability in Network Politics." Scandinavian Political Studies 28(3):239-256.

[2]. Baker, Wayne E. and Robert R. Faulkner. 2002. "Interorganizational Networks." Pp. 520-540 in Blackwell Companion to Organizations, edited by Joel A. C. Baum. Oxford, UK: Blackwell.

[3]. Bargh, John A., and McKenna, Katelyn. The Internet and Social Life. Psychology, Vol. 55, p.573-590.

[4]. The Advantages and Disadvantages of Social Networking." everyday-wisdom. 3 November 2010

[5]. Other www resources

Blended Learning – Redesigning Classroom Instructions

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***Abstract* -- In today's world of technological advancement & Globalization, the idea of Blended learning appeals more to many educationists all over the globe. There is an increasing need and demand to respond to diverse students' needs and provide engaging and meaningful learning experiences in higher education. Compounded with new technologies beyond and within the academy, this inevitably draws information and communication technology into traditional learning environments. The facilitator can combine two or more methods of teaching. Blended learning can also be applied to the integration of e-learning with a Learning Management System using computers in a physical classroom, along with face-to-face instruction. Thus come the implications for teacher educators we need to train our pupil teachers, the future artisans of our societies with the craftsmanship of blending, blending technologies with ever essential and irreplaceable support, guidance and foresight of an ideal teacher.**

KeyWords-Blended Learning, e-learning, hybrid learning, Mixed learning

I. INTRODUCTION

Learning is a key process in human behavior, it pervades everything we do and think. It plays a central role in the language we speak, our customs, our attitudes and beliefs, our goals, our personality traits and even our perceptions. Due to the universality of learning and its inclusion in all the walks of life, learning has been subjected to various interpretations.

It is generally agreed upon that learning is equivalent to change, modification, development, improvement and adjustment. It is not confined to school learning, cycling, reading, writing or typing but it is comprehensive term which leaves permanent effects or impression on the individual.

Benjamin Bloom has suggested three domains of learning

A. *Cognitive (Knowledge)**:*** To recall, calculate, discuss, analyze problem solving etc.

B. *Psychomotor (Skills):* To dance, swim, dive, drive a car, ride a bike etc.

C. *Affective (Feelings):* To like something or someone Love, appreciate, fear, hate, worship.

There are four different orientations about theories of learning:

- The Behaviorist orientation to learning.
- The Cognitive orientation to learning.
- The Humanistic orientation to learning.
- The Social/Situational orientation to learning.

But the contemporary research work is revealing that constructing one's own knowledge is the best form of learning. Hence the Constructivist theory of learning is becoming more popular these days among psychologists. Formalization of the theory of constructivism is generally attributed to Jean Piaget, who articulated mechanisms by which knowledge is internalized by learners. He suggested that through process of accommodation and assimilation, individuals construct new knowledge from their experiences which then resides within them. This approach is the most acceptable for the modern learner.

II. TRADITIONAL CLASSROOM

It is observed that even today Indian classrooms are dominated by the Traditional theory of learning i.e. they are following the behaviouristic approach which emphasizes on the role of external environment hence missing the role of internal motivation in attending to stimuli. So this approach is not learner centric because of following reasons:

1) *Dominance of tell mode***:**The teacher is the controller of the class who is primarily busy in lecturing and providing notes and information.
2) *Poor requisite analysis***:** Each day the teacher is ready with a new lecture least caring for the mental readiness or testing whether the students have enough previous knowledge to understand the upcoming lecture.
3) *Low levels of cognitive engagement***:** The class is dominated by the verbal talk of the teacher and questions are generally directed hence not stimulative. So the students are just passive listeners and are generally not mentally involved in the class.
4) *Cognitive Overload***:** Students are left under the pressure of retaining a lot of information majority of which they have not understood.
5) *Sheep dip (single dose) training***:** Students are exposed to a lot of information and the teacher has a new lecture everyday leaving no scope for repetition or breaking down of information into simpler parts. There is no provision to deal with individual differences in the class.
6) *No reinforcement***:** Reinforcement is the backbone of learning but as there is lack of interaction in the classroom so there is no scope of reinforcement by the teacher, leaving students with low motivation and enthusiasm to learn.
7) *Transfer Problems***:** Due to lack of cognitive engagement and interaction the students are not able to correlate class room learning with real life and other

areas of learning. Therefore benefits of positive of transfer learning cannot be attained by them.

Educators therefore must consider the characteristics of today's school aged students, who are referred as Generation "Z" or digital natives. Meeting the needs of these students involve 21st century tools.

III. ADVENT OF E-LEARNING

Technology had started creeping into our classrooms many years ago in the form of using improvised teaching aids. Gradually as technology advanced our classrooms also started becoming techno savvy and many types of hardware and software were developed to aid a teacher

A. E-learning is popularly understood as

1) The convergence of the Internet and learning, or internet-enabled learning.
2) Learning that is enabled by the use of digital tools and content.
3) The use of network technologies to create fosters, deliver and facilitate learning anytime and anywhere.
4) The delivery of individualized, comprehensive, dynamic learning content in real time, aiding the development of communities of knowledge, linking learners and practitioners with experts.
5) The delivery of content via all electronic media, including the intranets, extranets, satellite, broadcast, video, interactive T.V. and C.D.ROM. E-learning encompasses all learning undertaken, whether formal, or informal, through electronic delivery.
6) It is a specific mode to attend a course or programme of study where the students rarely, if ever, attend facts face to face for on-campus access to educational facilities because they study on line.
7) Hence there are numerous positivities of e-learning, but as is said there are always two sides of a coin so ignoring the other side will be following e-learning blindly.

B. Repercussions of Blinded E-Learning

It seems that competent educational institutions have blindfold landed the technology into the classrooms, completely ignoring the tradition teacher. This has led to:

1) Motivational Obstacles

a) Learning is still synonymous with classroom hence creating mental disposition for e-learning is one major problem (especially in countries like India).
b) Procrastination is another human problem; learners are forced into action by some degree of compulsion provided in a traditional classroom whereas e-learning is voluntary learning so getting started is an issue.
c) Continuous dependency on e-learning makes it dull and increases dropout rate as there is no social compulsion as exists in a classroom.

2) *Health and Social Issues*

a) Studies indicate problems of obesity in e-learners.
b) Eating disorders like starvation and vomiting to maintain beauty as advocated by net peers is increasing cases of anorexia and bulimia.
c) Misuse of internet for mere recreational purposes and lesser for educational purposes.
d) It widens gap between rich and poor, young and old, employed and unemployed, computer literate and illiterate.
e) May lead to cultural imperialism, 'Americanization' of the curriculum.
f) It may threaten the Public Education System and make education profit driven by MNCs.

So a critical analysis of e-learning (positivities and negativities) makes it worth recalling the analogy of the two wheels of a bicycle. The rear wheel (technology) provides the power and the drive whilst the front wheel gives direction and control. Power without direction/ thought may be valueless therefore we need to adopt a reflective approach and emphasize on Blended Learning rather than merely blindly following e-learning.

IV. BLENDED LEARNING

For reasons discussed above the idea of Blended learning appeals more to many educationists all over the globe. The term blended learning was first used within American literature. The major conclusion to draw is that blended learning is difficult to conceptualize as one idea. There are several understandings of the field and consequently many different aspects are investigated. The result is that blended learning is rather one mode to be used within other pedagogical models.

Smith (2004) suggests:

Blended learning is a fairly new term in education lingo, but the concept has been around for decades. Essentially, blended learning is defined as a method of educating at a distance that uses technology (high-tech, such as television and the Internet or low-tech, such as voice mail or conference calls) combined with traditional (or, stand-up) education or training.

The Higher Education Funding Council for England (HEFCE) (2010) defines blended learning as:

A method of educating that uses e-learning techniques, such as online delivery through the web, discussion boards and e-mail, combined with traditional face to face lectures, seminars, and tutorials.

A. From the above definitions following characteristics of blended learning can be deduced.:

1) It is the integrated combination of traditional learning with web-based online approaches
2) It is the combination of media and tools employed in an e-learning environment and the combination of a number of pedagogical approaches, irrespective of learning technology used.
3) It is a solution that combines several different delivery methods, such as collaboration software, Web-based courses, EPSS, and knowledge management practices.

4) It is a learning that mixes various event-based activities, including face-to-face classrooms, live e-learning and self-paced instruction.
5) It is an effective combination of different modes of delivery, models of teaching and styles of learning

A.Rationale (Why Blend?)

The rationale for supporting blended learning is that every learner is able to:

1) Have 24/7 access to all learning content, and to ensure equality of access;
2) Gauge their progress against the learning outcomes, to receive supporting feedback on this progress, and for staff to have information on student progress;
3) Participate in, and engage with interactive learning opportunities in her or his face-to-face learning sessions. There is no expectation that this need necessarily involves the use of technologies.
4) Use asynchronous collaborative learning which extends the face to face learning, creating supportive learning networks, managed by learners at a time and place best suited to their needs;
5) Understand better her or his learning process, act on feedback, so as to become more effective and successful, as well as collecting evidence on achievement to enhance our learners employability;
6) Save time and paper, and provide feedback quickly to each learner

B.How to choose an Optimal Blend?

There have been six major waves of technological innovations in learning namely:1) Writing (2) Printing (3) Broadcast Media (4) Computer Storage Media (5) PC and CD ROM (6) Internet Technology

So having so many options forces us to think about how we can methodically choose an optimal mix. We need not use many methods of delivery but we need to choose better methods. Integration of components in a blend is an important part of any blended learning experience. To make progress we must think beyond the simple dichotomy of e-learning and the classroom.

What are the components available for blending?

Six Offline Components	**Six Online Components**
1) Work place learning 2) Face to face tutoring 3) Classroom 4) Distributable Print Media 5) Distributable Electronic Media 6) Broadcast Media	1. Online learning content 2. E-tutoring 3. Online Collaborative learning 4. Online knowledge management 5. The Web 6. Mobile learning

Among above mentioned online components Web 2.0 can be utilized to provide personalized learning support and foster online collaboration and communication. Web 2.0 technologies include blogs, wikis, social networking and media sharing services etc.

The institutions must decide, through selected criteria, how these components should be blended to produce fruitful blends constantly determining the balance between face-to-face and technological components in didactical methods.

C. *Criteria for Blending*

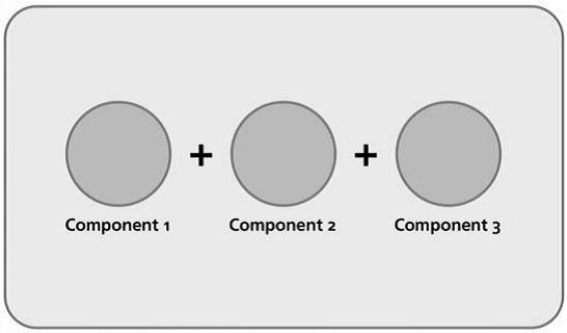
1) Does my new approach improve learning outcomes?
2) Is the blend appropriate for my learners?
3) Does the blend fit into the culture of my learner?
4) Do we have resources to cope?
5) Can our infrastructure support online components?
6) Is the blend sustainable?
7) Does the blend lead to the best combination of benefits and cost savings?

D. Levels of Blending

In designing, developing and delivering different types of blends - component, integrated, collaborative or expansive – the learning outcome must be in focus. This must be investigated with a look at learners, culture, learning resources, electronic infrastructure, the scalability and the maintainability of the proposed solution.

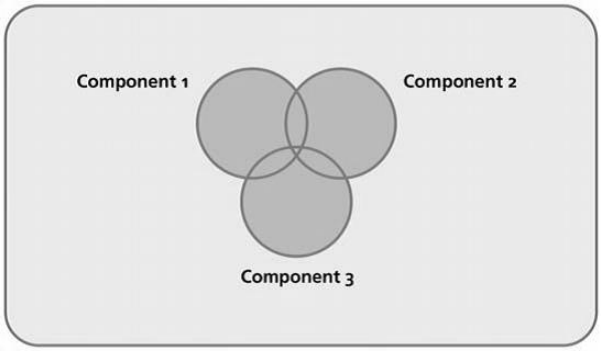
1. Four Levels of Blend

Level 1



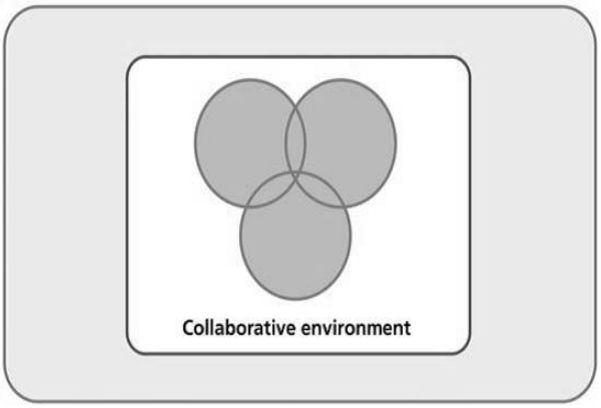
1) *Component Blend:* It takes separate delivery channels and stings them together to make a simple blend. So components are still separate as they can function alone in the absence of others.

Level 2



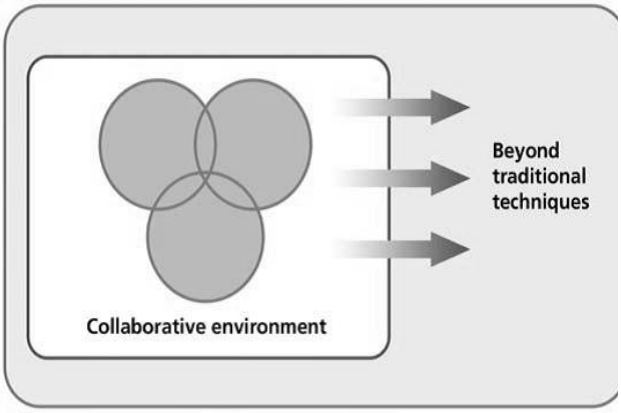
2) *Integrated Blend:* It is designed to integrate the components into a single mutually supporting structure. Each component is designed keeping others in mind, so learning experience comes as a whole.

Level 3



3) *Collaborative Blend:* It brings further cohesion between the components and learners by providing face to face or electronic tutoring or collaborative facilities.

Level 4



4) E*xpansive Blend:* Here learning is taken beyond the boundaries of predictable components of formal learning into the workplace, use of offline print resources electronic media, web and even mobile learning.

V. ROLE OF THE FACILITATOR

The facilitator can combine two or more methods of teaching. A typical example of blended learning methodology would be an integrated combination of technology-based materials and face-to-face sessions to present content. An instructor can begin a course with a well-structured introductory lesson in the classroom, and then proceed with follow-up materials online. Blended learning can also be applied to the integration of e-learning with a Learning Management System using computers in a physical classroom, along with face-to-face instruction.

Therefore the delivers of education have to see which the fruitful blend is. Increasing choice is not an end in itself. Good cocktails are not normally made by including as many different drinks as you can muster.

Thus comes the implication for teacher educators we need to train our pupil teachers, the future artisans of our societies with the craftsmanship of blending, blending technologies with ever essential and irreplaceable support, guidance and foresight of an ideal teacher.

REFERENCES

[1]. Bersin,J.(2004).The Blended Learning book: best practices, proven methodologies and lessons learned. San Francisco,CA:Pfeiffer.

[2]. Darsana,B.G.,&Rajeshwari,K.(2014).Effectiveness of a multimedia package as self learning material for enhancing achievement in chemistry at secondary level. GCTE, International Journal of research & extension in Education.9 (1), 26-30

[3]. Mangal, S.K.(2012).Advanced Educational Psychology(2nd ed) Prentice Hall of India.Pvt.Ltd.,New Delhi.

[4]. Ramachandran S, M.(2014)Computer assisted approach for developing spelling skills of upper primary students.GCTE Journal of Research & Extension in Education9(1),63-67.

[5]. Oliver,M. & Trigwell,K.(2005).Can Blended learning be Redeemed? E-Learning, 2(1), 17-26.

[6]. Pahuja, N.P.(2004).Psychology of Learning and Development,91-192,Anmol Publications, New Delhi

[7]. Pragathi,P.S.& vijaylakshmi,G.(2014).A study on achievement in social studies through computer assisted programme instructions.Edu Tracks,14(4),19-20.

[8]. Shinde, S.P. & Deshmukh,V.P.(2012).Blended learning methodology in school education. International Journal of Computing & business Research.3 (2).ISSN (online):229-6166.

[9]. Thomas, A.(2014).Development & tryout of computer assisted instructions for teacher trainees in the core subject of educational technology.GCTE Journal of Research & extension in Education.9(1),22-25.

[10]. Umamaheshwari, R.Learning versus Classroom learning. retrieved from www.ebstwebtraining.com/webvclass.htm.

[11]. Whitelock,D. & Jelfs,A.(2003).Special issue on Blended learning Journal of Educational Media.28(2),99-100.retrievedfrom www.infed.org./biblio/b-learn.

Importance of Soft Skills and Communication and their Enhancement

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***Abstract*: This paper makes an attempt to survey the significance of soft skills and communication skills in students' lives both at college and after college. It discusses how soft skills complement hard skills, which are the technical knowledge required for the students to do job. The paper inspires educators to take special responsibility regarding soft skills, because during students' university/college time. Educators have major influence on the development of their students' soft skills. Embedding the training of soft skills into hard skills courses is a very effective and efficient method of achieving both an attractive way of teaching a particular content and an enhancement of soft skills. Soft skills fulfill an important role in shaping an individual's personality. It is of high significance for every student to acquire adequate skills beyond academic or technical skills.**

I. INTRODUCTION

Before going any further in debating the importance of soft skills and communication skills we have to clarify the question, "What exactly are soft skills?" This basic question is not easy to answer, because the perception of what is a soft skill differs from context to context. A subject may be considered a soft skill in one particular area, and may be considered a hard skill in another. On the top of it the understanding of what should be recognized as a soft skill varies widely. Knowledge in project management for an instance is "nice to have" for an electrical engineer, but it a "must to have" for a civil engineer. Training in cultural awareness might be useful for a chemist, but it is an absolute necessity for public or human resources management in societies of diverse cultures.

Interesting enough the internationally renowned encyclopedias has little to say about the soft skills. The online encyclopedia, "Wikipedia" gives a very broad definition of soft skills, which leaves much room for discussion: "Soft skills refer to the cluster of personality traits, social graces, and facility with language, personal habits, friendliness, and optimism that, mark people to varying degrees. Soft skills complement hard skills, which are the technical requirements of a job."

Soft skills are shaping human beings' personality. Any educator's dream is that graduates, especially from tertiary education institutions, should not only be experts in a certain field but matured personalities with a well-balanced, rounded off education. However, this characteristic is reflected in soft skills, not in hard skills. During last decades in many societies the opinion on soft skills has changed considerably. Whereas in the past mastering of hard skills was rated first and soft skills were considered as "nice to have", the perception has been turned upside down. As mentioned before, good communication skills can easily be used to cover up a lack in hard skills. Nowadays in general, people who are extroverted, who are good in marketing themselves, and who are socializing easily, are rated superior to others who lack those attributes. The good old technician, an ace in his field, but being introverted and talking less than ten complete sentences a day is not appreciated any longer.

II. EXAMPLES OF SOFT SKILLS

A. Leadership

B. Time management

C. Case study

D. Creativity

E. Diplomacy

F. Cultural awareness\

G. Flexibility

H. Team building skills

I. Self awareness analytical ability

J. Listening skills

The list offers a list of examples of soft skills based on the Wikipedia definition. The list is by far not complete. For instance, under personal traits characteristics like imagination, curiosity, determination, passion, or persistence could be added. To keep things simple, from the definition and the list, it becomes immediately clear that we are looking at three very different skill categories, i.e.

a) Personal qualities,

b) Interpersonal skills, and

c) Additional skills/ knowledge.

Significance of Soft Skills And Communication Skills In The Globalised World. Again the answer regarding the importance of soft skills and communication skills depends very much on the context and one's personal perception. However, there is one property that immediately comes to most people's mind when soft skills are mentioned: those are the communication skills. And indeed, it is the talent of communication skills, which is mostly lacking among students from colleges and universities.

When asking people what exactly they understood to be communication skills, one will receive a wide range of answers, because communication skills include a lot of different aspects. Minimum requirements for students should be ample proficiency in spoken and written language, a certain amount of self esteem that will be reflected in conversation skills and body language, adequate discussion skills, good presentation skills to be able to market oneself and one's ideas.

However, soft skills and communication skills are not only necessary for as person's professional career, but are even more contributing to one's so-called social competence. Good social skills are also reflected at the working place and hence further the career. In today's English speaking world, language proficiency is the ability to speak, read and write Standard English in a more professional way. For sometimes, adequate communication skills are a prerequisite for a range of other soft skills like moderating discussions.

Another pair of soft skills frequently lacking in education is critical and structured thinking. Both go hand in hand with problem solving abilities. Especially in today's information society, it is of high importance to critically filter the endless stream of incoming data, analyze it, and make informed decisions based on it. Analytical skills also form the base for developing solutions to any kind of problem. And also in this case the soft skills are of equal usefulness in a person's professional and private life.

An interesting question to ask is whether a person's traits and habits can be changed or improved. Anybody raising children or living with a partner, who has irritating habits, might be tempted to answer that the task of changing personal traits is extremely difficult, if not impossible. The corporate trainer and instructional designers have a strikingly simple answer to this question: "there is a lot of argument in industry as to whether it is possible to enhance soft skills in a few hours of training, especially when one considers the fact that a person has lived with those traits all his life. To this, the answer is harsh but real—a professional who wants to do well in his/ her career, does not really have a choice."

A key aspect in this regard is a person's ability to recognize and acknowledge certain behavioral pitfalls or bad habits. As a German proverb states: "Self recognition is the first step towards improvement." As soon as a deficit has been identified, one can start working on its elimination. For example, many people are not fond of doing small talk, a common characteristic among those working in a scientific or technical environment. The reasons night vary: shyness, introverted character, lack of "how to", boredom, etc. However, small talk is an important part of communication skills necessary to display social competence. Once having acknowledged this truth, a person can undergo a simple self-training or guided training to improve the lacking skill. There are, for instance, many books available on the issue of "Small Talk". Forthwith, the person can make it a habit at parties or social gatherings to initiate a conversation with at least three strangers. While the first times might require quite an effort, after a few months the frequent chatting with strangers will become a second nature. With such and similar easy exercises even a very introverted person can appear reasonably sociable.

To sum up, it means that negatively perceived personal traits could be changed or successfully covered by undergoing self-imposed training. Only prerequisite is that one acknowledges one's weakness and takes the decision to change it. Training will most likely be unsuccessful if one is not fully convinced that it will lead to any improvement or that the improvement will be beneficial.

III. METHODOLOGY

Of all the methods, there are two methods for improving skills. One way is enrolling for formal training, e.g. taking evening classes on languages, soft skills, personality development, presentation skills, conflict or cultural management. This is a well-proven concept with the advantage of having some kind of certificate at the end of the course, which might come in handy for job applications. The slight sarcasm in the last sentence is intentional, because it is not always guaranteed that a certain course actually successfully enhanced a person's soft skills.

The other way of acquiring soft skills that was looked at, is self-training, usually based on books. As we saw earlier, changing of personal traits often requires long-term practice and therefore self-training might be more useful regarding the improvement of this category of soft skills. We know already that in this way we can improve our small talk capabilities, be practiced while chatting and discussing with others in an informal manner: e.g. language proficiency in general, listening, discussing, etiquette, self-esteem, or body language. Hopefully, at most educational institutions, at all levels teaching methodology have been changed or will be changed towards more student centered learning. Such a shift goes hand in hand with embedding soft skills into the teaching of hard skills. In other words: students participating in a lecture with the aim of learning a hard skill will inevitably and unconsciously practice a range of soft skills. This comes very close to an ideal way of lecturing.

Many educators will now rightfully intervene, asking whether the shaping of personal traits does not start at a much earlier stage, let's say at a child's cradle? And of course, this is exactly the case. Parents and school teachers have superior influence on a young person's aptitude in soft skills. This puts a lot of responsibility in this regard onto the shoulders of a child's family and school. And sociologists will add, not only parents and educators, but also the whole social environment and upbringing of a child will have major impact on its personal traits.

IV. MEASURES TO BE TAKEN TO ENHANCE THE SKILLS AMONG STUDENTS

In view of the importance of soft skills and the consequences of shortcomings, students should be encouraged to enhance their soft skills by applying the methods we mentioned before, e.g. reading dedicated books, attending courses, and joining clubs or societies to broaden

their horizon, like debating societies, scientific societies who offer presentations and discussions.

A formal approach to the problem would be to incorporate soft skills subjects into a programme's curriculum. On lower levels, a course that requires students to do a bit of research and to present their results to the class afterwards has been proven as being quite effective. N graduate level, a course on technical skills and management skills, including e.g. some communication skills together with the management of time, conflict, cultural issues, and major importance, oneself, has in practice has been well received by students.

However, very often the curricula are already overloaded with hard skills courses, making it almost impossible to add or substitute courses. Furthermore, other lecturers might be ignorant of the importance of soft skills and hence, do not support dedicated courses in this regard. A very elegant way of offering soft skills training to students is to embed it into the teaching of hard skills. An example would be a physics, social sciences and mathematics teacher who plan a lecture but firstly determining what soft skills she/he wishes to enhance on that day, and then secondly considers how the required subject's content can be arranged to support this goal. Correctly applied, such an approach to teaching will automatically increase the attractiveness and effectiveness of a course regarding both, hard skills and soft skills.

V. CONCLUSION

During the last decades in society, the perceived importance of soft skills has increased significantly, and it is of high importance for everyone to acquire adequate skills beyond academic or technical knowledge. This is not particularly difficult. Once a shortcoming in a certain area of soft skills has been identified at oneself, there are number of ways of rectifying such a deficiency.

All the lecturers have a greater role regarding soft skills, because during students' school and university time, they have major impact on the development of their students' soft skills. Besides raising awareness regarding the importance of soft skills and encouraging students to improve their skills, lecturers should actively practice soft skills with their students. A very effective and efficient way of doing this is to include soft skills training into the teaching of hard skills. As a positive side effect the lessons will become more attractive, which in turn will increase the success rate of learners.

Soft skills fulfill an important role in shaping an individual's personality by complementing his/her hard skills. However, over-emphasizing it to such an extent should not reduce the importance of soft skills, that hard skills, i.e. expert knowledge in certain fields, are demoted to secondary importance.

REFERENCES

[1] British Association of Graduate recruiters (AGR): www.agr.org.uk

[2] 'Classroom English' Bryan Gardner and Felicity Gardner, Oxford University Press, 2004.

[3] 'Functions of English' Leo Jones, Cambridge University Press, 1981.

[4] Horton W., Horton K. : www.horton.com

a. 'Patterns of Spoken English' Gerald Knowles, Longman, 1987.

[5] PISA: www.pisa.oecd.org

[6] Waggoner,Jacqueline: http://mountainrise.wcu.edu/html/waggoner.pdf

[7] Websites on classroom English.

[8] Websites on Functional English.

[9] Wikipedia:www.en.wikipedia.com

English Language Teaching to Engineering Students: Difficulties and Solutions

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***Abstract*---Being science student and wondering about robots, electrons, engineering students hardly bother about nouns, verbs and tenses. English no doubt has taken place as first language in the corporate world but heart of an engineering student still resist the panorama of English language in their lives. Subconsciously aware of the importance of communication skills in getting a job, they fail to realize its importance consciously in the class rooms. They fail to realize that the gateway to express their core knowledge is communication skill only. Maximum engineering students neglect this most important skill because of many reasons. Though there might be many argumentations which favor causing lack of interest in English learning process but its importance cannot be neglected. This research basically focus on the reasons ;why engineering students lack interest in learning of communication skills and what tentative pedagogies can be adopted to develop their interest in learning of communication skills. This research paper aims to find out the difficulties in teaching, learning of English/communication skills to engineering students and tentative solutions to ease the process of learning.**

Keywords: communication skills, practical learning, listening skill, improve expression, communication skills in present scenario, Non verbal communication

I. INTRODUCTION

English Training has become eloquently necessary in today's world and engineers are not exception for this fact. Corporate world need people not just with knowledge but with the expression of knowledge and it's just with language that one can be able to express. Though engineering students very well aware of the fact still lack efforts in learning communication.

Being science student and wondering about robots, electrons, engineering students hardly bother about nouns, verbs and tenses. English no doubt has taken place as first language in the corporate world but heart of an engineering student still resist the panorama of English language in their lives. Subconsciously aware of the importance of communication skills in getting a job, they fail to realize its importance consciously in the class rooms. They fail to realize that the gateway to express their core knowledge is communication skill only. Maximum engineering students neglect this most important skill because of many reasons. Though there might be many argumentations which favor causing lack of interest in English learning process but its importance cannot be neglected. This research basically focus on the reasons ;why engineering /business students lack interest in learning of communication skills and what tentative pedagogies can be adopted to develop their interest in learning of communication skills. Next part of the paper deals with the reasons why English learning is difficult for students along with the solutions to make it effective and interesting.

II. LACK IN UNDERSTANDING PRACTICAL UTILITY OF THE SUBJECT

One of the major issues which hinder learning of communication skills is the lack in collaboration of practical utility of the subject with the study material. Students are not able to cue up the knowledge the take in the class with the life experience. Where other engineering subjects give due stress on calculations, facts, figures and outer world observations; English gives stress to introspect language, expression and personality in total. Students find this subject not in legume with other subjects. It is very necessary to comprehend students about the practical utility of the course and the topics they study. For example if they study are studying tenses, then along with the grammatical structure they should be told about the practical usage of tenses in a particular context. If they are taught about letter writing then along with the format, contexts e.g. telephone complaint, ordering books and covering letters should be taught. To bring coherence between theory and practical is very important.

III. REALIZE IMPORTANCE OF COMMUNICATION SKILLS IN CORPORATE WORLD

Failing to realize the importance of communication skills in the corporate world is another major factor which affects the learning of engineering students. Actually communication skill is like an insurance policy which does not have immediate returns but returns comes after a long time and investments. The students who fail to understand the utility of the subject actually lack vision which eventually can be developed through learning of soft skills only. Corporate these days do not want dummies but dynamic personalities who are efficient in multitasking, because when it comes to cost cutting in recession ; companies will throw those employees first who lack dynamic personality.

English is the only language which is internationally known. No other language is as widely accepted at social, economical and political level as English. In this era of liberalization, privatization and Globalization, good communication skills are the keys to open the door of success. Students realize its importance when in spite of good marks companies hesitate to absorb them because of their low communication skills or soft skills. People with excellent communication skills and dynamic personality are considered as an asset for any organization, just

because of the fact that they can be utilized in any job any time. Students fail to realize that though technical knowledge is treasure but the key to unlock that treasure is communication skills only. Success of any idea, thought hinges on the ability to communicate effectively and the people who have mastered this skill are one prone to success.

Competition has risen to a level where everybody is asked to do more with least resources. Companies nowadays give due weightage to communication skills which is explicit in their job scrutiny test which sometimes include partial or full English/communication knowledge test. Any skill or knowledge is not of much use till the time it gets expressed. Students lack expression in not only spoken but written language but they cannot escape the fact that most of their time in job will be spent in inter or intra communication. More than that, being social a man has to be communicating most of the time; if not with anybody outside then with the self. If we see latest newsflashes and researches, it says that most of the fresher's get rejection in the interview not because they lack technical skill but because they lack the skill which expresses their technical skill. In this era of globalization, companies need employees who can deal with the international clients with an effective way which definitely calls for effective communication skills.

The first and foremost task of a language trainer is to realize the students about the importance of communication skills in personal life as well in professional life. Lack in communication skills can leave them in a situation where there is no destination ahead Before we start with the actual training on communication skills , it is important to make them realize why they need to lean it and what can be the aftermaths if they ignore the importance of these skills. Few methods which can be adopted for this are as follows:

- They can be presented with actual data of the students with whom they have to compete for jobs after their qualification is complete. Students should be enlightened about the tough completion ahead which demands more than just technical knowledge.
- They can be made aware of the industry needs with guest lectures by industry officials.
- Students can be sent to field visit with soft skill projects where they can observe the importance of communication skills.
- Can be motivated through movies which exhorts the need of communication skill
- Practical utility of their course in relevance to life can be told.

IV. PERSONALITY RELATED PROBLEMS

Students might have problem related to personality as well as language which create problem in their learning of communication skills. Few of the problems are as given below:

A. Lack of confidence:

Where other practical and theory subjects can be learnt in isolation and individually; learning of communication skills demand a public platform and that is the first step students hesitate to take. There are two categories of students; one who are basically of shy nature and interact least with people and the others who hesitate to speak in public but talk to their friends in an effective way. The second category is of students who hold their fake ego, resulting hesitation for public speaking. The fears of committing mistakes build such a barrier which deters their success also. These students if channelized properly can very good public speakers also.

The performance of such students displays when they are given group tasks and activities. This will not only build their confidence but will bolster their public speaking skill. A small nudge to their speaking ability can cue their public speaking and communication abilities.

Now discussing about first category of students, who basically have shy nature, demands individual care and attention. Knowing the fact that every student has some or other talent, these students should be encouraged in the field of their own interest. Taking first step is the only difficult with such students. Once started, they sincerely follow the instructions and work hard upon themselves. Patience is the main requisite for these students because if teacher looses patience, these students will close their heart and mind for language learning. The will consider it as a hard nut to crack and will lose interest in learning. Sometimes small boosters of motivational stories of some successful people who failed in the beginning of their career but eventually hard work bought them innumerous success. Purpose of all the activities with them should orient in building their confidence.

B. Bad Listening Skills

Listening, inspite of being most important activity for learning any language is the most neglected one especially when it comes to foreign language learning. Being in Indian atmosphere especially in rural culture, it is very difficult to inculcate habit of English listening. Family background and atmosphere sometimes becomes a big obstruction for imputing listening skills. English being second language in our country is not frequently used. Lack of listening skill causes problems with pronunciation and in understanding of native language. Moreover students lack patience in listening when they find it difficult to comprehend. Misconception of students' regarding English as an Easy subject becomes obstacle in language learning. Most of the time students consider it not as a tool for success but as a subject only. The misconception that English as a subject exam can be cleared with one day reading reduces their efforts which are actually required to learn English as a skill. They forget that English requires more hard work and continuous efforts than required for their regular subjects. Sometimes students have self induced fears, making English as a difficult language to learn. Without paying many efforts they start losing interest. This problem of listening skill can be treated well if students are given ample opportunity for participation in the class through role plays, group discussions, and games.

C. Lack of expression

Student lacks in giving right expression of their thoughts in both the communications i.e. spoken and written skills. Whenever it comes to express in spoken; they fumble and in written expression they lose coherence as well as proper answer to the question. Giving opinion on some topic in English is quite difficult for engineering students. Though they have to deal with wires, circuits but still they need to express themselves in the market. Here are few reasons due to which students lack expressing their feelings:sssss

- Unable to use long sentences (compound and complex)
- Limited vocabulary, not enough to express their feelings because of which they ramble
- Unable to comprehend a vivid experience in a vivid way
- Lack confidence in use of correct grammar

These are few reasons why student lack expression and hesitate in speaking in front of public. Solution though entirely does not depend solely on teacher but upon students' seriousness towards learning of subject too but with interactive classrooms topics can be made bit comprehensive to students. Solutions to the above said problems are as following:

Student should be given basic structure of simple compound and complex sentences followed by its usage in practical life. They can be asked to write some easy write ups e.g. one of their memorable moments or just the schedule of their previous day and then can be asked to change the structure of sentences to either complex or compound. Students will realize the importance of using different kind of sentences and how to use them to make their language more effective. The basic necessity is making student realize about the importance of language through practical usability of it.

Vocabulary is another area which demands constant focus and hard work. It demands regular learning and keen observation of the text as well as new words. Though there are not set rules through which we can embrace vocabulary easily but still few methods can be derived to ease the level of difficulty in learning of English vocabulary.

- They can be asked to learn phrasal verbs which enhance the vocabulary without much of ado and it gives ornamental effect to the language when used.
- Vocabulary cannot be retained if we try to learn new word daily but can be better learned if we take one word in two days but use it extensively in our communication for two-three days.
- Another method is to relate a story or joke with the new word so that students can retain it for longer.
- Student can be taught theme based vocabulary through role play or quiz. E.g. vocabulary used for cooking, travelling, medical, engineering can be taught. Registers and jargon of particular field can be taught to enhance their skill of field related vocabulary which will help them in interview tasks.

For learning communication skill, knowledge of tenses is one of the most important aspects. A student cannot build on confidence till he is not sure of his usage of tenses. Tenses are still taught in traditional way which does not serve the purpose of communication skill learning. Along with the grammar of tenses, students must be told about the practical usage. Using single sentence in isolation will hardly help students in learning practical usage of tenses. They should be taught about tenses with their practical utility in life, e.g. if we teach present indefinite tense then we shall discuss about the situation where present in definite tense can be used along with the grammatical structure. Once they learn the context, usage will become easier and interesting for them.

D. Body Language

All successful relationships, whether personal and professional have its foundation on communication skills. But we communicate with much more than words i.e. most of the messages we send other people are nonverbal. Nonverbal communication comprises of facial expressions, gestures, eye contact, posture, and tone of voice. The ability to use nonverbal communication, or body language, is a powerful tool that can help in expressing what you really mean, and in building better relationships.

Engineering students are good in using computer language but lack to express through body language in an effective way. Learning communication skill through body language is not a one day task but again needs continuous efforts. It's a part of communication skill which makes maximum of it. If we take reference from one of the theories of communication skill, it will come out to be 55% of overall communication we do. Being in engineering and dealing with straight statement students' lose the art of expressing through body language Postures, eye contact, tone , intonation etc are the factors which help in making clear cut communication but engineering students use least of them. For them only words matter but unfortunately on communication scale verbal has got just 7% importance and rest goes to vocal (38%) and visual (55%). Clearly visible that non verbal communication has significant role to play in communication skill. Employer today is very demanding and search for a dynamic personality. Rightly said that first impression is the last impression and first impression is always non verbal. It is at the moment when student enters the interview room; his destiny is half written, positive or negative depends on the first impression made. First impression works like a gatekeeper. If this goes well then all the information given by student will be accepted easily but if due to any reason first impression goes wrong then becomes hard for the student to convince the interviewer. Academic knowledge and high grades become secondary but personality and appearance, behavior, attitude becomes priority. Students fail to realize the utmost importance of body language skill for interview as well as for life.

This skill however cannot be exactly taught without demonstrating. If a teacher asks students to wear formals, he should be in formals first. If we train students to express through non verbal communications, use gestures, eye contact during communication then these skills can be

taught only if teacher is using these skills in his teaching. Students should be make clear that the gap between what they say and what people understand comes from non verbal communication i.e. body language.

Non verbal communication is something which cannot be taught but suggested only. Students can be at the most advised on how to sit certain way, steeple your fingers or shake hands so that they appear confident but anything would not work until they are actually confident because you cannot control the non verbal signals sending off about what you are thinking or feeling.

E. How to manage Body language:

If you can manage stress, you can manage non verbal communication effectively and to learn how to manage stress, it is important to learn and practice it continuously. When you're stressed out, you're more likely to misread other people, send off confusing or off-putting nonverbal signals. Further on, like attracts like and unhealthy feelings attracts more unhealthy situations, making a bad situation worse.

If you're feeling some stress, it's best to take a time out, a moment to calm down before you jump back into the conversation. Once you've balanced your emotions, you'll be better equipped to deal with the situation in a positive way.

V. CONCLUSION

Communication skill is an unavoidable part of any learning process. It works as a supplement to core and technical education but according to Derrida (French philosopher), supplement is more important than the actual subject. Once realized about the actual necessarily and utility engineering students can be trained about communication skills. Why does it happen that students are ready to pay thousands of rupees for ILETS and not ready to learn college English? May be somewhere we lack to connect it to practical life. Communication skill should not be taught as a subject but as a skill, not to equip them for exams but to equip them for life.

REFERENCES

[1]. Borich, G.D. 2007. Effective Teaching Methods: Research-Based practice. 6th ed. New Jersey: pearson prentice Hall.

[2]. Candline, C. and Murphy, D. 1987. Language Learning Tasks. Englewood cliffs, NJ: Presntice Hall .

[3]. Cook, V.J. 2001. Second Language Learning and Language Teaching (3rd ed.). New York: Oxford University press Inc.

[4]. Cottrell, S. 2001. Teaching Study Skills and Supporting Learning. New York: Palgrave, Metamorphous press.

[5]. Crystal, D. 1987. The Cambridge Encyclopaedia of Language. Cambridge: CUP.

[6]. Deckert, G. 1987. 'The Communicative Approach: Helping Students Adjust'. English Teaching Forum Vol. 25, No 3, pp 17-20.

[7]. Dudley-Evans T. & M. J. St John (1998) *Developments in English for Specific Purposes: A multi-disciplinary approach*, Cambridge: CUP.

[8]. Ellis, R. 1992. Second Language Acquisition and Language pedagogy. Clevedon: Multilingual Matters.

[9]. Harmer, J. 2001. The Practice of English Language Teaching (3rd edt. London: Longman.

[10]. Koul, L. 1996. Methodology of Educational Research (2nd ed). Delhi: Vikas Publishing House Pvt. Ltd. The British Council (1980), *ELT Documents 106 – Team teaching in ESP*. London: ETIC.

Politics of Paralanguage

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***Abstract*-- As communication process is all about expressing our knowledge thoughts, emotions, ideas, feelings, knowledge, experiences of past and present, doubts and apprehensions about future: all the same we should not forget that our mode and manner of communication can be easily manipulated or rather be adroitly engineered to produce the desired effect on the receiver of the message. These speech tactics are both fortunately and unfortunately used for the public benefits and personal benefits by the mighty and powerful.**

Keywords: **Politics, paralanguage, prosody, pitch,tone Intonation, non-phonemic properties, lexical,resonance, tempo, volume and rhythm.**

Paralanguage is an area of non-verbal communication that underlines body language and nuances of voice as a means of expressing thoughts, ideas, views, emotions, and feelings. Paralanguage is a crucial ingredient of meta-communication. It that may modify, magnify or underline the meaning, or convey emotion. Its major components are prosody, pitch, volume, intonation etc. Paralanguage may be expressed consciously or unconsciously. Paralanguage is a part of meta-communication. It has a tendency even to modify or convey emotion, such as prosody, pitch, volume, intonation and other non-phonemic properties. Paralanguage may be expressed consciously or unconsciously. The study of paralanguage is known as paralinguistic's, and was invented by George L Trager in the 1950s, while he was working at the Foreign Service Institute of the Department of State. We, the Humans, have an excellent tendency to understand paralanguage long before we learn the lexical meanings. This leads George L. Trager to study the "language beside" which he termed as "paralanguage" in late 1950's. His observations that we often use different forms of Paralanguage with no conscious effort are the turning point in the field of communication skills. Many vocal features that contribute to our interpretation of spoken language also include voiced pauses or intonation (the pitch and volume of spoken words). Some, like respiration, are even a combination of physical and vocal components producing the voiced and voiceless sounds. Majority of the times, listener comprehends the spoken message most often by a speaker's use of intonation. For instance, if the volume of your friend's speech is decidedly low, then there is a good chance he's sad over something. Similarly, if someone ends a sentence with a rising pitch then she is most likely raising a question.

Dr.Paschlis Chliaras, an eminent researcher in the field of paralanguage from University of Birmingham suggests that in routine, people consistently use paralanguage so profusely, naturally and consistently that they themselves are sometimes not even aware they are doing so. The ability to interpret this kind of communication correctly is considered as a crucial competence in both personal and professional growth. The body language and gestures of sender of an encoded message often conveys just as much meaning as spoken words. Good communicators also have the ability to gauge how their own paralanguage affects others and to alter it so as to gain others' trust. Various aspects of paralanguage include posture, eye contact, hand gestures, and tone of voice and proxemics. Vocal qualities such as volume and tempo are also part of non-verbal communication.

If a speaker changes even one of these aspects, the whole message may land in a completely different manner on the listener. People who are able to adjust their non-verbal language to the needs of various situations are generally better at diffusing troublesome interaction such as arguments.(Dr. Paschalis Chliaras)

Dr. Paschalis Chliaras, of University of Birmingham, identifies this skill as meta-communicative competence. Paralanguage and Meta messages are considered to be non verbal components in a mechanism of Public Speaking and they have great influence on the whole speech. No matter how the speech is contracted the non verbal delivery may change its meaning and its ultimate impact. In this respect the ability of manipulation of paralanguages and meta messages can have influence on the development of a person as a public speaker, thus making his messages more deliverable for the audience .(Anahit Parzyan) The Importance of Paralanguage and Metamessages in a Delivery of a Massage in Public Speaking.

The political thinkers and leaders are amongst such selected few who have these skills and the capability to manipulate their paralanguage. Even a lay man knows that political system of almost all the countries is based on the democratic set up. A well known theoretician and internationally acclaimed French scholar -Dr.Jacques Ranciere opines that a Democracy is "precisely not a political regime in the sense of a particular constitution that determines different ways of assembling people under a common authority." Rather it is "the institution of politics -- the institution of both its subject and its mode of relating." Political argument is at one and the same time the "demonstration of a possible world where the argument could count as argument, addressed by a subject qualified to argue, upon an identified object, to an addressee who is required to see the object and to hear the argument that he or she 'normally' has no reason to either see or hear." It is

the construction of “this paradoxical world that relates two separate worlds” thus giving us the reason to ponder over the politics of speech and paralanguage. This work can help us to better understand the non verbal behaviour of the speaker and give us key insights into the mind and thought process of the speaker. The 'people' that is the “subject of democracy -- and thus the principal subject of politics -- is not the collection of members in a community, or the labouring classes of the population. It is the supplementary part, in relation to any counting of parts of the population that makes it possible to identify 'the part of those who have no-part' [le compte des incomptés] (count of the unaccounted for) with the whole of the community. (Ranciere Jacques. Dis-agreement).Paralanguage and meta messages are considered to be non verbal components of Public Speaking ,playing vital role in creating the effect on whole speech. No matter how the speech is composed, the non verbal delivery may change its meaning. In this respect the ability of manipulation of paralanguages and meta messages can have a tremendous influence on the development of a person as a public speaker, thus making his messages more deliverable for the audience.

An Achilles heel of a politician is his “image,” which comprises of speech style, physical appearance, and general mode of self-presentation.

A particularly powerful channel through which an image is perceived is the politician’s use of gestures, facial expressions, voice movement, and general appearance, or his nonverbal behaviour… (Ambady, Bernieri, & Richeson, 2000)

An ambitious politician concerned with his image and the way he is perceived by his voters and general public is “more conscious of his paralanguage and voice qualities than the average person”. For the receiver of the message or the listener of the speech, such nonverbal signals forms his impressions. Another Metalinguist- Ekman observes that though “politicians cannot be expert in every issue”, but they are “more conscious” that is why “they are able to control their nonverbal behaviour “to impress their voters. He further points out that, the politicians are intelligently “aware of which paralanguage should be used in order to form a credible impression.” Ekman is quite true in his observation that “politicians should receive higher ratings on scales related to credibility than non-politicians, or those who are not as skilled at impression management, even though they are equally competent in the subject of the speech”. (Ekman, P., Friesen, W. V. (1969)). The Facial Expressions also reveals a lot about the intensity and the nature of words being used to convey the message .The human face has tremendous capacity and is capable of all manner of articulations and each of them can be interpreted in a unique way depending on the situation. For instance, a wink may suggest a mischief, a sexual advance towards an opposite gender or even a disapproval where person doesn’t see eye to eye over some point or even a secret nod .Similarly, A cocked eyebrow could also manifest a surprise or dominating quizzical look, but many of us might be more familiar with its use in conveying extreme disapproval.

Here it becomes quite obvious to state that mode and manner of communication can easily be manipulated or rather be adroitly engineered to produce the desired effect on the receiver of the message. These speech tactics are both fortunately and unfortunately used for the public benefits and personal benefits by the mighty and powerful speakers.

People usually converse with each other, be it personal, formal or informal talk, they can’t feel complete, or in technical terms can’t communicate without using their hands for gesticulation. Our postures and positions of hands, feet, knees can tremendously influence our message .Our arms crossed, for instance, communicates a very standoffish or disinterested attitude, so listeners would probably be less inclined to actually pay attention. A crossed leg person, do not want to be intruded. Pointing effectively indicate or emphasizing something, but in public it is rude.

We subconsciously use paralanguage while communicating with children .For instance, when we tell them to be quiet by saying "shush." If we see something disgusting , in order to show disapproval, we may produce the fricative sound like ttt... We also use kinesics today a lot too. We use the "O.K." sign to signal that everything is fine. Without the understanding of kinesics or paralanguage there would be a big ridge between the genders and cultures. We need these two non--verbal communication techniques for co-existence.

We speak with our vocal organs-active and passive articulators which help us to identify our manner and place of articulation. Beyond that we communicate with our whole bodies; conversation is beyond a mere interchange of spoken words. The term paralanguage is currently used to refer to non-verbal communicating activities which accompany verbal behaviour in conversation like pitch, resonance, articulation tempo, volume and rhythm. Through paralanguage you unintentionally betray your mood and attitude, No matter what you say, the sound of how you say it will reveal a great deal about who you are and what you feel. When a speaker intentionally alters the rhythm or pitch of his speech to lay stress, he is sending meta- messages. The two most crucial elements of paralanguage are pitch and resonance :

Pitch: while expressing intense feelings the pitch move towards the extremes. For instance during the feeling of intense joy, happiness, anger or excitement, the muscles of vocal chords are constricted thus the voice goes up. But when one is depressed, calm or tired the vocal chords are relax and the pitch goes down.

Resonance: it is the thickness or thinness of the voice .with regular practice the resonance of the voice can be monitored as in the case of singers and public speakers. Deep baritone voice as in case of Amitabh Bachan, Rekha , Vidya Balan , Ompuri reflects firmness, self assurance, strength on the contrary the thin voice or high pitched reflects the indecisiveness, insecurity and weakness.

We are startled by the latest revelations that paralanguage conveys and communicates a lot as observed

by Poyatos, Fernando another meta-linguist of this generation who has been working consistently on the novels to study the impact of paralanguage on the readers.He brings our attention towards the very silences and the strangeness of the sounds in the texts:

Silences in a novel, as in real life , can be such silences by the absences of interactive discourse and they cover the variable segment of time …however certain sounds can be produces… they enhance it(silence)…specific qualities of very low intensity"(Poyatos,95).

Research by Ekman and Friesen (1969) suggests that the 'nonverbal channel under the least conscious control is the voice'; 'more cognitive attention seems to be paid to the visual nonverbal channels such as body posture and facial expressions...". Thus our action or rather our body speaks louder than our voice .At the same it is not a child's task to manipulate ,monitor or control our body language.

Because of the complexity involved with controlling nonverbal behaviour from multiple channels at the same time,… nonverbal behaviour results in a relatively valid source of information regarding the dispositions and internal states of others. (Wu & Shaffer, 1987).

Those who are in power, or are carving a niche for themselves to reach the corridors of the power house are always on a move to project their image as "that of a credible, competent speaker (Wu & Shaffer, 1987).

REFERENCES

[1.] Ambady, N., Bernieri, F. J., & Richeson, J. A. (2000). Toward a histology of social behavior: Judgmental accuracy from thin slices of the behavioral stream. Advances in Experimental Social Psychology, 32 , 201-271.

[2.] Ekman, P., Friesen, W. V. (1969). Nonverbal leakage clues to deception. Journal for the Study of Interpersonal Processes, 32, 88-106.

[3.] Poyatos, Fernando. Nonverbal Communication across Disciplines: Narrative literature, theatre cinema.Vol:3.John Benjamins Publications. Philadelphia, North America.2002

[4.] Parzyan,Anahit. Article: The Importance of Paralanguage and Metamessages in n a Delivery of a Massage in Public Speaking.eJournal http://www.academia.edu/240278/The_Importance_of_Paralanguage_and_Metamessages_in_a_Delivery_of_a_Massage_in_Public_Speaking 16.08.09.

[5.] Dr. Paschalis_ Chliaras Article: The Role of Pragmatics in Communicative Approach Language Teaching Concepts 09/2012;

[6.] Dr. Paschalis_ Chliaras Article: The Role of Pragmatics in Communicative Approach Language Teaching Concepts 09/2012.

[7.] Rancière Jacques. "Ten Thesis on Politics." in: *Theory & Event.* Vol. 5, No. 3, 2001. (English).

[8.] Ranciere Jacques Dis-agreement: Politics and Philosophy, (Julie Rose trans., Minneapolis: University of Minnesota Press, 1999)v

[9.] Wu, C. & Shaffer .Susceptibility to persuasive appeals as a function of source credibility and prior experience with the attitude object. Journal of Personality and Social Psychology, 52 , 677-688. (1987).

Income Statement as Stakeholder's Value Driver

Working Capital Management - Enhancing Core Value

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ABSTRACT **- This paper establishes a theoretical perspective to appreciate elements of Income Statements as value drivers for various stakeholders within and out of an organization. Further paper maps these value drivers with respective stakeholders and argues their criticality in overall value creation. Upon this foundation the paper identifies that core value creation is reflected in an income statement between revenue and gross profit. This core value creation is a function of firm's credit policy, efficiency, inventory management and raw material sourcing. With financial perspective, paper identifies these operational and business strategies are knitted upon working capital management. Working capital management as starting point of core value creating strategy, paper discusses various perspectives abounding around it.**

Liquidity is a prerequisite to ensure that organizations are able to meet its short-term obligations and its continued flow can be guaranteed from a profitable venture. It has been well established by researchers that a decrease of 30% in working capital has increased profitability by 16%. Therefore a firm is required to maintain a balance between liquidity and profitability while conducting its day to day operations, to ensure minimal opportunity cost and adequate Cash Surplus. Further, paper assesses the effect of different corporate strategies on Working capital Management and its effects on the organization's profitability. As organizations are pushing for greater cash efficiency because of the current economic climate, it can mean a strategic advantage.

Research indicates that working capital management in different industries, significantly increase profitability; moreover, they have different elasticity. In light of these findings, we have segmented different sectors based on their requirements in working capital. We have identified three different strategies, which suit the specific industry needs. Thus better visibility and control over cash inflows and outflows, which in turn can reduce dependence on external source of funding. Finally, the paper analysis the trends followed in India and a comparative study with China in the SME, MSME space. This helps us understand, the working capital strategies which would help the organizations unlock the true stakeholder value. Thus, reducing costs and increasing profitability through efficient working capital management. The implications being crucial for organizations to improve the business climate in their respective industries. The paper comes with recommendations for the best practices to be followed, to optimize the use of working capital management.

I. OBJECTIVES

- To appreciate strategic importance of Income statement as stakeholder's value driver.
- To establish that Working capital Management is linked to core value creation.
- To relate specific specify business strategies for better WCM.

II. METHODOLOGY

- Data from secondary sources has been analyzed at length to reach logical conclusions.
- A Working capital model has been developed to relate the various WCM business strategies with increased profitability.

III. INCOME STATEMENT

A Stakeholder's Comprehensive value driver

Income statement has been an excellent reflect of financial performance of a firm. Financial analyst have been using income statement for investment decisions, gazing how well the firm is performing. Lesser emphasis has been laid on strategic view of income statement. This paper is an attempt to establish the strategic importance of income statement.

Income statement is a statement which shows how the obligation towards every stakeholder around the business is being met. These stakeholders include customers, labour, employees, debt providers, equity holders, management, government and economy as a whole. Therefore it can be stated that income statement, accounts for the value delivered to stakeholders, by the business activity during a period. This very perspective of an income statement changes the view of management from it being a mere account of income and expenses to an account of value delivered to various stakeholders. And this brings out the strategic importance of income statement which is in congruence to the core objective of any business – i.e. to maximize value for every stakeholder. The Basic Income statement consists of the Revenue or the sales which are earned from the goods delivered to the customers. We then subtract the cost of goods sold from the revenue to get the gross profit. Cost of goods sold broadly consists of value delivered to the employees and suppliers, through the employee cost and the raw material cost. And from the Gross profit, depreciation and amortization is deducted to reach what is known as the operating profit.

IV. WCM linked Business Strategies

Core value creation is a function of firm's credit policy, efficiency, inventory management and raw material sourcing. These business strategies are being affected or affect working capital management. Working capital requirement and its fluctuation can be regarded as an indicator of effectiveness of these business level strategies, or one can argue that working capital management is a controlling tool for them. Whatever may be the case, importance of none can be undermined. Therefore it is imperative to discuss both strategies that affect WC and WC that can be levered to drive these strategies. In this section we briefly discuss various business strategies and their impact on organizational efficiency and profitability. While in the next section we emphasize the connect of these strategies with WC and hence business value.

Business level decisions includes questions regarding:

a) Use of technology (effecting fixed and variable costs, efficiencies, process velocity etc);

b) Decisions regarding costing & raw materials etc;

c) Decisions relating process variables;

d) Credit and collection policies. Preceding text discusses these specific strategies; however compressive listing and analysis of such strategies is beyond the scope of this study.

A. Technological Advance:

Firms which are technologically advance in nature are more equipped with efficient solutions to new business challenges. Technology plays a very important role in identifying cost effective business solutions and hence improve profitability. Once, the firm becomes technologically mature the nature of the business simplifies and break down complex structure into simpler once. The firms across the industries should keep themselves technologically advance and efficient.

B. Cost efficiency

A cost leadership strategy is when the producer commands the least cost of production in the industry. Some firms sustain because of their advantageous positioning as a cost leader in the industry. This cost leadership is the result of better utilization of available resources and better management implementation.

C. Credit policy

The credit policy of the company also determines its profitability. The manufacturing industry in particular is very important. But the credit policy is driven by other factors such as market share, product demand and industry growth. Based on these parameter the credit policy may be skewed towards the supplier or customers.

D. Process Efficiency

The success to an efficient working capital management would be through a re-engineering of the processes followed in the firm. The processes include cash collection, payments to supplier and availing short term financing for better business delivery. These re-engineered processes would lead to:

1. A win-win for both supplier and producer.
2. A shorter cash conversion cycle.
3. A reduced cost of sales.
4. A certain cash flow at a predetermined time.

Thus the process efficiency is a requisite for effective working capital management. With constant re-engineering and improved process, the chances of a better management style and improved bottom lines.

Working Capital Management - Enhancing Core Value

Working capital refers to the firm's total current assets (the short-term ones), inventory, accounts receivable, marketable securities, and cash. Working capital management deals with day-to-day operations, by making sure that production lines do not stop due to lack of raw materials that inventories do not build up because production continues unchanged when sales dip, that customers pay on time and that enough cash is on hand to make payments when they are due.

Net Working capital = Current Assets - Current Liability.
A firm's value can only be enhanced in long term through efficiently managing their short term financing. Firms fail most often because they are unable to meet their working capital needs; consequently, sound working capital management is a requisite for firm survival. Now the objective of the firm is to maintain a NWC which does not block a huge amount, which could otherwise be utilized in various investments to reap better returns. The firm should also maintain an adequate level of NWC to meet any unwarranted short term obligation.
Every firm requires some amount of working capital. It is needed for following purposes-

1. To pay wages and salaries.
2. To provide credit facilities to customers
3. To purchase of raw materials, components and spares from the suppliers
4. To incur day to day expenses and other selling general and other administrative expenses.

Factors determining working capital requirements:
1. Size of business - *Economies of Scale.*
2. Nature of character of business - *pull or push based demand.*
3. Seasonal variations working capital cycle – *e.g. Beverages industry.*
4. Operating efficiency – *Application of JIT or Lean manufacturing.*
5. Profit level – *Cost efficiency*

Hence to optimize the Working capital required in a particular firm, we have three different strategies, which on implementation would lead to increased profitability.

V. CONCLUSION

1. Income statement is the key value driver for all the stakeholders in a profit oriented firm. And the paper

re-establishes this fact in light of the various stakeholders. The key to any increase in stakeholder value enhancement in bottom-line has to root through the income statement. Therefore paper suggests firms to develop and implement business level strategies with income statement as a strategic driver.

2. Business strategies according to the firm requirement, industry standards and market share drives better value to different stake holders. Hence any business strategy driven decision on the Working capital requirements would have a direct impact on the profitability of the company.

REFERENCES

[1.] MSME Share in GDP May Touch 10%'." Business News, Finance News, Stock Market, World Business, Financial Markets News Online. Web. 31 Mar. 2011. <http://www.financialexpress.com/news/-MSME-share-in-GDP-may-touch-10--/589711/>.

[2.] Income Statement Definition." *Investopedia.com - Your Source For Investing Education*. Web. 15 Mar. 2011. <http://www.investopedia.com/terms/i/incomestat ement.asp>.

[3.] Organization on Diet." *Gtnews: Home*. Web. 15 Mar. 2011. <http://www. gtnews.com/article/5644.cfm>.

[4.] Smaller Firms to Benefit from New Definition of SMEs - China.org.cn." China.org.cn - China News, Weather, Business, Travel & Language Courses. Web. 31 Mar. 2011. <http://www.china.org.cn/business/ 2010 10/27/content_ 2121 2569. htm>

Social Networking Media
A Unique Platform for Brand Promotion

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Abstract **- As world has now turned into a global village that has no boundary. Businessmen from all over the world use web and internet to communicate with the people. Today Internet is the media that has access to almost every part of world. In this, Social networking sites allow the friends and family to stay connected by sharing messages, photos, videos and a host of other information. Nowadays Social Networking Sites have become advertising shops. Companies open their account in this Social Networking Site and promote their brand, because they know that there are lots of traffic for advertisements and the promotion of their brand. In today's context, nothing can help in building a brand better than social networking. This paper tries to analyze the motive of companies behind using social networking sites as promotional tool, to find out the what extent to which the customers are made aware of brands through these sites, to study the success rate of companies who branding through social networking sites.**

I. INTRODUCTION

Twenty years ago, "branding" was focused on appearance. That time, no business had the ability to be in front of their target demographics 24/7 the way they do now through the use of Twitter, Facebook, YouTube, iPhones, smart-phones and other various outlets. Today's market is changing. Branding no longer means a logo and business cards. Branding means how your business lives and breathes. Now, it is about true value and emotion. It is about communicating the true impact you can have on others' lives through your services or products.

II. OBJECTIVES OF THE STUDY

1) To analyze the motives of companies behind using social networking sites as a promotional tool.
2) To find out to what extent the customers are made aware of brand through social networking sites.
3) To study the success rate of companies branding through social networking sites.

III. RESEARCH METHODOLOGY

1) Sampling techniques: Technique of convenience sampling has been used.
2) Target population: The target population varied from 18 to 50 years of age.
3) Information acquiring tecqniques: Information has been collected using secondary sources of information.

IV. SCOPE OF STUDY

This study reveals the contribution of social networking sites to promoting the companies and its brands. It shows the effectiveness of social networking sites in comparison to other advertising tools which are used. It will provide a clue to the company to select a suitable promotional media i.e. social networking sites to face the tough competition in the market.

V. SOCIAL NETWORKING SITES AS A PROMOTIONAL TOOL

Now days, business can't survive without an online presence. Social media is an umbrella term that defines the various activities that integrate technology, social interaction and content creation. It is used by millions of people all round the world. It is hard to find a person who does not have a profile on any social networking site. Websites like Twitter, Facebook, LinkedIn, YouTube, Friend Feed etc have proved so crucial for building a strong brand name. These sites are extremely helpful in promoting your site to the social media scene.

A. Seeking the Fundamental Objective: Increasing Brand Awareness

The primary reason why business professionals are interested in social media is because they want to appeal to their target audience through a popular medium. Consumers are increasingly using social networking sites, and business professionals want to increase awareness and exposure to the company's brand, product or service. Social media is an inexpensive and intuitive form of marketing to an engaged consumer community.

B. Creating a Coherent Campaign: Building Relationships

Social media marketing services provide wonderful opportunity to the marketers to connect with people who are still unaware about the business, brand or products and services. It is quickest form of marketing medium to connect with existing and potential customers. Social media marketing techniques are a great way of creating awareness about the products and services. Using these services, customers are always updated with latest business developments. Top social media marketing firms use options like link building and site building to create credibility among the target groups.

C. Brand Monitoring

Having a social media presence allows you to better understand what current and potential customers are saying about your product or services. Through active social media monitoring, you have the opportunity to address negative comments and correct false or inaccurate information about your brand. In order to monitor negative feedback, professionals should set up Google News Alerts, in which a

system will email every instance of the company name that shows up on the web.

D. Cost Saving:

Social networking is an inexpensive way to promote a company rather than putting together a huge marketing team or prohibitive budgets. Marketing the products through social networking websites is less costly than promoting the products through conventional methods, such as magazine advertisements, newspaper classifieds and television and radio commercials.

E. Helps in Increasing Sales:

Social media helps the many companies to stay in touch with their consumers. Social marketing plans expand the reach of the firms and make it much easier to receive client feedback which ultimately results into improvement in products and services and boosting the sales.

VI. WHAT EXTENT CUSTOMERS ARE MADE AWARE OF BRAND THROUGH SOCIAL NETWORKING SITES

It took radio 38 years to reach 50 million listeners. Terrestrial TV took 13 years to reach 50 million users. The Internet took four years to reach 50 million people. In less than 9 months facebook added 100 million users. (As per the Nielson Company report 2009)

Creating brand awareness is as tough as it can be. Now, there's this new trend that you can indulge into with a lower budget but without sacrificing the output that you deserve. It's called, social media marketing. Facebook, Twitter, YouTube, MySpace, and blogs are only some of the many platforms used in social media marketing.

Facebook bested Web giants Google, Yahoo and Microsoft in time spent online in the United States through 2010, with users spending 12.7 percent of their time at the social network Website. More than 500 million active users of facebook. and Orkut (100 million), or the micro-blogging site Twitter (which crossed 10 billion tweets recently) Linked In (50 million users). Social networking websites have given rise to a new era of global interconnectedness. Using social networking for business can bring real benefits for companies of all types and sizes.

Now days, people don't believe what company tell to them. They rarely believe what company shows them. They often believe what their friends tell them. They always believe what they tell themselves. Social networking sites include various phases as introducing a product, endorsing & stimulating it. These networking sites endorse product & hence act as brand endorser for various companies. These sites not only introducing the products & making the aware about its existence, but also playing a role of ladder to promote, endorse & stimulating the customer go for that product.

VII. SUCCESS RATE OF COMPANIES BRANDING THROUGH SOCIAL NETWORKING SITES

With the social networks there is no more middlemen, brands have now the unique opportunity to have a direct relationship with their customers. Building and managing a brand is an intense process and social media, in one way making it a bit more complex. But these new tools also create fantastic opportunities for brands. Following are the some examples of companies who achieved high rate of success through social sites:-

A. Starbucks: - From natural touch point to a successful social strategy

The first channel Starbucks launched was mystarbuckidea.com where people submit, comment on, & vote for their favorite idea. But rather than just put up the technology, it set out to ensure the departments impacted by site had a representative who was responsible for being the laison with customer. The success of mystarbucksidea.com helps the starbuck manager to understand that each channel is different & required developing different facets of the relationship with their audience. Starbucks has over 705,000 followers on twitter and over 5,428,000 fans on Facebook.

B. The Coca-Cola company's:- Groundswell Award Entry – Energizing Category

The Coca-Cola Facebook Fan Page was created by Fans for Fans. In fact, when Fans Dusty and Michael created the Page, they broke Facebook rules by positioning themselves as brand representatives, a common problem for many social media platforms and brands. Coca-Cola solicits content from Fans and highlights Fan favorites on the Page. All of these activities drive more new Fans to sign up and declare their love for the Coca-Cola brand, energizing the community around this favorite product. At the time of this submission, the Coca-Cola Fan Page has 3,662,191 Fans. The amount of Fans grows every single hour, every single day. In July alone, Coca-Cola spoke to its Fans 15 times via various formats (Status Updates, Wall Posts, Photo Posts, or Notes), and as a result of these Fan connections, the Page saw a total of 82,228 "likes" and 8,187 comments.

VIII. CRITICAL SUCCESS FACTORS FOR COMPANIES IN SOCIAL NETWORKING SITES

Brand seems to gradually become familiar with social network & the importance & the opportunities offered by this "tool", for targeting all demographic groups, reach old customers, gain new ones & build or maintain credibility and reputation among consumers seem to be quit well understood.

Most brands still think that monitoring their brand awareness through social networks can just be resumed as putting up a Facebook page dedicated to their brand, creating a corporate twitter account or launching a viral video. It's definitely not enough and even if in some case company succeed and create a Buzz it will still be "tatics" and the results they will get will still apply only in a short time. Most brands still choose a tool before defining their strategy. Tactics (Facebook, MySpace campaigns, Twitter account, Blogs, You tube Channels…) should come after building a solid foundation of brand image, personality and engagement online.

IX. LIMITATIONS OF THE STUDY

Time constraint was the major limitations in the study. Further small sample size was also a limitation in this study.

X. FINDING OF THE STUDY

1. In today's world Social Media Marketing is one of the most powerful weapons by which a company can sell their product with proper strategy and plans that will get them links, attention and more amounts of traffic.
2. Facebook, Twitter, Myspace etc. are some of the good social networking sites where advertisers can get good and handsome traffic for their brand.
3. There is no other low cost promotional method which can give you more visitors and feedbacks.
4. With the power of word of mouth brought by social networks, campany's can no longer over-promise/be fake. Lies can get caught and be spread hundred times faster online.
5. Social media allows you to reach very specific subsets of individuals based on their personal preferences and interests.

XI. CONCLUSION

The digital social world is a fast moving space where companies are not immune to a bad buzz that would undermine the company's image. The company's should always stay alert. Negative comments are, as well as positive ones, inevitable. The companies don't make the mistake of ignoring them. It is an inexpensive measure that aids a company to meet its ultimate goal of creating brand awareness. By using some simplest tools of promotions and through some well-planned strategies, an organization can penetrate the targeted customer base, ensure more traffic and at the end, derive the best result, in Related Coverage.

REFERENCES

[1] Allen, Leslie. "Social media: Say 'hi' before 'buy'." Automotive News 23 Nov. 2009: Research Library, ProQuest. Web. 21 Feb. 2010.

[2] Allen, Leslie. "The biggest sin: Don't let your Facebook fans get bored." Automotive News 23 Nov. 2009: Research Library, ProQuest. Web. 22 Feb. 2010.

[3] "Car Talk: Ford, Social Media and Me. " MarketingProfs Daily Fix [MarketingProfs Daily Fix –BLOG] 15 January 2010 Research Library, ProQuest. Web. 21 Feb. 2010.

[4] Connor, Angela. "Does Social WORK? Measuring Community Effectiveness." EContent 1 Jan. 2010: Research Library, ProQuest. Web. 22 Feb. 2010.

[5] Dumenco, Simon. "Be honest: What's your real Twitter and Facebook ROI?" Advertising Age 11 Jan. 2010: Research Library, ProQuest. Web. 21 Feb. 2010.

[6] "GOSO; Automotive Dealer Study Reports an Increase in Social Media Activity." Journal of Transportation 27 Feb. 2010: Research Library, ProQuest. Web. 21 Feb. 2010.

[7] Hall, Chris. "Socially Adept: Social media has become an essential marketing tool for connecting with clients, colleagues and centers of influence. here's what you need to know." Financial Planning 1 Dec. 2009: Research Library, ProQuest. Web. 21 Feb. 2010.

[8] Harris, Angela. "Contractors Market With Social Media. " Air Conditioning, Heating & Refrigeration News 21 Dec. 2009: Research Library, ProQuest. Web. 21 Feb. 2010.

[9] "Listen, Learn, Adapt: Harnessing The Growing Power of Facebook." PR News 25 Jan. 2010: Research Library, ProQuest. Web. 21 Feb. 2010.

[10] Palmer, Kimberly. "Talking to Gen Y about the New Culture of Thrift: Companies fumble as they try to appeal to 20-something consumers." U.S. News & World Report 1 Mar. 2010: Research Library, ProQuest. Web. 22 Feb. 2010.

[11] Soat, John. "7 Questions Key To Social Networking Success." InformationWeek 18 Jan. 2010 : Research Library, ProQuest. Web. 21 Feb. 2010.

Workplace Diversity a Vigorous Gain in this Globalized Era

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Abstract **- This paper constitute and attempts to heave light on one of the major wavering blocks in the field of human resource management i.e. workplace diversity. All the organizations in this global epoch incident diversity among individuals as they look around: race, gender, traditions, nationalized origin, sexual orientation, age, religion, language, outer shell, marital status & qualification. This paper illustrates how hiring people from assorted backgrounds can support organizations to face taut rivalry in this era as they prove to be an asset and backbone of any organization. The review reveals the optimistic and pioneering aspects generated by the diverse workplace i.e outside the package. This research indicates that diversity enhances individual yield, organizational efficacy and unrelenting achievement.**

Keyword - HRM(Human Resource Management); Workforce Diversity.

I. INTRODUCTION

Driven by a number of significant internal and external environmental forces, HRM has progressed from a largely maintenance function, with little if any bottom line impact, to what many scholars and practitioners today regard as the source of sustained competitive advantage for organizations operating in a global economy. As "we do live in a world in which knowledge, rather than physical capital, is increasingly important, we need smart people who can do great things—increase productivity, build new products and services—and do so even more quickly" (O'Reilly and Pfeiffer 2000). Researchers emphasize the role of employees for achieving enterprise goals (Boudreau 1997; Baird and Meshoulam 1988), and that the employees are the most important enterprise asset (Quinn 1992; Mayo 2001).

Globalization is not just a recent phenomenon. Some analysts have argued that the world economy was just a globalized 100 years ago as it is today. Yet the term is used since the 1980's, reflecting technological advances that have made it easier and quicker to complete international transactions, both trade and financial flows. Short-term partnerships between multinational firms are also becoming increasingly common as are corporate 'buyouts' of potential competitors on foreign markets (Lei and Slocum, 1992). At the same time, international careers are becoming more common features of the working lives of professionals and managers all over the world. And, increasing numbers of graduates world-wide are now pursuing transnational career opportunities. All these authors argue that Globalization refers to an extension beyond national borders of the same market forces that have operated for centuries at all levels of human economic activity (village markets, urban industries, or financial centers). It means that world trade and financial markets are becoming more integrated.

At a business level, we talk of globalization when organization decides to take part in the emerging global economy and establish themselves in foreign markets. First they will adapt their products or services to the customer's linguistic and cultural requirements. Then, they might take advantage of the internet revolution and establish a virtual presence on the international market place with a multilingual corporate website or even as an e-business. Overall, globalization requires a combination of linguistic, engineering and marketing knowledge that is not easily available. (Sparrow, Paul, R, 2006).

II. HUMAN RESOURCE MANAGERS: THEIR ROLE IN A CHANGING ENVIRONMENT

Issues facing HR are expected to change dramatically in the next decades. Thus, HR professionals must play special roles in dealing with these changes and must develop specific competencies to support these roles. Workplace flexibility is expected to be on the rise as the future workplace, the 'virtual office' is characterized by creative and flexible work arrangements. As more employees work off-site-up to two thirds of an organization in the 21st century – there will be an increase in emphasis on performance and results as opposed to the number of hours worked. In addition, off-site employees can expect to attend fewer meetings. Specified work will become much more collaborative and management will spend nearly all its time managing cross-functional work teams who enjoy a lot of autonomy. In essence, there will be a movement, a trend towards a decentralized model of HR.

HR managers will have to accommodate employees in their virtual work locations and find ways to manage corporate culture, socialization and employee orientation. In order to obtain and maintain a competent workforce, they must act as organizational performance experts and shape employees behavior without face to face meetings. Globalization will impact HR managers by requiring new skills such as language capabilities. For e.g., in order to recruit employees from other cultures, HR managers will either have to learn new languages or else they will certainly have to have foreign speakers on staff. But in order to facilitate communication among people coming from a wide range of language backgrounds, in most multinationals, it is preferred to speak English. Organization must take into account cultural differences that shape managerial attitudes, when developing multinational management programs. For e.g., British managers value individual achievement and autonomy, whereas French managers appreciate competent

supervision, fringe benefits, security and comfortable conditions, while Indian managers gives more importance of their culture and tradition.

Training and development is another area. In the IT industry training takes on a new connotation. It is not just about identifying training needs and giving the required training. It is foreseeing and anticipating the requirements and developing suitable training so that the employees are well-equipped to handle the challenges.

Another major challenge is how we are able to incorporate all the sub-systems in HR and help them in achieving the ultimate goal – exceptional performance. People have to be groomed to get in tune with the performance culture. Creating an environment that stimulates the creation of knowledge and its sustenance throughout the organization is big challenge. No longer can the HR department carry on with its traditional functions. However, Human Resource Information Systems (HRIS) is to be put in place – to build and sustain a performance – driven culture. The role will shift to that of facilitator. HR will have to involve the whole organization in this process and act as a counselor and that is the most gingatic change that the HR of any company faces.

III. CHANGES IN FUTURE HRM DUE TO DYNAMIC ENVIORNMENT

Some of the significant changes that are likely to take place in the human resource management as a result of the dynamic nature of today's business enviornment are summerized as follows:

1. Increase in education levels: Due to technological progress and the spread of educational institutions workers will increasingly become aware of their higher level needs; managers will have to evolve appropriate policies and techniques to motivate the knowledge of workers. Better educated and organized workforce will demand greater discretion and autonomy at the work place.
2. Technological developments: This will require retraining and mid-career training of both workers and managers. Rise of the international corporation is proving new challenges for personnel function.
3. Changing composition of work force: In future, women and minority groups, SCs and STs would become an important source of man power in future on account of easy access to better educational and employment opportunities. Therefore manpower planning of every organization will have to take into consideration the potential availability of talent in these groups.
4. Increasing government role: In India, personnel management has become much legalized. In future private organizations will have to co-ordinate their labour welfare programmes with those of the government private sector will be required increasingly to support government efforts for improving public health, education training and development and infrastructure.
5. Occupational health and safety: Due to legislative presence and trade union movement, personnel management will have to be more healthy and safety conscious in future.
6. Organizational development: in future, change will have to be initiated and managed to improve organizational effectiveness. Top management will become more actively involved in the development of human resources.
7. New work ethics: greater forces will be on project and team forms of organization. As changing work ethic requires increasing emphasis on individual. Jobs will have to redesigned to provide challenge.
8. Development planning: personnel management will be involved increasingly in organizational planning, structure, composition etc. Greater cost-consciousness and profit-orientations will be required on the part of the personnel department.
9. Better appraisal and reward systems: organizations will be required to share gains of higher periodicity with workers more objective and result oriented systems of performance, appraisal and performance linked compensation will have to be developed.

IV. CONCLUSIONS

Over the last 20 years, the workplace has changed in more ways that one could have ever imagined, resulting from the increase in technology, innovation and globalization. The next decade will bring even greater change, impacting all facets of the workplace, including major changes for the HR department and HR managers. In order to respond to the demands of globalization, HR managers will require new skills and competencies relating to language and culture, technology capabilities to facilitate overseas communication, methods to measure and quantify effectiveness and evaluate strategies and return on investment. Evidently, these new skills and competencies will result in an emerging new role for HR managers, requiring them to be strategic business partner, supportive of the overall corporate strategy.

REFERENCES

[1] Baird, L., Meshoulam, I. (1988), "Managing two fits of strategic human resource management, *Academy of Mnagement Review*, 13 (1), pp. 116-128.

[2] Boudreau, J.W. (1996), "Human resources and organization success", *Human Resource Management Journal*, 6 (3), pp. 75.

[3] Czebter, Anamaria, (2002), "Labor market and Gloablization: Human Resources management in global enterprises", Centre International de Formation Europeenne, Nice

[4] Lado A.A., Wilson, M.C. (1994), "Human Resource Management and sustained competitive advantage: A competency based perspective", *Academy of Mnagement Review*, pp. 699-727

[5] Mayo, A. (2001), "Human Value of an entreprise: Valuing people as assets: monotroing, measuring, managing", London: Nicholas Brealey

Effective Organizational Change Management

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Abstract - The issue of managing organizational change is of key importance within management theory and practice. A number of cases have shown that attempts to 'manage' organizational change frequently failed. Therefore the objective of this paper is to find why does the failure almost occur? Additionally, this papers objective is to provide discussion and find reply on the following questions: Which specific aspects of change are currently impacting most on practicing managers? How do they react to change? How are they dealing with them? And how successful are their attempts? How do the problems identified and solutions described, relate to the theory and research on organizational change? What kind of organizations are the most adopted to changes? The findings suggest that most companies' operational strategies and structures reflect past business realities—making organizational inertia one of the most significant obstacles to change. However, it is noted that leadership and management skills, such as visioning, prioritizing, planning, providing feedback and rewarding success, are key factors in any successful change initiative.

Keywords: Organizational change, management, managers, small business

I. INTRODUCTION

The increased pace of change over the past ten years has been dramatic. Competition has heated up across the board. To succeed, the organization of the future must serve customers better, create new advantages and survive in bitterly contested markets. To stay competitive, companies must do away with work and processes that don't add value. This hyper competition has invalidated the basic assumptions of sustainable markets. There are few companies that have escaped this shift in competitiveness. Entry barriers, which once exerted a stabilizing force on competition have fallen in the face of the rapid changes of the information age. These forces have challenged our capacity to cope with organizational life required. Managing change effectively requires an understanding of the variables at play, and adequate time must be allowed for implementation.

II. MANAGING ORGANIZATIONAL CHANGE

What Are Organizational Change and Organizational Change Management?

Change has several meanings, but for the purposes of this paper, change—or, more precisely, organizational change—will be defined this way: Organizational change is the implementation of new procedures or technologies intended to realign an organization with the changing demands of its business environment, or to capitalize on business opportunities. In addition, organizational change management is the process of recognizing, guiding, and managing these human emotions and reactions in a way that minimizes the inevitable drop in productivity that accompanies change. Organizations have to deal with new technology, and with upgrades for existing technology. They have to cope with reorganizations, process improvement initiatives, and mergers and acquisitions. Which specific aspects of change are currently impacting most on practicing managers? How do they react to change? How are they dealing with them? And how successful are their attempts? How do the problems identified and solutions described, relate to the theory and research on organizational change? Mergers, acquisitions, new technology, restructuring and downsizing are all factors that contribute to a growing climate of uncertainty. The manager who moves straight into why the change is best for everyone and how business is going to be conducted disregards the human nature element - the emotions that are normal and natural for anyone feeling threatened by change to feel. At every step in the process of implementing an organizational change, a good manager will ask him/herself "How might I react to these changes "?As the organization implements the changes though, the reality of the change becomes present and employees may either resist the changes or start to adjust to the changes depending on the person. The employee who continues to resist, remains angry and is labeled as "difficult" is feeling more threatened and may need some one-to-one time with the manager to discuss the changes or at some point, may need clarification from the manager about performance expectations in light of the changes. There are external and internal triggers for organizational change. External triggers include: developments in technology; developments in new materials; changes in customers' requirements and tastes; the activities and innovations of competitors; new legislation and government policies; changing domestic and global economic and trading conditions; shifts in local, national and international politics; changes in social and cultural values. Internal triggers include: new product and service design innovations; low performance and morale, triggering job redesign; appointment of a new senior manager or top management team; inadequate skills and knowledge base, triggering training programmes; office and factory relocation, closer to suppliers and markets; recognition of problems, at triggering reallocation of responsibilities; innovations in the manufacturing process; new ideas about how to deliver services to customers. Top management's actions are usually reactions to some outside force, such as stiffer competition, shifts in the marketplace or new technology. It is important to realize that change is a key to surviving and growing in today's global economy. Without change we would run the risk of becoming stale and unresponsive. The challenge we face is to learn to move through this wave of transition as easily and creatively as possible. The organizations that succeed at change do so by considering the people who are affected by, will have to live with, and are often crucial to effecting the change in question. Even better, not only does managing the human aspects of an

organizational change initiative help ensure the successful implementation and use of the technical solution, it sets the groundwork for implementing future solutions. As organizations seek to implement new technology and take other actions to keep themselves competitive in their chosen markets, they must ensure that the changes they implement achieve the full scope of their technical, financial, and human objectives. This is the ultimate objective of the organizational change management process: to ensure that tactics for addressing human reactions to change are fully integrated with other aspects of the implementation in order to achieve the full scope of objectives intended by the initiative. The outcomes of effective organizational change management can have positive, bottom-line impacts.

III. ORGANIZATIONS MOST ADOPTED TO CHANGES

Many entrepreneurs are recognizing the opportunities that this process offers and gaining access to global markets has become a strategic instrument for their further development. Access to global markets for small businesses can offer a host of business opportunities, such as larger and new niche markets; possibilities to exploit scale and technological advantages; upgrading of technological capability; ways of spreading risk; lowering and sharing costs; and in many cases, improving access to finance. Gaining access to global markets can help prospective high-growth firms realize their potential and are often an essential strategic move for SMEs with large investments in intellectual property. To prosper, SMEs need a conductive business environment and regulations, adequate basic infrastructure services, access to short and long-term funding at reasonable rates, equity and venture capital, advisory assistance, and knowledge about market opportunities. In spite of many companies engender a desire to win, but people in high-performance organizations know what winning looks like. They know that companies need talented people with the global mindset, competencies and commitment to execute strategy both today and in an increasingly unknown future. However, this economy relies on the need of good informing and applying the best.

Table 1. Outcomes of Effective Organizational change management (OCM)

OCM Outcome	Bottom-Line Impact
Visible, consistent support for the change (less resistance)	Reduced project contingencies
Implementation plans that accurately and proactively identify and address change-related disruption	Closer adherence to project timeframes and budgets
Greater implementation speed because of reduced resistance from end-users, and increased capabilities for successfully interacting with technical solutions	Momentum necessary for selling and implementing follow-on versions of technology solutions
Alignment of change with existing organizational structures and systems	Greater customer satisfaction and an increase in customer referrals leading to a competitive advantage

Therefore, small businesses managers now face permanent task to gain knowledge and continual examination of competition all around the world. Besides that, they have to accept the fact that employees, stuff and manager team together make business formula of success which should find market, meet customers' demands and offer products and services at the lowest prices possible.

For small businesses, according to this and other experts, the use of modern technology is extremely important for these companies because they largely depend on them. Therefore, small businesses existence in new economy is directly related to new technologies. The challenge which new economy brings to small businesses managers is the use of new technologies and completely new and non-traditional competition on the market. Namely, new technologies enable larger competition which is on the global market. Therefore, a key to success in understanding customers' expectations in advance in terms of price and product quality, that is, what the customers are and what are not willing to pay. Also, it is very important to be flexible in product delivery. Due to internet use, delivery costs are significantly reduced as well as gathering all the necessary related information. For example, only five or six years ago, information about recommendations for buying and selling certain products were send through post mail and they were waited for several days. Now they are sent either over cellular phones through SMS or over internet through emails messages which are delivered almost instantaneously. Small businesses managers' and entrepreneurs desire to share knowledge and to apply business concept widely accepted form all stakeholders in organization are of great importance. A strategic alliance is formed among entrepreneurs in order to find the best business model, often a technical analysis is conducted, different investment ideas are examined and all for the sake of maximizing profit or income, but to minimize losses at the same time. Namely, regardless of the industry or type of business, strategic alliances are the best way for a company to compete and succeed in today's networked economy. But building a strategic alliance and making it work are not easy. The principles for developing that competence apply to any type of alliance. Strategic alliances are critical to organizations for a number of key reasons:

1. Organic growth alone is insufficient for meeting most organizations' required rate of growth.

2. Speed to market is of the essence, and partnerships greatly reduce speed to market.

3. Complexity is increasing, and no one organization has the required total expertise to best serve the customer.

4. Partnerships can defray rising research and development costs.

5. Alliances facilitate access to global markets.

Much has been written about the power of strategic alliances. However, a balanced perspective is critical. In recent years, there has been an explosion of alliances around the world and across industries. For example:

1. In an effort to establish itself as a force in European and Japanese markets, the Nasdaq formed a joint venture with SSI Technologies of India to develop an Internet based trading and market system to launch Nasdaq Europe and Nasdaq Japan.

2. In February 2001, The Coca-Cola Company and Procter & Gamble announced a $4.2-billion (all currency in U.S. dollars) joint venture to use Coca-Cola's huge distribution system to increase reach and reduce time to market for the P&G.

3. EPOST was the world's first national, secure electronic mail delivery system, an alliance between Bank of Montreal and Canada Post Corp. This partnership connects billers and users in an efficient and secure environment.

4. Star Alliance is the largest partnership in the airline industry; its reach extends to 130 countries and more than 815 destinations, with collective revenue for the partnership at more than $63 billion.

5. Hewlett-Packard and NTT DoCoMo created a partnership to conduct joint research on technology for fourth generation mobile phones, bringing together HP's network infrastructure and computer servers with DoCoMo's wireless broadband technology.

Finally we can conclude that innovative and winning company's position has to respond rapidly as new opportunities for competitive advantage emerge:

• Teams are structured so that skills can be quickly added and employees are empowered to work collaboratively across functions and networks of partners.

• Organizational structures and management systems can be created or realigned without hesitation.

• Enabling business technologies are applied carefully and are driven by end users, not technologists.

• Processes are streamlined end to end, and form the basis for ongoing adaptation of

Work practices.

• Developing and executing solid communication plans can help organizations in the digital drive survive and thrive in today's changing business environment

• States that the ability to manage change is now recognized as a core Organizational competence

IV. CONCLUSION

The rate of organizational change has not slowed in recent years, and may even be increasing. The rapid and continual innovation in technology is driving changes to organizational systems and processes. Many companies spend a lot of time and effort to accept new economic trends, while others adopt them easily. New business imperatives call for new organizational behaviors. Globalization has seen the tearing down of previous international market barriers. It is no wonder that relentless change has become a fact of organizational life. Unfortunately, most companies' operational strategies and structures reflect past business realities—making Organizational inertia one of the most significant obstacles to change. This failure almost occurs for a number of reasons, like the following:

• Absence of a change champion or one who is too junior in the organization

• Poor executive sponsorship or senior management support

• Poor project management skills

• Hope rested on a one-dimensional solution

• Poorly defined organizational objectives

• Change team diverted to other projects

Failed organizational change initiatives leave in their wake cynical and burned out employees, making the next change objective even more difficult to accomplish.

It should come as no surprise that the fear of managing change and its impacts is a leading cause of anxiety in managers.

At the end it can be concluded that we should further recognize that we are living in the globalization era, or the Global Age. According to this statement it must be clear that the new economy sets new standards of success and opportunities for small businesses which are related to forming strategic alliance, new technology use, experiences and knowledge exchange among entrepreneurs and similar. Leadership and management skills, such as visioning, prioritizing, planning, providing feedback and rewarding success, are key factors in any successful change initiative. This is something that small businesses must not ignore in the future.

REFERENCES

[1.] Galpin, Timothy, Connecting Culture to Organizational Change, Spages.

[2.] Geoff Baum, issue of Forbes ASAP Kotter, J.P., Leading Change, Harvard, Business School Publishing, Boston, MA, Vorbach,A, Small to Medium Business: The New Economy, University of Technology in Sydney.

Business Potential in Upcoming Field: Biotechnology

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***Abstract*-Seed is the single most *important input* in crop production and considered to be a catalyst of change in agriculture. Good quality seed alone increases the yield by 15-20 per cent. Biotechnology can play a key role in the massive production of improved crop varieties as well as in their genetic improvement. Plant tissue culture is the first commercially exploited plant biotechnology innovation. Sugarcane is an important commercial multipurpose crop. Healthy seed cane supply is the lifeline in the productivity of the sugarcane. The advantages of tissue culture based seed production are well appreciated and the technology has been well adopted. A three - tier seed production system using tissue culture seedlings helps achieve higher productivity. The advantages of using tissue culture planting material have been realized by the sugarcane growers and the sugar industry. This technology has been identified as a separate enterprise and promoted among many nursery growers.**

Keywords: Biotechnology, Tissue culture, Sugarcane, Sugarcane Nursery Business

I. INTRODUCTION

Agriculture sector is the backbone of country's development. Approximately 58 percent of the Indian population still dependent on agriculture for their livelihood. Large part of an agricultural land it is being used to develop infrastructure for increasing population due to which agricultural land is shrinking. Therefore, the millennium challenge is to produce more food from less land.

To meet current and future demands in agriculture and production, it is important to adopt new technologies that ensure optimum results.Technological interventions shall increase food production many morefolds. Use of improved direct inputs such as seeds, plant material, fertilizer sand pesticides helps to increase yield of crop. Crop production could be increased by use of quality seeds of high yielding varieties and by judicious use of appropriate technologies for value addition. Radical changes in agricultural inputs over the past century made this increase possible.

Seed is a material which is used for planting or regeneration purpose. It is an important input for increasing agricultural production and considered to be a catalyst of change in agriculture. It is the starting point of agriculture and dictates ultimate productivity of other inputs. Good quality seed alone increases the yield by 15-20 per cent. There is vast scope to produce and distribute quality seeds

II. BIOTECHNOLOGY

Biotechnology is broadly defined as any technique that uses live organisms viz. bacteria, viruses, fungi, yeast, animal cells, plant cells etc. to make or modify a product, to improve plants or animals or to engineer micro-organisms for specific uses. Biotechnology can be used to meet the growing demand for food by improving yields, improving the nutritional quality of crops and reducing the impact on the environment. It can play a key role in the massive production of improved crop varieties (through in vitro tissue culture followed by clonal propagation), as well as in their genetic improvement.

A. Benefits of Biotechnology in Agriculture:

- Increased crop productivity- Incorporation of the technologies like marker-assisted breeding and biotechnology traits into crop improvement programs help to increase the rates of gain.
- Enhanced crop protection- Genetic engineering has the potential to provide an enhanced ability to withstand or resist attack by plant pathogens. Genetically engineered plants resistant to plant pathogens can prevent crop losses and reduce pesticide usage.
- Improvements in food processing-Biotechnology can be used for improvement of existing methods of food processing. It can produce top-quality foods with a reduced need for additives and can also reduce the environmental impact of food processing.
- Improved nutritional value- Advancement in agricultural biotechnology has developed technologies to correct the deficiency and improvement of the nutritional quality of food crops.
- Better flavor- Biotechnology can deliver complex flavors both as fermentation products and single constituents. It is also playing an increasingly important role in the breeding of food crops for enhanced flavor.
- Fresher produce- Second generation biotech foods promise to provide consumers with products that stay fresh longer. Scientists have been working to delay fruit ripening so that farmers will have the

flexibility in marketing their goods and ensure consumers of "fresh-from-the-garden" produce.

- Environmental benefits- Agricultural biotechnology provides environmental benefits by:
  - Production of disease resistant crops that need fewer applications of pesticides
  - Increasing the yields, thereby reducing pressures to force more land, often marginal and highly erodible land, into production.
  - Producing herbicide tolerant crops that allow the use of no-till farming practices, enhancing soil moisture content and reduced soil erosion.

B. Business Potential in Biotech

In India, the biotechnology is one of the fastest growing knowledge-based sectors and is expected to play a key role in shaping India's rapidly developing economy. It has been considered as a powerful enabling technology that can revolutionize agriculture.

Plant tissue culture is the first commercially exploited plant biotechnology innovation.It is a key tool of plant biotechnology that has been extensively exploited to meet the growing demands for elite planting material in the current century. The technique of plant tissue culture may play a key role in the "Second Green Revolution'' in which biotechnology and gene modification are being used to improve crop yield and quality.There exists a large demand for disease free clones of superior quality plants in ornamental, horticultural, floricultural and agro-forestry sectors, which form the core sectors of agriculture.

Tissue culture involves the use of small pieces of plant tissue (explants) which are cultured in a nutrient medium under sterile conditions. Using the appropriate growing conditions for each explants type, plants can be induced to rapidly produce new shoots, and, with the addition of suitable hormones produce new roots. These plantlets can also be divided, usually at the shoot stage, to produce large numbers of new plantlets. The new plants can then be placed in soil and grown in the normal manner.

III. SUGARCANE TISSUE CULTURE

Sugarcane(*Saccharum sp*.L.)is an important commercial multipurpose crop that provides sugar and a myriad of by-products/co-products with ecological sustainability, given that it is also a renewable, natural agricultural resource. It is the main source of sugar in India and holds a prominent position as a cash crop and good planting material contributes to higher yields.

Availability of disease and pest-free, true to type planting material is an important prerequisite for achieving the desired yield improvement. Sugarcane, being a vegetative propagated crop has a low 1:6 to 1:8 seed multiplication rate. Hence, non-availability of quality seed material is one of the major problems faced by farmers. Healthy seed cane supply is the lifeline in the productivity of the sugarcane. Since the disease is carried to the planting material and sugarcane, it is very important to maintain the healthy cane supply system for improving / sustaining the productivity.

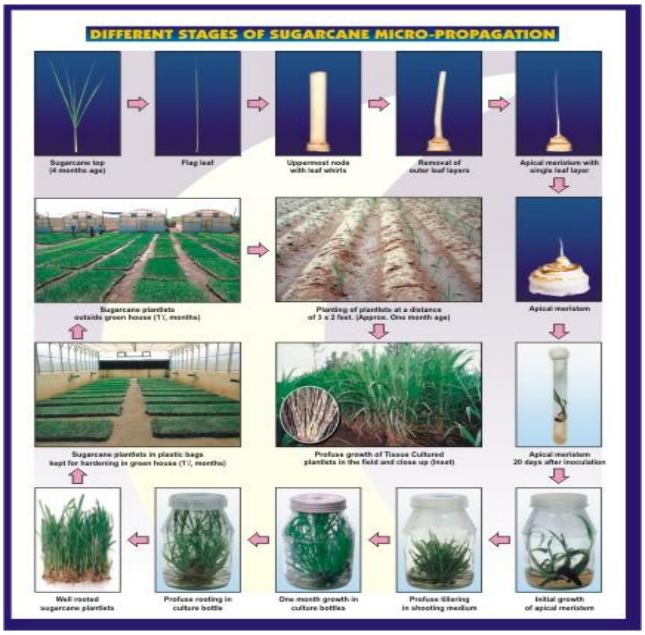
Seed multiplication of newly released varieties of sugarcane is one of the major constraints. Due to limited availability of seed cane of a new variety at the time of its release, it further takes about 8-10 years to cover the desired area for commercial cultivation, by the time the variety starts.It has been realized that the growing demand of seed cane material of newly released varieties could not be fulfilled in time only by the conventional methods of plant multiplication. Therefore, the use and exploitation of biotechnologies are quite essential for fast multiplication of newly released varieties.

An efficient protocol for tissue culture of sugarcane using meristem explants has been developed by various research institutes. The planting material obtained by tissue culture is genetically pure, disease and pest free. Therefore there is no need of giving hot water treatment or moist hot air treatment to the planting material.

A. Advantages of the use of tissue culture plantlets;

1) Genetic purity ensured.
2) Growth of the crop will be vigorous and the maturity will also be earlier compared to normal method.
3) Higher seed multiplication ratio under field condition.
4) Disease and pest freeness.
5) High yields about 25-50 % higher yields can be obtained.
6) The seedlings are placed at a depth, which will be always moist, hence, in case of drought, or non-availability of water, the yields will not get affected.
7) Spread of only specific desired varieties in the area of particular sugar factory.
8) Uniform cane maturity.
9) It gives better ratoon crops and has also been found useful under saline water irrigated conditionsand saline soils.

B. Different Stages of Sugarcane Tissue Culture:



IV. TISSUE CULTURE BASEDSUGA|RCANE SEEDRODUCTION SYSTEM

The advantages of tissue culture based seed production are well appreciated and the technology has been adopted with success in several countries. A three - tier seed production system using tissue culture seedlings,comprising breeders' seed, foundation seed and commercial seed production as detailed below is ideally followed.

A. Breeders seed production:

Tissue cultured plantlets are used for production of Breeders seed. Breeders' seed production is done in scientifically supervised farms of research stations or State seed farms or research and development farms of sugar factories.

B. Foundation Seed Production:

One eye bud setts from breeders' seed nursery are used for planting foundation seed nursery.

C. Commercial Seed Production:

Setts (one eye bud or two eye buds) obtained from foundation seed crop of sugarcane are used for planting commercial seed nurseries.

Table 1.Comparative area Coverage

Stage of Production	**Conventional (Without Heat Therapy Treatment)**	**Conventional (With Heat Therapy treatment)**	**TCP as Breeders Seed**
1. Breeder's Seed Nursery	1 ha	1 ha	1500 plantlets
2. Foundation Seed Nursery	10 ha	5 ha	10 ha (Stage I)
3. Certified Seed Nursery	100 ha	50 ha	250 ha (Stage II)
4. Commercial Sugarcane Crop	1000 ha	500 ha	2500 ha

V. USINESS OF SUGARCANE NURSERY

Income generation is the most important issue for a farmer today as several agriculture produces do not get a good price and marketing facilities are not always readily available. If proper technology is provided on time and implemented with the combination of market avenues it can lead to profitable farming.The biotechnology commercialization sector has rapidly emerged globally as a potential source of commercial benefits.

Farmers are generally using 3 eye budded setts for planting in which 9-10 tons/ha canes are required as seed material. Butin one eye bud seedling method only 2.0 tons/ha canes raised from tissue cultured seedlings are sufficient. Here seedlings are raised from eye buds in the nursery and then transplanted in the field. The seed nursery method of planting is more advantageous than general method of planting. The cost can be reduced by 36% than the general method of planting. The labor can be reduced.

An appropriate site, an assured water source, materials like plastic trays, coco-pith/saw dust, sieved Farm Yard Manure (FYM), gunny bags, polythene sheets and rose watering cans are necessary for setting up the sugarcane nursery. Young seedlings are raised in the nursery in a shade net. It is a fully covered structure meant to provide shade and create other favorable conditions like warm and wind free environment.

One eye buds are obtained from tissue cultured sugarcane crop and its planting is done in polybags. When the seedlings are of about 6 week old, they are transplanted in the prepared main field.There is increase in yield up to 20 to 25% in the commercial crop due to higher number of mill able canes.

This technology has twin advantages. For the farmers it helps achieve higher productivity, better return and

saving on water, electricity and labor. For the sugar factories it ensures higher recovery, increase in crushing days and additional employment.

Several sugar factories, research organizations, agricultural universities and private entrepreneurs have set up facilities for sugarcane tissue culturein order to produce the high quality seedlings and meet market demand. The Government of India also provides financial assistance to various organizations to set up commercial tissue culture facilities. The tissue culture based seed production technology is also widely accepted by the farmers who have obtained higher seed yield. Sugarcane tissue culture facilities have been developed in both private and public sectors. The largest facility having a capacity to produce two million tissue culture seedlings per annum has been set up by Vasantdada Sugar Institute, Pune.

The advantages of using tissue culture planting material have been realized by the sugarcane growers and the sugar industry of Maharashtra. This technology has been identified as a separate enterprise and promoted among many nursery growers. This helps farmers by reducing their costs of cultivation while enhancing their crop productivity in a sustainable manner.

Sugarcane seed nursery is good business and numbers of entrepreneurs have started sugarcane nurseries and they are supplying good quality planting material to the farmers. Information about some of the nurseries is as below-

1. PARAS SUGAR-CANE NURSERY
Prop :Sagar Mahaveer Galage
Location :Dattawad, Tal-Shirol
Dist : Kolhapur, Maharashtra, India-416107.

2. KUMBHAR SUGAR-CANE NURSERY
Prop :MukundKumbhar
Location :Takawade, Tal-Shirol
Dist : Kolhapur, Maharashtra, India-416121.

3. PADMAVATI BIOTECH
Prop :Amol Mule
Location :Kavalapur, Tal :Miraj
Dist : Sangli, Maharashtra, India.

4. KISAN SUGAR-CANE NURSERY
Prop :PralhadPawar
Location :Jambhali, Tal-Shirol
Dist : Kolhapur, Maharashtra, India-416121.

5. JANANI SUGAR-CANE NURSERY
Prop :BharatPatil
Location :Kondigre, Tal-Shirol
Dist : Kolhapur, Maharashtra,India-416101.

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REFERENCES

[1.] A.Aamir, N.Shagufta, A.S. Fayyaz and I.Javed, "An Efficient Protocol for Large Scale Production of Sugarcane through Micropropagation",Pak. J. Bot., 40(1),2008,pp. 139-149.

[2.] H.Altaf, A. Q.Iqbal, N.Hummera and U.Ikram, "Plant Tissue Culture: Current Status and Opportunities", Recent Advances in Plant in vitro Culture, 2012, pp. 22.

[3.] S.S. Bhojwani and M.K.Razdan, Plant Tissue Culture: Theory and Practice. Elsevier, Amsterdam,1983.

[4.] S.Geeta and S.Sudheer, "Impact of Tissue Culture on Agriculture in India", Invited Review, Biotechnol. Bioinf. Bioeng. 1(3), 2011, pp. 279-288.

[5.] N.C.Jalaja, D.Neelamathi, and T.V.Sreenivasan, "Micropropagation for QualitySeed Production in Sugarcane in Asia and the Pacific", Food and Agriculture Organization of the United Nations, Rome; Asia–Pacific Consortium on Agricultural Biotechnology, New Delhi; Asia- Pacific Association of Agricultural Research Institutions, Bangkok, 2008, pp. p.i -x + 46.

[6.] Y.S. Nerkar, "Strategy for the production and supply of adequate sugarcane seed for Maharashtra", Sugarcane Seed Certification Manual. First State Level Training Programme for Officers of Maharashtra Seed Certification Agency. Akola. February, 2006, pp. 7-8.

[7.] S.S.Salokhe,"Biotechnological Approaches for Sugarcane Improvement", Bhartiya Sugar Journal, 6, 1999, pp. 35-40.

[8.] S.S. Salokhe,"Performance of micropropagated sugarcane seed", Indian Sugar, LVII (3), 2007, pp. 23-27.

[9.] S.M.S.Samuel, "Application of agricultural biotechnology to improve food nutrition and healthcare products", Asia Pac. J. Clin. Nutr. 17(S1),2008, pp.87-90.

[10.] R.A.Sawant,P.N.Tawar, N.T.Meti and P.K.Ranjekar, "Role of Sugarcane Micropropagation for Production of Quality Seed",International Journal of Recent Biotechnology, Int. J. Rec. Biotech., 2 (4),2014, pp. 34-41.

[11.] T.V.Sreenivasan, and N.C. Jalaja,"Micropropagation of sugarcane varieties for increasing cane yield", SISSTA Jour. 19, 1992,pp. 61 -64.

[12.] A.Wieczorek, "Use of Biotechnology in Agriculture— Benefits and Risks", Biotechnology, CTAHR, 3,2003, pp. 1-6.

Family-Grooming Point for Better Existence

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***Abstract*—Family is the basic unit of human society and the first school of learning. Only the family can give us the better understanding of human relationship. We learn to live with others, accept others, work as a team, and give our best even in the limited resources.**

Keywords: Family, Prosperity, Society, Forgiveness, Respect, Evaluation.

In view of each individual, family's definition varies but one thing is common that it consists of individuals who care about each other. We must be proficient about the skills and should know about the values. We must be particular about our behavior. Let us not allow others to interfere in our family. Visiting a religious place shall support the family values.

We should be loyal to each other and should support each other in trouble. It should be the best shelter place for each family member. Real love is the need of the family it cements each and every family member to one another. There must be humor in the family. Laughing together is essential as it builds up the family.

Family should be given priority than other responsibilities. We should consider each member as precious. There should be faithfulness to the partner. Forgiveness and sacrifice strengthens the family. We must follow the traditions. We should not miss the chance to appreciate each other. Appreciation should be sincere, graceful and heart out and not merely lips out. There must be frequent communication among all the family members. Existence of trust in the family is the back bone of the relations. Special occasions should always be kept in mind. We should spend time together.In family life conflict can't be avoided, but we should know how to resolve the conflict in best safe way and understand other family member's point of view. The skill helps to strengthen the family to march ahead.

Each member f the family should contribute to promote moral values to strengthen the family as family. "Family is the natural laboratory to understand human relationship" (Gaur,160) . Elders of the family should handle the situation before it takes an ugly turn. Parents should be living model of patience and kindness, showing love through their intimate relationship with their children so that they may learn to raise their family in an efficient way. But in the contemporary times we stand as the mute witness to state of pandemonium in various societies. Even the pious institute of marriage is being tailored to suit the situations and senses.

"It seems that the ties that bind are desired ones. Even though the meaning of marriage has changed over the years from one of signaling the initiation of sexual relations and co-residence with a partner" to one of being more of "a legalization of a partnership", majority of the people will prefer it. (McDonald 1984).Audrey Vanden Heuvel in her article The Most Important Person in the World: A Look at Contemporary Family Values very well observes "undercurrent of self satisfaction "in this generation:

Marriage is valued for the companionship it brings the individual. Divorce is currently viewed as easy to get and many people like it that way. One reason most value children is for the fulfilment and enrichment children bring to their own lives. Children are also often seen as security against loneliness in old age." Heuvel, FAMILY MATTERS no.29 August 1991, pp.7-13

Even Edgar, a well known scholar in this field notes: " people have come to expect marriage and children to satisfy individual, not institutional, needs" (Edgar, D. Discussion Paper No.13,).This scenario has mirrored one thing at least - today the relations are not made to be maintained but to suit our situations. Such tailor made families shrivels off too soon. Like Traditional Indian Families and set up, "among Christian conservative groups, the idea of family is considered both sacred and fixed". They also, like Asians consider "the family sacred because it is the most fundamental unit of communal life that God has established for the development and nurture of humanity". Dr. James Dobson, one of the most well-known Christian conservative advocates of traditional family values has no doubts when he states that traditional family structures should remain fixed because it is not a structure that needs to develop or change. (Matthew Herbst) Dobson goes a step beyond his periphery by stating that: there must be" rigid gender roles." Dobson expresses with great clarity his views on the roles of both the genders in running the family:

Because of the fragile nature of the male ego and a man's enormous need to be respected, combined with a female vulnerability and a woman's need to be loved, I feel it is a mistake to tamper with the time-honored relationship of husband as loving protector and wife as recipient of that protection. Because two captains sink the ship and two cooks spoil the broth, I feel that a family must have a leader whose decisions prevail in times of differing opinions. If I understand the Scriptures, that role has been assigned to the man of the house. (J. Dobson)

Now this may not be digestible to the feminists, as it may lead to the financial enslavement of women. Such an

approach may push our society back to the age old chaos and social evils which were inflicted on women. All the members of the family need to be respected and treated equally .The right evaluation of the family members should be done irrespective of physical state ,gender and age as all the members are equally important in a family. A prosperous and happy family trust and do the justice to their relations. The trust will help the love to blossom and when there is love, their comes patience and tolerance which leads to the right understanding of ourselves, our situations, our family and the society. This achievement of overall right understanding brings happiness in our lives and prosperity in the society.

All that we need to realize today is that we are born in these relationships and these relations are a reality of our life .If we can learn to be in harmony with our family members; we can do the magic of creating harmony at the society, village, and nation and world level. No wand but only the right understanding at an individual and family level can help to create harmony and happy existence. When the realization that other like me are also the coexistence of self (I/Soul) and body; body has physical needs and the need of I is happiness. We will be able to strike the right cords with the people around us.

REFERENCES

[1.] Gaur,R ,Sangal,Bagaria.Human Values and Professional Ethics.Excel Books,New Delhi.2010

[2.] Audrey Vanden Heuvel The Most Important Person in the World A Look at Contemporary Family Values. A Look at Contemporary Family Values Australian Institute of family studies FAMILY MATTERS no.29 August 1991, pp.7-13

[3.] Edgar, D. Marriage, the Family and Family Law in Australia, Discussion Paper No.13, Australian Institute of Family Studies, Melbourne. (1986),

[4.] McDonald, P. (1983), Can the Family Survive?, Discussion Paper No.11, Australian Institute of Family Studies, Melbourne.

[5.] J. Dobson (1995). Straight Talk to Men. Recovering the Biblical Meaning of Manhood. Nashville: Word Publishing; pp. 126-27

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