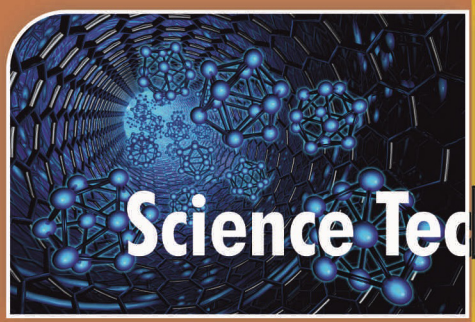
Vol. III / Issue-VI September-2014 ISSN:2278-4187

Anusandhan



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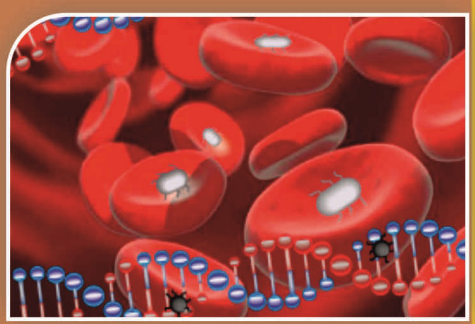

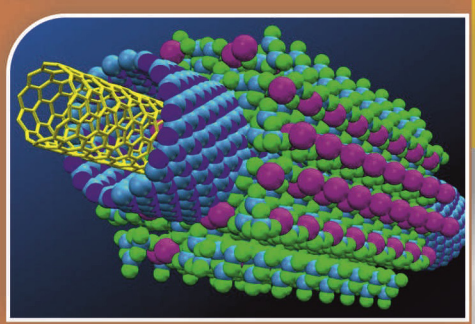

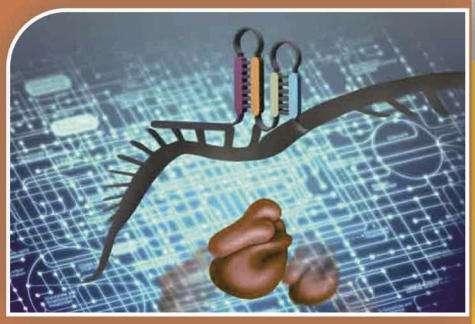

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Anusandhan (AUJ-AN)

- Technology & Management

Indexing and Impact Factor :

INDEX COPERNICUS : 48609 (2018)

Newly Develop Technology For Managing Water Supply in Urban Areas With Computational Grid System.

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ABSTRACT
Urban population growth together with other pressures, such as climate change, create enormous challenges to provision of urban infrastructure services, including gas, electricity, transport, water, etc. Smart grid technology is viewed as the way forward to ensure that infrastructure networks are flexible, accessible, reliable and economical. "Intelligent water networks" take advantage of the latest information and communication technologies to gather and act on information to minimize waste and deliver more sustainable water services. The effective management of water distribution, urban drainage and sewerage infrastructure is likely to require increasingly sophisticated computational techniques to keep pace with the level of data that is collected from measurement instruments in the field. This paper describes two examples of intelligent systems developed to utilize this increasingly available real-time sensed information in the urban water environment. The first deals with the failure-management decision-support system for water distribution networks, NEPTUNE, that takes advantage of intelligent computational methods and tools applied to near real-time logger data providing pressures, flows and tank levels at selected points throughout the system. The second, called RAPIDS, deals with urban drainage systems and the utilization of rainfall data to predict Flooding of urban areas in near real-time. The two systems have the potential to provide early warning and scenario testing for decision makers within reasonable time, this being a key requirement of such systems. Computational methods that require hours or days to run will not be able to keep pace with fast-changing situations such as pipe bursts or manhole flooding
And thus the systems developed are able to react in close to real time.

***Keywords*:** urban water, infrastructure, intelligent/smart systems, decision support, real-time, sensor.

I INTRODUCTION

Today, half of the world's population lives in cities and, by 2030, this will grow to nearly 60%.1 The trends in urban population growth together with other pressures, such as climate change, create enormous challenges to provision of urban infrastructure services, including gas, electricity, transport, water, etc. Urban water services are delivered by complex and interconnected water infrastructure and its management involves consideration of sustainable use of water resources, pollution control, stormwater and wastewater network management and flood control and prevention. Expanding, renewing and strengthening the physical infrastructure could help relieve the pressures of urban population growth and global climate change, although at extremely high costs. Therefore, there is a critical and urgent need to investigate and implement efforts toward improved use of the existing urban water infrastructure by employing 'intelligent' management techniques. This, in turn, will help delay the large investments required for a foreseeable future."Intelligent grid" and/or "smart grid" are terms that have their origin in the electricity industry. They refer to an electrical grid that uses information and communications technology (ICT) to automate processes that improve the efficiency, reliability, economics and sustainability of the production and distribution of electricity. This concept of smart-grid technology is being adopted in many countries around the world as the way forward to ensure that electricity networks are flexible, accessible, reliable and economical.2 The intelligent grid concept will also benefit from the rapid increase in the amount of data (i.e., "big data") becoming available through proliferation of sensors, mobile communications, social media, etc. However, without intelligent computational methods, grid managers and decision makers will find it increasingly difficult to make sense of the large amount of data being made available in near real-time.

In a similar vein to the smart electricity grid, "intelligent water networks" or "intelligent water infrastructure", which take advantage of the latest ICT to gather and act on information in an automated fashion, could allow the minimization of waste and delivery of more sustainable water services. This paper introduces two examples of intelligent systems developed to utilise increasingly available real-time sensor information in the urban water environment. The first deals with the failure management decision-support system for water distribution networks that takes advantage of intelligent computational methods

and tools applied to near real-time logger data providing pressure, flows and tank levels at selected points throughout the system. The second deals with urban drainage systems and utilisation of rainfall data to predict flooding of urban areas in near real-time.

II REAL-TIME FAILURE MANAGEMENT IN WATER DISTRIBUTION SYSTEMS.

Water utilities around the world are obliged by law to supply water in sufficient quality and quantity to the consumers. However, due to their ageing assets utilities are under increasing pressure to improve the management of their infrastructure and optimize operational and capital expenditure. The performance of water utilities in the INDIA is monitored by the Economic Regulator, , which seeks to ensure that performance is achieved in an efficient way, thus protecting the interest of the consumers. Since economic regulation of the INDIA water sector began in the late 1980s, It has facilitated over £98bn of private investment and delivered safe drinking water, a much improved environment and improved customer service.3 Water utilities have made progress in reducing leaks, and leakage is now around 35% lower than its 1994–95 high, but still amounts to 3.4bn litres of water every day, almost a quarter of the entire supply.

Leaks and interruptions to water supply often occur due to partial or complete failure of various water distribution system (WDS) elements (e.g., pipes and pumps) or due to accidental damage caused by third-parties (e.g., by digging roads). The scale of the impact of such failures can vary significantly beginning with inconvenience caused to the consumers that are cut off from the water supply or receiving water under sub-standard pressure leading up to water quality problems caused by discolouration or contaminant intrusion.4,5\ Monitoring and repairing failed infrastructure elements involves considerable costs. Therefore, early detection, location and repair of such failures in WDS are of primary interest to water utilities aiming to protect the continuity of water supply and mitigate the impact on the customers.

The wide availability of pressure and flow data has triggered research in early warning systems.6,7 However, even with the latest developments in sensing technologies and promising results of various anomaly detection methodologies, diagnosing and locating problems in a District Metered Area (DMA) due to a pipe burst still remains a challenging task due to inherent uncertainties (e.g., stochastic nature of water consumption and lack of field data).

III DSS SYSTEM

The DSS was designed in a modular fashion to maximise its extensibility. Figure 1 provides a highlevel overview of an architecture for a real-time DSS for operational management of WDS under abnormal conditions. Off-line modules utilised by the DSS for one-off data import or model calibration are not included in the figure. A loose form of coupling between individual modules (i.e., mostly via a common database) was chosen to facilitate their integration within the DSS. All inter-process communication is achieved indirectly by polling information stored in a Database Management System (DBMS) or alternatively through Hypertext Transfer Protocol (HTTP) requests (e.g., the interaction between the “System Overview” and the “Alarm Diagnostics” UI modules of the DSS front-end).

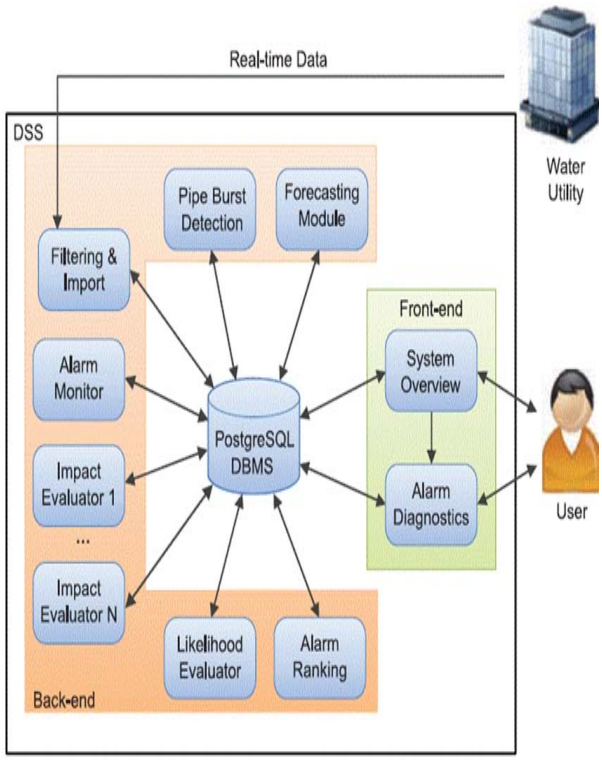

Fig 1 : An overview of a risk-based DSS for WDS management.

(a) Alarm Monitor

The Alarm Monitor periodically checks the contents of the “source alarm” table in the Database (DB) for new (fresh) alarms.

(b) Likelihood evaluator

The Likelihood evaluator is a process responsible for determining the likelihood of occurrence of a burst in every pipe within a DMA where an alarm was generated. The evaluator combines the outputs from several sources of information (models) to assess the likelihood of a particular pipe burst being associated with the active alarm.

The Dempster-Shafer theory of evidence14 has been applied to combine the evidence from those sources of information, as shown in Figure 2.

(c) Impact Evaluator

Similarly to the Likelihood Evaluator described above, the process also monitors the alarms table for newly generated alarms. The Impact Evaluator can be launched on a number of computers simultaneously to distribute the load (i.e., each node evaluates the impact of only a part of potential pipe bursts).

(d) Alarm Ranking

The Alarm Ranking process concludes the risk-based methodology by performing impact aggregation and alarm prioritisation. Similarly to the Likelihood and Impact Evaluators, the process also monitors the alarms table in the Postgre SQL DBMS (as shown in Figure 1).

(e) Likelihood evaluation

The use of the hydraulic model (EPANET) as a source of evidence to support the location of a pipe burst within WDS relies on a number of appropriately located pressure and/or flow monitoring points. Additionally, it takes into account the timing and magnitude of the burst that needs to be large enough to cause headloss that creates measureable drops in pressure at the location of pressure loggers in the vicinity of the burst pipe.

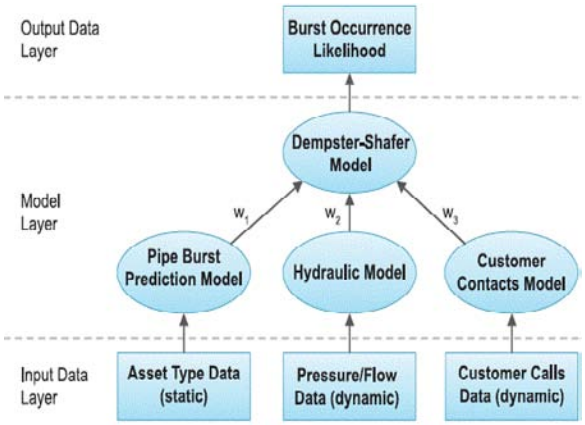

Fig 2 : An information fusion concept to estimate the most likely location of a failure.

IV DSS APPLIED - CASE STUDY ON UK WATER SYSTEM.

The above DSS has been applied on a case study in a highly looped urban DMA located in the city of Harrogate in North Yorkshire, UK (highlighted in grey in Figure 3). The studied DMA contained over 19 km of mains, supplying almost 1,600 properties (over 95% residential customers). The average minimum and maximum pressures were 30 m (8:00 AM) and 53 m (4:00 AM) respectively. The minimum night flow was 6–ls and the overall daily water consumption was almost 106 litres per day (1 Ml/d). The DMA contained 450 pipe segments that were considered in the risk analysis (i.e., likelihood and impact evaluation).

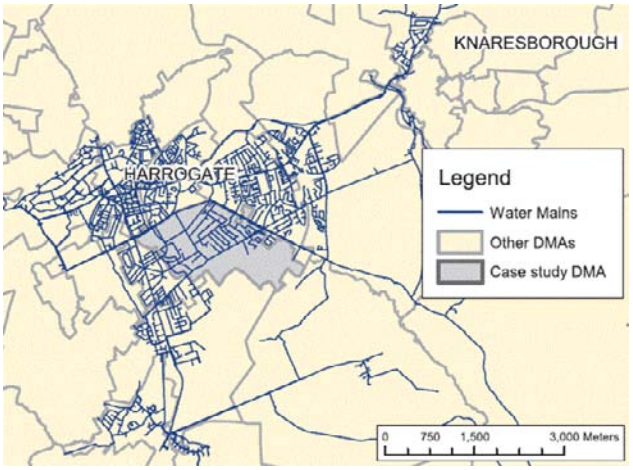

Fig 3 : An overview of the case study area.

(a) Risk Based Decision Making

Given the risk distribution shown above, the decision maker would probably decide to put higher importance to the likelihood component of the risk since a relatively small number of pipes formed a cluster (see the points within the circle in Figure 4) with high likelihood of being the cause of the problem. In this case the decision maker would also know that the likely pipes under investigation fell into the category of the critical ones as they have relatively high impact (e.g., compared to the majority of other pipes that have the normalized impact lower than 0.6). Therefore, even in the case that the diagnostics component providing the likelihood failed to identify the correct location, the region where the consequences of a burst would be significant is investigated. It should be noted that the closeness of the points in Figure 4 does not indicate geographical proximity of candidate pipes. Therefore, suitable visualization techniques that allow easy exploration of the risk maps and the scatter plots need to be investigated in the future.

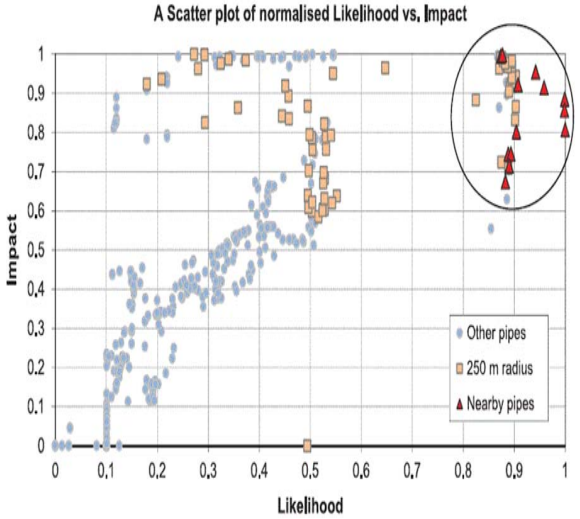

Fig 4: A scatter plot capturing the non-aggregated risks of a pipe burst at various locations in a DMA.

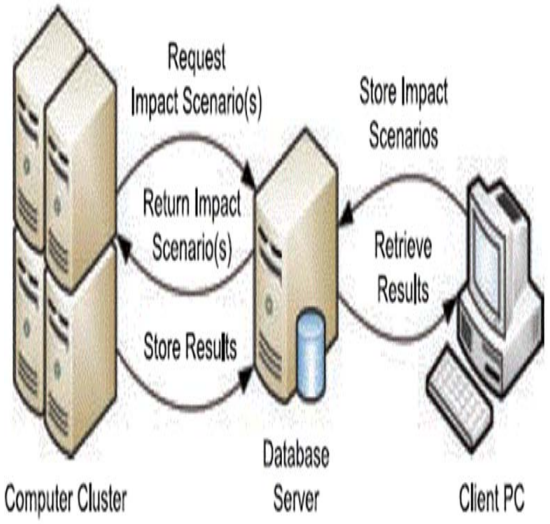

Fig 5 : A database-centric distributed architecture for pipe burst impact evaluation

V COMPUTATIONAL PERFORMANCE

The primary focus of the methodology presented in this paper is to support near real-time decision making. Evaluating the impact of all potential pipe bursts within a DMA on the rest of the system requires a large number of runs of a hydraulic solver. Therefore, it is computationally demanding as those runs cannot be performed off-line. This is a consequence of the need to consider the current of the system based on the information from: (i) pressure and flow monitoring devices, and (ii) demand forecast (as it is necessary to project the effects of the pipe bursts into the future, i.e., the next 24 hours). Even with the high-performance personal computers impact evaluation of a single failure is time consuming, which prevents its application in the near real-time domain. To increase the speed of impact evaluation a database-centric distributed architecture has been implemented (see Figure 5).

The system builds upon the strong transaction processing capabilities of modern DBMS, such as PostgreSQL. The RDBMS serves as a mediator between a client application and a computer cluster comprising of several nodes. The distributed impact evaluation is done in the following steps: (1) the client application inserts a set of impact scenarios into the database (2) each of the processes running on the computing nodes in the cluster periodically attempts to retrieve new scenario(s) from the database (3) if a new failure scenario(s) are retrieved from the database, their impact is evaluated and (4) the results are stored back into the database (5) the client application retrieves the results of evaluated scenarios.

The above presented architecture has shown as suitable for given application since the time required to retrieve failure scenarios and to store the results was negligible compared with the time needed to evaluate the impact. Implementation of such distributed application was conceptually simple and the solution was scalable. The results for the case study presented in this paper have been obtained using the distributed impact evaluator which was concurrently running on 14 computing nodes. The full impact evaluation of the above DMA took approximately 5 minutes, which is acceptable given the fact that new data from the network is currently received every 30 minutes. However, this performance could still cause needless delay in the investigation.

(a) Hydraulic Model

Hydraulic modelling has commonly been used to assess the response of urban drainage systems to rainfall events. However, for large networks and/ or when repetitive simulation runs are needed (i.e., for flood risk assessment), these can be slow and computationally expensive. We present a faster surrogate method based on Artificial Neural Networks (ANN) that permits modelling of very large networks in real-time, without unacceptable degradation of accuracy.

(b) Early Warning System for Urban Flood Management

The ANN model is based on a 2-layer, feed forward Multi-Layer Perceptron (MLP).32,33 This is now an established machine learning technique applied to many fields. In the case of supervised learning, it relies on the discovery of a multi-dimensional non-linear relationship between the desired model target outputs and a set of predictor factors applied as input signals to the model. In applications such as urban flooding, the inputs and targets take the form of time series signals, sampled at a regular time interval (‘time step’). The modelled relationship is discovered during

a 'training' phase based on a number of events from the previous history of the system. Having learnt this generalised relationship, the trained model is then ready for use on new events including those occurring in real-time. Although training can require significant computational time, the resulting trained ANN model is able to provide flooding responses to rainfall in a fraction of the time require by traditional mathematical models.

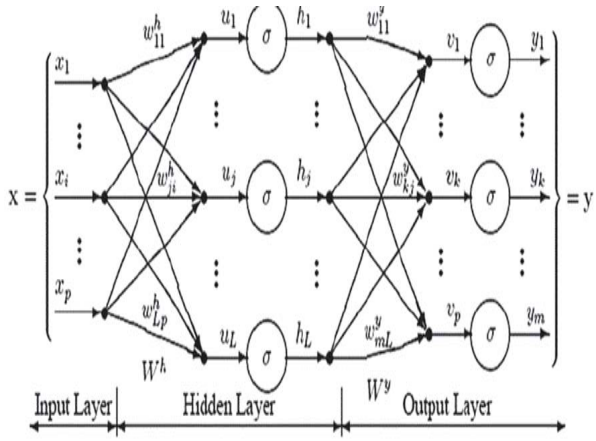

Fig 6 : Architecture of Multilayer Perceptron (ANN).

From this study it is concluded that ANN technology has the capability to satisfactorily predict manhole flooding or CSO spills. However, this study has only used input signals which are isolated from the hydraulic performance of the sewer system and in particular any downstream influences causing backing up or re verse flow. Some of the measurement points were at locations where the InfoWorks modelling had indicated that reverse flows could occur but there was no input signal for this phenomenon. It is possible that ANN models may struggle to be reliable for all rainfall events, and careful attention to training should take account of these situations.

VI CONCLUSION

Water utilities around the world already monitor and evaluate large amounts of data regarding the operations and performance of their physical infrastructure. Supervisory Control and Data Acquisitions (SCADA) systems continuously collect and provide data and information to the control room personnel. Furthermore, the water industry has invested heavily in a variety of asset management tools that store large amounts of data to assist with the maintenance, repair and replacement of system components and equipment. On the customer side, the industry is also making progress with Automated Meter Reading (AMR) and considering smart metering to reduce water losses at customer premises and implement customer-facing behavioural change programmes.41 The effective management of water distribution, urban drainage and sewerage networks is likely to require increasingly sophisticated computational techniques to keep pace with the level of data that is generated from measurement instruments in the field. The sheer volume and speed of acquisition of this data means that decision makers will find it increasingly difficult to make sense of events as they are occurring within the network. The solution proposed here is the use of intelligent computational methods to help the decision maker and to present knowledge based on past experience with the network to propose solutions from which the decision maker can choose. The two systems described above have the potential to provide early warning and scenario testing for decision makers within reasonable time, this being a key requirement of such systems. Computational methods that require hours or days to run will not be able to keep pace with fast-changing situations such as pipe bursts or manhole flooding and thus the systems described above are able to react in close to real time. As measurement devices proliferate in water distribution and hydrology systems, so the water industry will undergo a 'data explosion' similar to that seen in the biosciences. The challenge for the computational methods, therefore, is to make sense of increasingly large volumes of data, in real time, to aid decision makers and significantly improve the operation of these important systems.

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Enhancement of the Efficiency of Solar Air Heater by Using Artificial Roughness of Spiral Tubes Contained Hot Oil Flowing Inside the Tubes

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Millennium Institute of Technology, Neelbud Bhopal (M.P.) India.

ABSTRACT
Generally heat transfer from fluid flowing to the stationary plate due to conduction process. After conduction further heat transfer will takes place that is due to convection process. Heat transfer will be reducing due to low thermal conductivity and due to relatively low air velocity. To overcome such type of a problem it is necessary to use artificial roughness to break laminar sub layer in order to reduce the thermal resistance and to increase the turbulence of flowing fluid result increase in heat transfer rate. In order to increase the heat transfer in solar air heater artificial roughness in spiral-pipe form are used. Inside the spiral pipes hot oil enforced to flow so it will create a further enhancement of heat transfer to the flowing air across the tubes. High frictional losses occur due to artificial roughness result high power required for the fluid flow. Turbulence results Due to artificial roughness which ultimately break the viscous laminar sub layer.
Keywords: Solar air heater, Heat transfer, Friction factor, Spiral tubes.

I INTRODUCTION

Sun is the ultimate source of energy for all form of energy. Sun which is over a hundred times larger than the earth is located at a distance of 150 million kilometer from the earth. A sun ray emitted from the sun takes about 9 minute to reach the earth. Sun is a fusion reactor emitting 3,800 million, million, million watts of energy each second and the earth receives only 1/2,00,000,000,000 portion of this amount equal to 1.3×10^{17} w/h which is 20,000 times the energy requirement of the world. The temperature of the sun at the center is 15 million ^{o} C and at the surface it is about 6000^{o}K.About 50% of the energy received outside Earth's atmosphere actually reach the earth and is about 1 cal/sq.cm min at sea level. In these tropical and subtropical countries, the isolation is considerably high, and therefore, solar energy has been traditionally used in drying and preservation of agriculture crops .In the current scenario when the petroleum prices is increases sharply it is essential that we can switch over to non conventional energy sources to avoid such type of energy crisis. The thermal efficiency of a solar air heater with smooth duct plate is always low as compare to a solar water heater due to greater heat loss and low value of heat transfer coefficient .Solar energy is very abundant in nature that provide a clean and pollution free atmosphere. the solar air heater are modeled as a rectangular channel having one rough wall and two smooth walls. This make the fluid flow and heat transfer characteristics distinctly different from those found in the case of channel with two opposite roughened wall rough annular and circular tubes. Further the range of reynolds number application in solar air heater are of lower range in comparison of the studies discussed above. This can be done by keeping the height of the roughness element small in comparison with the duct dimension. Several parameter that characterize the arrangement and shape of the roughness, the relative roughness pitch (p/e) and pitch (p) are the most important parameter. These parameters, namely, relative roughness height (e/D) and the roughness element height(e). Here chamfered , circular, semi- circular and grooved sections have been investigated in order to get most beneficial arrangement from thermo hydraulic consideration.

These investigations studied the effect of geometric parameters of roughness element, on heat transfer and friction factor in gas turbine cooling and heat exchanger applications. Keeping this in view several investigators investigation various geometries of artificial roughness in solar air heater ducts. Correlation for heat transfer and friction factor were develop based on the experimental study carried out by the various investigators. Different geometries of roughness element studies by the investigators of roughness element studies by the investigators are discussed later.

II SETUP USED FOR ARTIFICIAL ROUGHNESS

In this type of set a extra concept is used for increasing the heat transfer rate to the air flowing inside the solar air heater . A oil sump is provided here in which when solar radiation is falling on it get heater and lot of energy has been stored in the form of heat. That heat will be used to increase the performance rate of solar air heater. Spiral pipes are used to flow the oil inside the tube that will create the artificial turbulence to the flowing oil result of increasing the heat transfer rate. The inlet and outlet condition of flowing oil through the spiral pipes is show in the given figure-02

III EXPERIMENTAL DATA COLLECTION

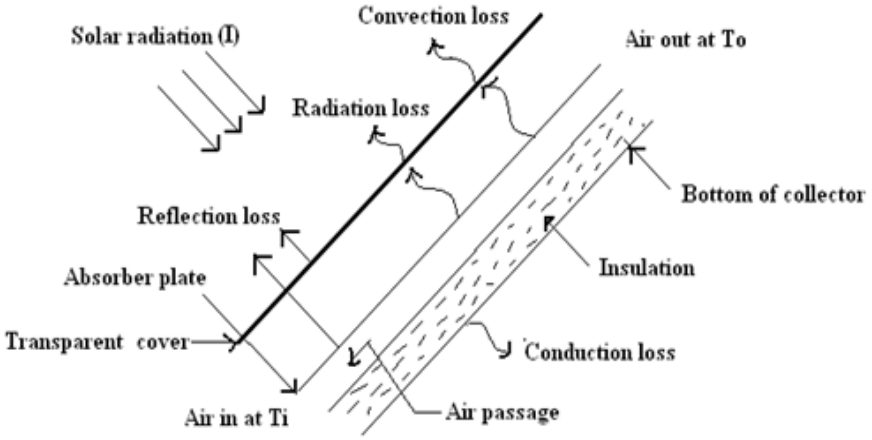
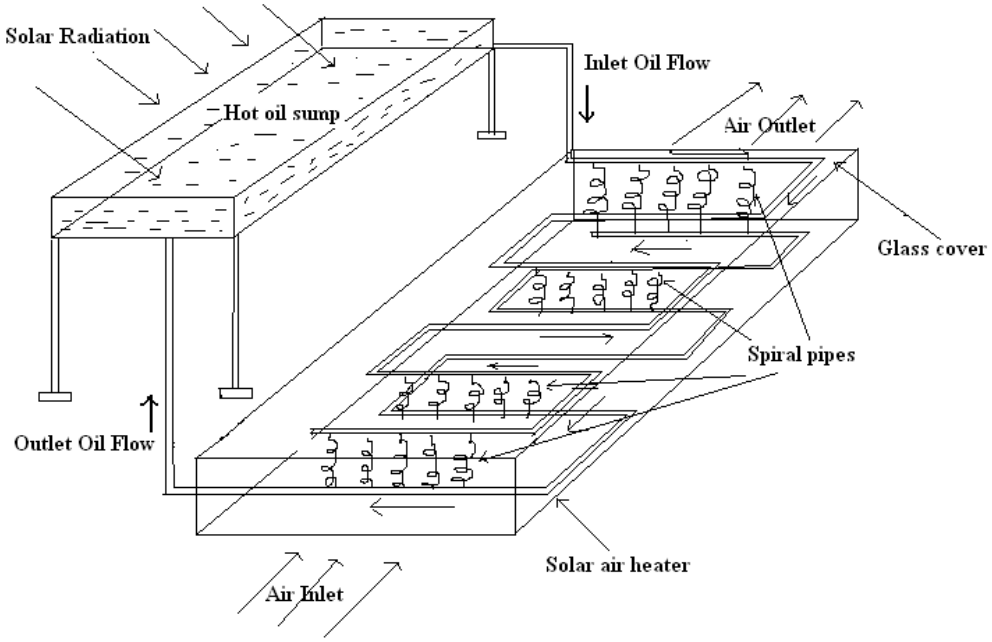


Fig-01

Conventional solar air heater



A Solar Air Heater in which Hot Oil Flowing Inside the Spiral Pipes

Fig-02

OBSERVATION TABLE

FLOW OF AIR THROUGH THE SPIRAL PIPES

S.NO	TIME	Ti	To
1	8 A.M	27	45
2	9. A.M	30	58
3	10 A.M	33	71
4	11 A.M	35	79
5	12 A.M	37	82
6	13 P.M	38	81
7	14 P.M	38	78
8	15 P.M	38	71
9	16 P.M	36	58

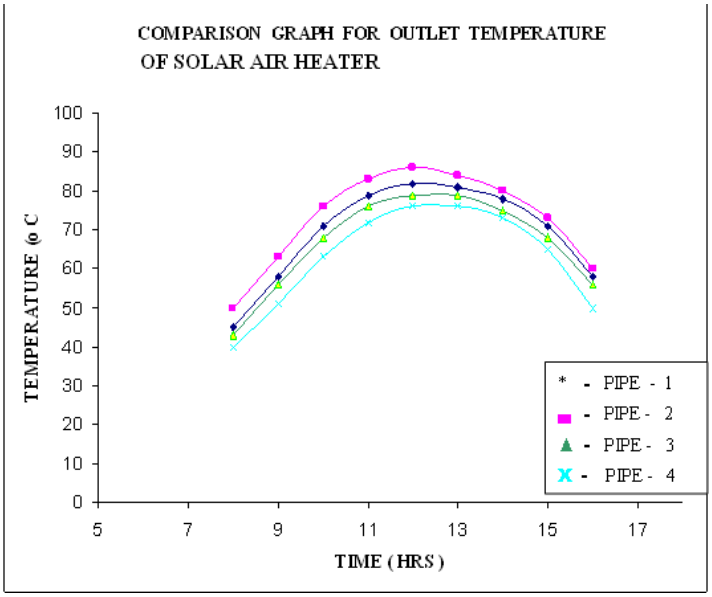


Fig-03

IV FORMULATION

Following equations have been used for the evaluation of relevant parameters

$Q = m \times c_p \times (t_o - t_i)$

$H = q / [A_c \times (t_p - t_f)]$

$Nu_r = (h \times D_h) / h$

$f_r = D_h \times \Delta p / (2 \times L \times V^2 \times \rho)$

V CONCLUSION

In this type of artificial roughened solar air heater more heat transfer has been observed due to hot oil flow through spiral pipe. As compare to another type of roughness geometries it is much more effective because of turbulence create by the spiral pipe to the flowing fluid also, this give an extra benefit for increasing heat transfer rate.

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Utilization of Solar Energy for Drying Applications

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ABSTRACT
In many countries of the world, the use of solar thermal systems in the agricultural area to conserve vegetables, fruits, coffee and other crops has shown to be practical, economical and the responsible approach environmentally. Solar energy is freely available during day time, while it's not available in the night, which is the major drawback for such type of the systems. Developing efficient and inexpensive energy storage devices using through phase change materials (PCMs) in solar dryers, which can play an important role in energy conservation to fill the gap in between energy supply/demand and important as developing new sources of energy. Also the PCMs storage integrated with a solar dryer for drying of fruits and vegetable and other food products is found to be promising low cost option for preservations. Therefore, in this paper, an attempt has been taken to summarize the investigation of the solar drying system incorporating with PCMs for drying agricultural food products and also the development of the PCMs for these applications at NCEL, RGIPT, Rae Bareli, U.P., India.

Keywords: Solar Energy, Solar Drying, Phase Change Materials, Energy Storage

I INTRODUCTION

Drying using the sun under the open sky for preserving food and agricultural crops has been practiced since ancient times. However, this process has many disadvantages: spoilt products due to rain, wind, moisture and dust; loss of produce due to birds and animals; deterioration in the harvested crops due to decomposition, insect attacks and fungi, etc. Further, the process is labour intensive, time consuming and requires a large area for spreading the produce out to dry [1]. Artificial mechanical drying, a relatively recent development, is energy intensive and expensive, and ultimately increases the product cost. Solar-drying technology offers an alternative which can process the vegetables and fruits in clean, hygienic and sanitary conditions to national and international standards with zero energy costs [2]. It saves energy, time, occupies less area, improves product quality, makes the process more efficient and protects the environment. Solar drying can be used for the complete drying process or as a supplement to artificial drying systems, in the latter case reducing the fuel energy required [3]. Solar dryer technology can be used in small-scale food processing industries to produce hygienic, good quality food products [4]. At the same time, this can be used to promote renewable energy sources as an income-generating option. Further, this solar technology is ideally suited for women since they can place a load in the dryer and then get on with their other numerous tasks [5].

The justification for solar dryers is that they may be more effective than sun drying, but have lower operating costs than mechanized dryers. A number of designs are proven technically and while none are yet in widespread use, scientists still have optimism about their potential. However, available dryers still have some disadvantages such as low efficiency, short time of use within year round, dependence of inside temperature on temporary solar radiation. In order to overcome these troubles, there are some trends being investigated such as adding in phase change materials (PCMs) to keep stable temperature inside and prolong working time of the systems. Energy storage through PCMs not only reduces the mismatch between supply and demand but also improves the performance and reliability of energy systems and plays an important role in conserving the energy.

The aim of this study is to identify and develop the low cost PCMs for drying application and also to find out their thermal properties employing the DSC method. For this purpose, the binary mixtures based on commercial grade fatty acids *i.e.* lauric acid (LA), myristic acid (MA), palmitic acid (PA), stearic acid (SA) and acetamide developed with different weight percentages (10/90, 20/80, 30/70, 40/60, 50/50, 60/40, 70/30, 80/20 and 90/10) and their thermal properties measured through the DSC method. Several slat hydrates i.e. Zinc Nitrate Hexa-Hydrate, Calcium Nitrate Tetra-Hydrate, Sodium Thio-Sulfate, Penta-Hydrate and Sodium Acetate Tri-hydrate are also found as potential candidate, abundant and cost-effective materials for latent heat storage applications from points of view of melting temperature and high latent heat of fusion [6]. The developed PCMs in the present work can use for the other thermal applications and would be easily available in the commercial market in India or as well as in other countries.

II MATERIALS AND METHOD

Commercial grade materials (purity > 98%) such as MA, PA, Acetamide, Zinc Nitrate Hexa-hydrate, Calcium nitrate tetra-hydrate, Sodium thio-sulfate penta-hydrate and Sodium

acetate tri-hydrate supplied from the Burgoyne Pvt. Ltd. company used as promising PCMs for this research work and used without purification. To develop the binary mixtures, a series of binary mixtures, i.e., MA-AC, PA-AC and SA-AC prepared with different weight percentages (10/90, 20/80, 30/70, 40/60, 50/50, 60/40, 70/30, 80/20 and 90/10 wt. %). Twenty seven samples (100 g each) formed by mixing in melted state, kept at room temperature for one hour. A semi analytical digital balance (accuracy ±0.0001 g) also used to measure the weight of the samples (g).

III MEASUREMENT TECHNIQUES OF LATENT HEAT OF FUSION AND MELTING TEMPERATURE

The latent heat of fusion and melting temperatures is the main interest of TES systems, which is generally measured by DSC. In this research work, thermal properties of the samples measured by using a DSC 4000 Perkin Elmer model instrument at 2oCmin−1 under a constant stream of nitrogen at a flow rate of 20 ml−1minThe largest deviation in enthalpy measurements was ±2% and the largest deviation in temperature measurements was ±0.1°C. A semi analytical digital balance (accuracy ±0.00001 g) also used to measure the weight of the samples (mg) for the DSC test. Thermal properties i.e. melting temperature (Tm), and latent heat of fusion (λm) of identified and developed PCMs measured by DSC for drying applications are given in Table 1.

Table 1
Thermo-physical properties of identified and developed PCMs

S. No.	*T_m	^ λ_m	Laboratory Code/Name
1	40.72	165.93	Zinc Nitrate Hexa-hydrate
2	45.67	145.15	Calcium nitrate tetra-hydrate
3	46.13	190.21	Lauric acid
4	51.66	206.34	Sodium thio-sulfate penta-hydrate
5	56.65	197.34	Myristic acid
6	57.73	180.79	Stearic acid
7	59.91	135.68	Paraffin Wax
8	62.04	211.43	Sodium acetate tri-hydrate
9	64.89	206.31	palmitic acid
10	81.24	214.59	Acetamide
11	48.08	160.13	MA-AC (60/40 wt.%)
12	48.99	170.13	MA-AC (70/30 wt.%)
13	46.04	188.39	MA-AC (80/20 wt.%)
14	50.69	195.93	MA-AC (90/10 wt.%)
15	55.82	144.01	PA-AC (50/50 wt.%)
16	55.72	143.98	PA-AC (60/40 wt.%)
17	59.42	187.03	PA-AC (70/30 wt.%)
18	59.61	190.34	PA-AC (80/20 wt.%)
19	58.00	184.79	PA-AC (90/10 wt.%)

*Tm : Melting temperature (°C)
^ λm : Latent heat of fusion (kJ/kg)

IV RESULT AND DISCUSSION

Authors identified technical grade fatty acids, i.e., MA (T_m =56.83°C, λ_m =168.27 kJ/kg), PA (T_m =64.25°C, λ_m =206.11 kJ/kg) and AC (T_m =81.24°C, λ_m =214.59 kJ/kg) for this study as these materials having high latent heat of fusion and also easily available with low price in the Indian market.

Pure acids characterized by a single peak in DSC graph, which are also sharp and well-defined. Binary mixtures samples prepared in the laboratory for MA-AC and PA-AC composition to find out their melting temperature and latent heat of fusion through DSC analysis technique with a scan rate of 2oCmin−1 and dat a obtained from the DSC curves were also given in Table 2.

Table 2
Thermal properties of the MA-AC and PA-AC developed materials

S. No.	A	B	MA-AC		PA-AC	
	Wt%		Tm (°C)	λm (kJ/kg)	Tm (°C)	λm (kJ/kg)
1	10	90	N.A.		69.03	69.43
2	20	80	N.A.		55.39	51.72
3	30	70	48.29	60.39	55.03	118.53
4	40	60	48.11	96.26	55.48	83.07
5	50	50	47.70	114.53	55.82	144.01

6	60	40	48.08	160.13	55.72	143.98
7	70	30	48.99	170.13	59.42	187.03
8	80	20	46.04	188.39	59.61	190.34
9	90	10	50.69	195.93	58.00	184.79

N.A. data not available due to the various peaks in D.S.C. figures

Overall nine samples were prepared at different mass fraction of MA-AC which was characterized by DSC measurement were not compatible with each other for proper mixing that is why in the DSC results showed two separate peaks were found [7, 8]. AC binary mixture follows a regular trend within the range of 46°C-48°C still the concentration of MA increase in the mixture from 30 wt.% to 80 wt.%. It was also found that melting temperature was nearly maintained at 48°C for the concentration range of 30 wt.% to 70 wt.%. The binary mixture samples (60/40, 70/30, 80/20 and 90/10 wt.%) showed melting temperature in the range of 46°C-51°C and their latent heat of fusion also high and due to this factor, these binary mixture can be recommended for the drying applications. Figure 1 shows the DSC curves for these four samples MA-AC (60/40, 70/30, 80/20 and 90/10 wt.%) for the 0th cycle. From the figure it's clear that the developed PCMs have a single peak in DSC curve, which are also sharp and well-defined.

For the PA-AC binary mixture development, sample (10/90, 20/80, 30/70 and 40/60 wt. %) did not show high latent heat of fusion, that's why these binary samples can not recommend for the applications. The melting temperature of PA-AC samples (50/50, 60/40, 70/30, 80/20 and 90/10 wt.%) were 55.82oC, 55.72oC, 59.42oC, 59.61oC and 58oC, respectively. The latent heat of fusion was 144.01, 143.98, 187.03, 190.34 and 184.79 kJ/kg, which proved that these developed materials had enough latent heat of fusion. From the table 2, it was also found that melting temperature was nearly maintained within at 55-56oC for the concentration range of 20 wt.% to 60 wt.%, while melting temperature was maintained within at 58-59oC for the concentration range of 70 wt.% to 90 wt.%,. Figure 2 shows the DSC curves of binary mixture samples (50/50, 60/40, 70/30, 80/20 and 90/10 wt.%) for the 0th cycle and these binary samples have a single peak, which are sharp and well defined.

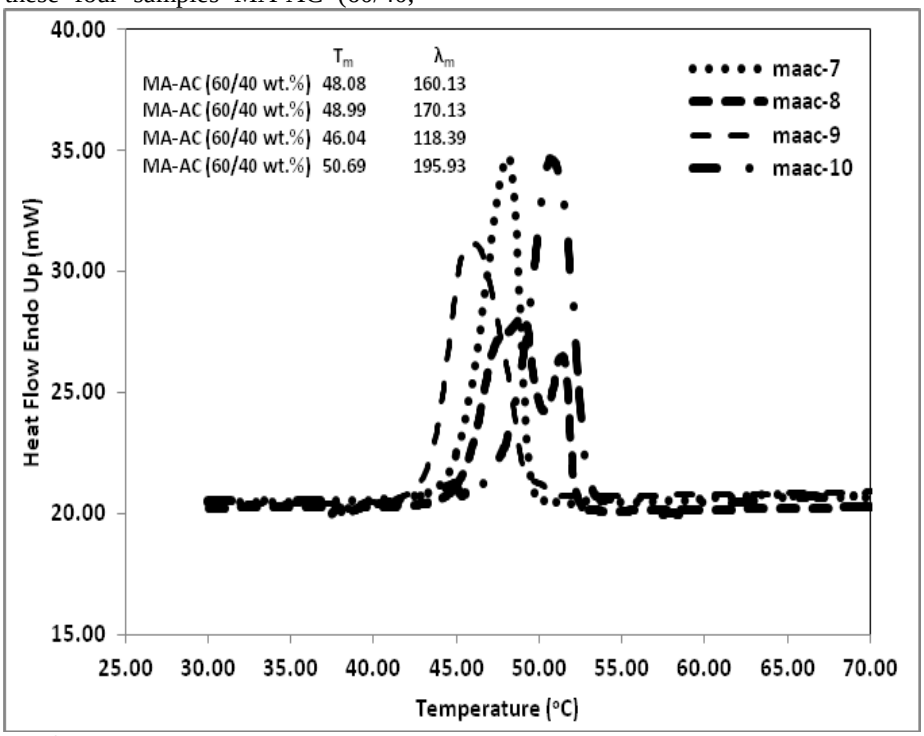

Fig 1: DSC curve with 2°C scanning heating rate for MA-AC (60/40 wt.%), MA-AC (70/30 wt.%), MA-AC (80/20 wt.%) and MA-AC (90/10 wt.%) 0th Cycle.

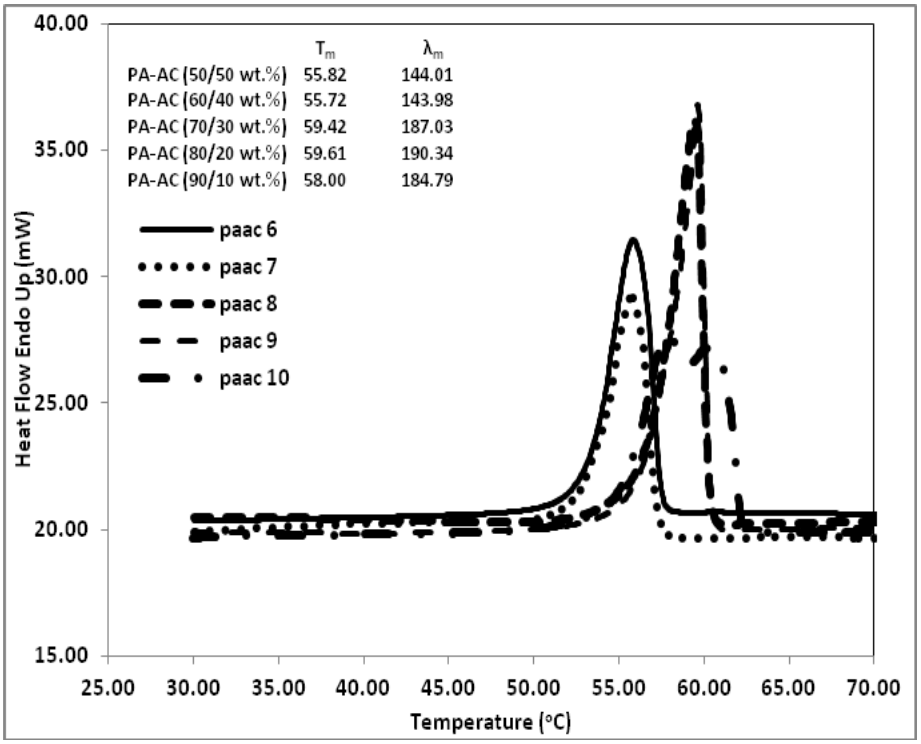

Fig 2: DSC curve with 2°C scanning heating rate for PA-AC (50/50 wt.%), PA-AC (60/40 wt.%), PA-AC (70/30 wt.%), PA-AC (80/20 wt.%) and PA-AC (90/10 wt.%) 0th Cycle.

V CONCLUSION

In this study, binary mixtures were prepared as stable PCMs for solar drying applications. The developed PCMs such as MA-AC and PA-AC with different weight percentages were characterized by using DSC analysis techniques. DSC results showed that only few binary samples were found satisfactory with due to respect of melting temperatures in the desired temperature range for the drying application. These samples also showed high latent heat of fusion (140-220 kJ/kg) with appropriate phase change temperature; this is another reason to recommend these PCMs for the drying applications. It is also recommended that before employing any PCM for applications, its thermal cycle test should be conducted, as the behaviour may change [9]. It was also found that several PCMs are available in local Indian market and having good potential for the drying application.

VI ACKNOWLEDGEMENT

Authors would like to acknowledge research grants provided by DST (Reference No. SR/S3/MERC/014/2010) and Indo-Taiwan joint research project grant (GITA/DST/TWN/P-40/2012) between 'Rajiv Gandhi Institute of Petroleum Technology (RGIPT) Rae Bareli' & Kun Shan University (KSU), Tainan, Taiwan, R.O.C, which has been helpful in developing some new phase change materials and applications.

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Phase Change Materials Development for Building Application

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ABSTRACT
The use of a latent heat storage system using phase change materials (PCMs) is an effective way of storing thermal energy and has the advantages of high-energy storage density and the isothermal nature of the storage process. PCMs have been widely used in latent heat thermal-storage systems for heat pumps, solar engineering, and spacecraft thermal control applications. The uses of PCMs for heating and cooling applications for buildings have been investigated within the past decade. There are large numbers of PCMs that melt and solidify at a wide range of temperatures, making them attractive in a number of applications. The present study includes the energy storage materials R & D efforts at NCEL, RGIPT through commercial grade fatty acids used as potential PCMs. The selected fatty acids were capric, stearic, palmitic, myristic and lauric acid with melting temperatures between 25–70°C and industrial-grade with 95–99% purity. Latent heat storage capacity and phase transition temperature of the PCMs were determined by Differential Scanning Calorimeter (DSC) technique and showed that all developed materials at NCEL, have a low melting point which is very much essential for low temperature thermal application as well as with a good amount of latent heat of fusion which is also quite suitable and the most desired parameter to implement any kind of PCMs for the designing the system.

***Keywords**:* Phase Change Materials, Fatty Acids, Buildings, Differential Scanning Calorimetry.

I INTRODUCTION

Because of the increasing demand for air conditioning in buildings with the continual increase in energy utility price, the development as well as use of new materials to generate and conserve the energy is highly desirable. The indoor energy utilization varies considerably due to several factors such as weather conditions, material & structure used in building and thermo physical properties of a material etc. Generally, the energy is lost from building components such as Roof, Walls, Windows, and Doors where the majority of energy/heat loss is through walls. Therefore the use of appropriate materials for buildings is fundamentally important to conserve the energy in building itself. In order to minimize the losses, the thermal energy storage (TES) systems are commonly used to store the heat and cold which can be used afterward. TES can be further divided into physical and chemical processes. The most normally observed thermal energy storage is through sensible and latent heat storage. In sensible energy storage, the energy absorbed and released is accomplished through the change in temperature whereas the latent heat storage works by storing energy during the phase change process. Latent heat storage can happen as solid-solid, solid-gas, solid-liquid, and liquid-gas phase change. Many phase change materials (PCMs) have been demonstrated in past to enhance the conservation of energy in the buildings but among these solid-liquid based PCMs have revealed promising thermal energy management capability at the human comfort level [1-3]. Although, many existing organic and inorganic materials are available including paraffin waxes and fatty acids in PCM markets but the fatty acids based organic phase change materials possess a few superior properties for instance melting congruency, great chemical reliability, low corrosion activity, non-toxicity and appropriate melting temperature range.

This could be possibly because of the protected carboxyl group present in the fatty acids. The elevated latent heat of transition and high specific heat are the two primaries elements in fatty acids based PCMs. Furthermore, these systems don't occupy a large space due to the small volume change occurrence during melting or solidification. Additionally, these PCMs experience a very little super-cooling throughout the phase transition and which is the most important benefit over numerous other materials based PCMs. All these properties of fatty acids based PCMs demonstrate its effective utilization in solar passive heating applications in buildings.

The aim of this study is to see the effect on the thermo-physical properties of the developed PCMs due to thermal cycles. For this purpose, the binary mixtures based on commercial grade fatty acids i.e. capric acid (CA), lauric acid (LA), myristic acid (MA), palmitic acid (PA) an stearic acid (SA) developed with different weight percentages (10/90, 20/80, 30/70, 40/60, 50/50, 60/40, 70/30, 80/20 and 90/10) and their thermal properties measured through the DSC method. Only a few binary mixtures of CA-LA and CA-MA were shown better results after the repeated thermal cycles. The developed PCMs in the present work can use for energy storage applications and would be easily available in the commercial market in India or as well as in other countries.

II MATERIALS AND METHOD

Commercial grade fatty acids (purity >98%) such as LA, MA, SA and PA supplied from the Burgoyne Pvt. Ltd. company were used as promising PCMs for this research

Table 1:
Thermo-physical properties of fatty acids

Fatty Acid	Range of Melting point (^oC)	*T_m (^oC)	*λ_m (kJ/kg)	*T_f (^oC)	*λ_f (kJ/kg)	Purity (%)
CA	29-31	33.03	154.42	27.87	157.97	98.5
LA	44-46	45.93	175.77	40.42	179.72	99.0
MA	51-54	56.83	168.27	50.29	174.95	98.0
PA	60-63	64.25	206.11	58.93	208.67	99.0
SA	68-69	57.73	180.79	51.70	180.05	99.0

*Measured through D.S.C. with 2^oC scanning heating/cooling rate.

work and used without purification. To develop the PCMs, a series of binary mixtures, i.e., CA-LA and CA-MA prepared with different weight percentages (10/90, 20/80, 30/70, 40/60, 50/50, 60/40, 70/30, 80/20 and 90/10 wt. %). Eighteen samples (100 g each) were formed by mixing in melted state, and kept at room temperature for one hour. A semi analytical digital balance (accuracy ±0.0001 g) was also used to measure the weight of the samples (g).

III MEASUREMENT TECHNIQUES OF LATENT HEAT OF FUSION AND MELTING TEMPERATURE

The latent heat of fusion and melting temperatures is the main interest of TES systems, which is generally measured by DSC. In this research work, thermal properties of the samples were measured by using a DSC 4000 PerkinElmer model instrument at 2^oCmin^{-1} under a constant stream of nitrogen at a flow rate of 20 ml min^{-1}. The largest deviation in enthalpy measurements was ±2% and the largest deviation in temperature measurements was $\pm0.1^oC$. A semi analytical digital balance (accuracy ±0.00001 g) was also used to measure the weight of the samples (mg) for the DSC test. Thermal properties i.e. melting temperature (T_m), freezing temperature (T_f), latent heat of fusion (λ_m) and crystallization (λ_f) of fatty acids were measured by DSC for heating/cooling applications and information provided by the manufactures are given in Table 1.

IV THERMAL STABILITY TEST PROCESS

Thermal stability test for the best identified samples has been conducted to study the changes in melting point and latent heat of fusion. Subsequently, about 70 g of these samples were taken in a borosil glass test tube and kept into a water bath at a steady temperature at 60^oC above their melting temperature. Later on, after melting process, test tubes were shifted to a cooling chamber at 15^oC, which were coupled with an ultra cryostat bath manufactured by Mahindra Pvt. Ltd., Kanpur. The samples of identified samples were subjected up to 600 accelerated melt/freeze cycles. About 1 g of material was withdrawn on a selected melt/freeze test cycle for each material to find out the latent heat of fusion and melting temperature.

V RESULT AND DISCUSSION

Authors selected five technical grade fatty acids, i.e., CA (T_m =33.03^oC, λ_m =154.42 kJ/kg), LA (T_m =45.93^oC, λ_m =175.77 kJ/kg), MA (T_m =56.83^oC, λ_m =168.27 kJ/kg), PA (T_m =64.25^oC, λ_m =206.11 kJ/kg) and SA (T_m =57.73^oC, λ_m =180.79 kJ/kg) for this study as these materials having high latent heat of fusion and also easily available with low price in the Indian market. Figure1 shows the DSC heating/cooling curves of CA, LA, MA, PA and SA for the 0^{th} cycle. Pure acids characterized by a single peak in DSC graph, which is also sharp and well-defined. Eutectic samples were prepared in the laboratory for CA-LA and CA-MA composition to find out their melting temperature and latent heat of fusion through DSC analysis technique at a scan rate of 2^oCmin^{-1} where the data obtained from the DSC curves is given in Table 2. Overall eighteen samples were prepared at different mass fraction of CA-LA and CA-MA which were characterized by DSC measurement. Based on these results, it can be explained that the melting temperature of the CA-LA mixture follows a downtrend with increase in concentration of CA in the mixture. This decline is observed regularly until the composition of CA in the mixture reaches up to 80 wt. %. As per the melting temperatures found in the range of 20-30^oC with enough amount of latent heat of fusion, these binary mixture can be recommended for the building applications.

For the CA-MA binary mixture development, sample (10/90 wt. %) showed the melting temperature 52.03^oC, it happened due to the higher mass percentage of the MA in the eutectic

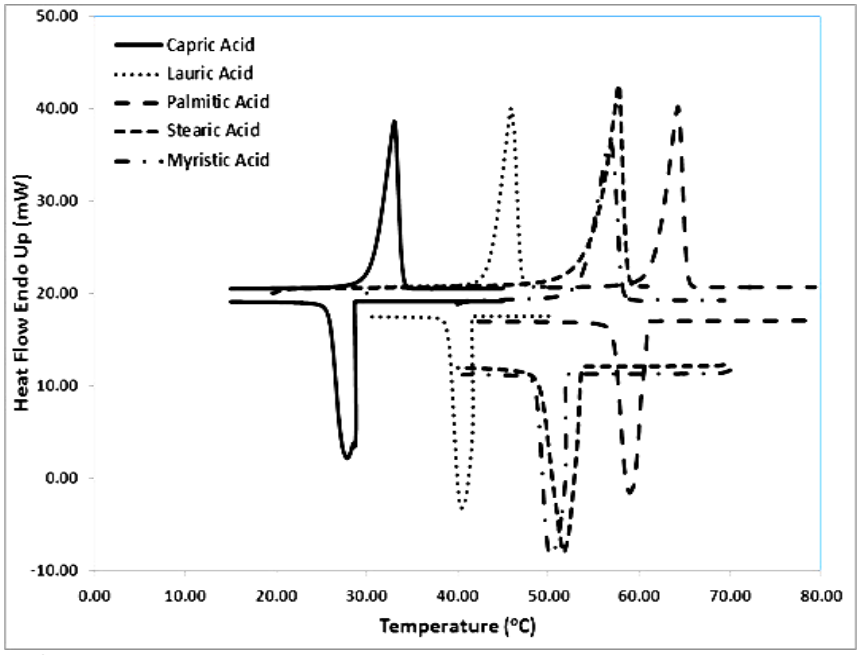

Fig 1: DSC curve with 2°C scanning heating/cooling rate for capric acid (CA), lauric acid (LA), myristic acid (MA), palmitic acid (PA) and stearic acid (SA) 0th Cycle.

Table 2
Thermal properties of the CA-LA and CA-MA developed materials

S.No.	A	B	CA-LA		CA-MA	
	Wt%		T_m (°C)	λ_m (kJ/kg)	T_m (°C)	λ_m (kJ/kg)
1	10	90	40.73	113.64	52.03	136.80
2	20	80	24.30	28.23	N.A.	
3	30	70	23.70	52.64	N.A.	
4	40	60	24.12	164.46	N.A.	
5	50	50	23.98	128.38	N.A.	
6	60	40	21.33	150.10	N.A.	
7	70	30	21.09	123.98	21.79	123.62
8	80	20	21.24	136.91	24.15	158.97
9	90	10	28.41	104.67	22.63	135.84

N.A. data not available due to the various peaks in D.S.C. figures

sample, that's why the binary mixture sample melting point was near to the melting point of the pure MA (56.83°C). DSC curves of binary mixture samples (20/80, 30/70, 40/60, 50/50 and 60/40 wt. %) did not show a sharp peak because both the materials were not compatible with each other for proper mixing purpose. That is why in the DSC results two separate peaks were found [4, 5]. The melting temperature of CA-MA samples (70/30, 80/20 and 90/10 wt. %) was 21.79°C, 24.06°C and 24.05°C, respectively. The latent heat was 123.62, 131.09 and 148.48 kJ/kg, which proved that these three developed materials had enough latent heat of fusion.

Table 3
Latent heat of fusion and melting temperature of CA-LA (60/40 wt. %) and CA-MA (80/20 wt. %) with thermal cycles

S.No.	CA-LA (60/40 wt. %)		CA-MA (80/20 wt. %)	
	T_m (°C)	λ_m (kJ/kg)	T_m (°C)	λ_m (kJ/kg)
0	21.33	150.10	24.15	158.97
50	23.46	118.31	24.53	141.68
100	23.86	116.94	24.97	163.83
200	23.96	134.14	24.24	140.11
300	23.21	162.29	25.10	142.49
400	23.93	130.04	24.00	127.61
500	23.80	124.05	25.32	135.58
600	24.42	140.89	24.44	126.16

N.A. data not available due to the various peaks in D.S.C. figures

Two samples from CA-LA (60/40 wt. %) and CA-MA (80/20 wt. %) identified for the thermal cycling process due to their therophysical properties which were shown in a good trend after the repeated melt/freeze thermal cycles and up to the 600 thermal cycles and the data presented in Table 3.

The binary sample of CA-LA (60/40 wt. %) shown a variation of +8 % to +15% for melting temperature and also a variation between -22% to +8% in the values of the latent heats of fusion from its 0^{th} cycle values. The binary sample of CA-MA (80/20 wt. %) shown variations of +5% for melting temperature and -20% to +5% for latent heat of fusion from its 0^{th} cycle values. The possible reason may be the impurities available in the sample that's why there is a variation in the melting temperature and latent heat of fusion.

VI CONCLUSION

In this study, binary mixtures were prepared as stable PCMs for TES applications in buildings. The prepared eutectics PCMs such as CA-LA and CA-MA with different weight percentages were characterized by using DSC analysis techniques. DSC results showed that only a few eutectics were found satisfactory with due respect of melting temperatures in the desired temperature range (20-30^{o}C), as well as these samples also showed high latent heat of fusion (100-170 kJ/kg), this is another reason to recommend these samples for the building applications. Samples of developed binary mixtures of CA-LA and CA-MA have shown no regular degradation in their melting points during repeated 600 thermal cycles. It is also recommended that before employing any PCM for applications, its thermal cycle test should be conducted, as the behaviour may change [6]. It was also found that if CA mixed with any other lower melting temperature PCM than a desired binary mixture can be developed for the building applications.

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An Efficient Adaptive Cache Update Protocol for Mobile Adhoc Networks

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ABSTRACT
The cooperative caching is one of the most attractive schemes used in the area of Mobile Adhoc Networks (MANETs) to improve the data access performance. The cached data is shared between multiple mobile nodes which cooperatively manages the cached contents. The node mobility and unpredictable network partitioning creates additional overhead, latency and reduces data access ratios in the highly dynamic network environment. An efficient adaptive cache update protocol (ACUP) is proposed in this paper, which address the above problems effectively. A Rendezvous Region (RR) is adopted in the proposed work to exploit the cluster based approach that satisfies the data consistency requirements among partitioned network. A content server transmits data through cluster head nodes (H-Nodes) to local mobile nodes (L-Nodes) in a rendezvous region. The ACUP provides the consistency of cached data in L nodes by utilizing a Time-To-Live (TTL) threshold value. The simulation results show that the proposed scheme outperforms the existing scheme called Flexible Cache Consistency Maintenance (FCCM) in terms of reduced delay, control overheads and increased packet delivery ratio.

Keywords: Mobile Adhoc Networks (MANETs), Cooperative caching, Adaptive Cache Update Protocol (ACUP), Rendezvous Region (RR), Time-to-Live (TTL), Flexible Cache Consistency Maintenance (FCCM).

I INTRODUCTION

Mobile Ad-hoc Network (MANET) is a category of wireless networks which is capable of operating without the support of any fixed infrastructure. It is peer-to-peer, self-configured network in which mobile terminals (such as PDAs, cell phones, tablets and laptops) are connected by wireless links. The application areas of MANETs include disaster relief, emergency response, etc. [1] and become the essential ingredient of the next generation networks [2]. Due to mobility of individual nodes, the network topology becomes highly dynamic which enables frequent and unpredictable changes in the nodes connectivity. Hence, some pairs of nodes may not be able to exchange their information directly with each other and should have to depend on some other nodes so that the information is being correctly delivered to the destination node. This scenario can be referred to as multi-hops networks or store-and-forward networks [3] and is shown in Figure 1. One of the most common data access applications of Mobile Ad-hoc networks is content sharing in which a user can share some information, such as music, video, and document files, with other user(s) on the network. The user may also search for required information and find it from other nodes and downloads them from First, long delay in accessing remote station via multi

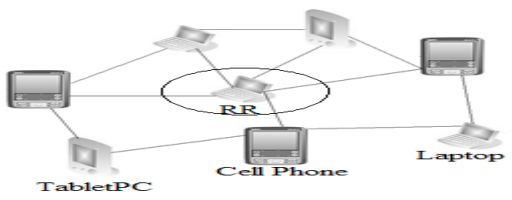

Fig 1 Multi-Hops / Store-and-Forward Networks

hop-communication links leads to high energy consumption. Second, frequent accesses to the database server by many nodes cause a high load on the server and reduce the server response time. Third, the network capacity degrades when network partition occurs due to node's mobility. To overcome the above limitations, an efficient data caching method is introduced in this paper to reduce access delay and bandwidth. To enhance the performance of proposed system, a cluster based approach is used to explore the idea of cluster head and the capability of in-network data caching. Specifically, a Rendezvous Region (RR) – is a cluster with subset of mobile nodes in the network. Within a RR, nodes are one-hop away from each other and it may access a head node (it may be either static node or node with limited mobility) acts as a cluster head that serves as a gateway to the other side networks (Internet or web servers). When a mobile node (MN) visits a RR, it receives data from the AP (i.e., Cluster Head) and stores it in its local cache and disseminates the collected information to its neighbor node when it is requested by the neighbor.

In the data caching approach, the data is widely partitioned and cached across many nodes of the network. The dynamic cached content is periodically modified and updated which requires consistent method to ensure that all cached data are consistent with respect to the source. The mobile node may change its location during the data transmission process. A node in the network cannot retrieve the required data from a remote terminal due to the mobility and network partitioning. Hence, it may cache the data retrieved from remote source to share with its neighbors which improves data availability in the network. However, the overhead in the query latency and response time drastically decreases the performances of the network. The remote source node

must ensure the consistency of cached copies of the data which makes the data consistency becomes a challenging problem in the mobile environment.

In this paper, cluster based data caching algorithm is proposed to improve the overall performance of the network by reducing the delay and response time. The rest of the paper is organized as follows: The related works are described in section II. The network model and the proposed algorithm are presented in section III. Section IV describes the performance evaluation of the proposed algorithm and section V concludes the paper.

II RELATED WORKS

There are many data caching and consistency maintenance schemes for distributed environments have been proposed by G. Cao et al [5]. However, they cannot be suitable for MANET due to node mobility, dynamic topology and energy constraints. The data prefetching techniques presented by Grassi, V [6] provides good trade-off between delay and the cost of power in broadcasting environments. H. Jin et al [7] have proposed a novel scheme based on a selective push algorithm for cooperative cache consistency maintenance over MANETs. However, they fail to reduce control overheads involved in data transmission. Narottam Chand et al [8] have presented an approach, called zone cooperative (ZC) for caching in MANETs. In this scheme, one-hop neighbors of a mobile node establish a cooperative cache zone which reduces the cost for energy consumption and message exchange but increases control overheads due to more control packets exchange. Yu Huang et al [9] have proposed an algorithm to provide cached data consistency maintenance by using a hybrid approach where server utilizes self-learning technique based on history of past queries initiated by mobile clients. In [10-13], an extensive number of schemes have been proposed which give higher priority to data accessibility than access latency. However, the traditional cache replacement policies like LRU, LFU, etc. cannot be directly applied to the MANET environments. The proposed ACUP scheme provides the consistency of cached data by utilizing a Time-To-Live (TTL) threshold value and outperforms in terms of reduced delay, control overheads and increased packet delivery ratio.

III NETWORK MODEL AND ALGORITHM

In the proposed network model, two types of nodes are used: Local mobile nodes (L) with low caching capacity, low power and lower transmission range and Head nodes (H) with high power, high caching capacity and have a long transmission range. It is assumed that at least one H node is present in every RR and number of H node << number of L node in a RR. It is possible that a RR may not cover an L node and is referred to as isolated mobile node. To exploit the benefits of gateway node as cluster head, the initial phase of the proposed algorithm forms a hierarchical structure of the network as shown in figure 2.

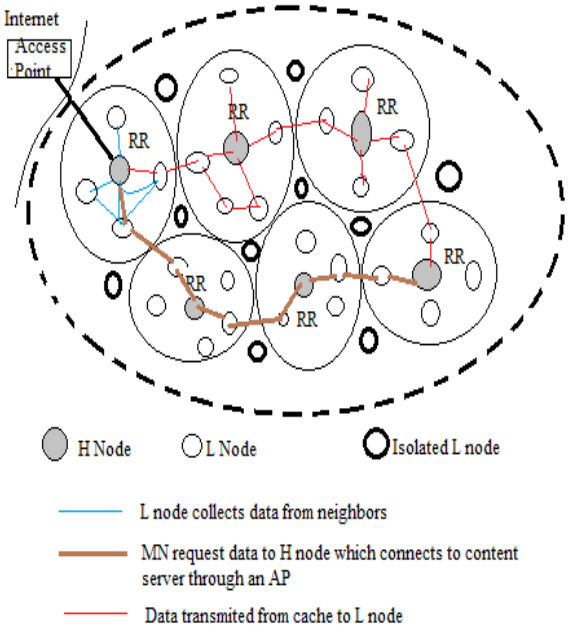

Fig 2 Proposed Network Model

The initial phase of the proposed algorithm called Adaptive Cache Update Protocol (ACUP) finds the neighbor nodes with bidirectional links. Each node periodically sends a 'hello' message containing its own ID (with other network related parameters) and its discovered neighbors. All nodes then construct two tables, a neighbor table (NT) and a cache table (CT) using the following procedure.

(a) Each node broadcasts 'hello' packets within one hop nodes and informs about its type and CT status initially has a null value.

(b) Each node waits for a random period of time T and uses the received 'hello' packets to construct its neighbor table and updates its CT if the received message type is a request for data access.

(c) When a node receives the 'hello' packet, it will check whether its own information is available in the hello packet. If yes, the bidirectional link between the current node and the sender of the packet will be determined. Then the sender information will be updated into the CT for future reference.

To exploit the benefits of Rendezvous Region (RR), a novel algorithm is proposed. In this algorithm, the H node is selected as the head node (cluster Head) of the RR. The H node creates a loose coupling relations ship with its one hop neighbors. Only L nodes come under the coverage of H nodes can participate in the communication process involved within the RR. Isolated L nodes may join the nearest RR region at any time. The proposed algorithm has two features. First, the loose coupling between H node and L nodes avoids overheads caused by node mobility and cluster maintenance when the density of H nodes with in a RR

is small. Second, the proposed scheme can be adaptive to the density of H nodes.

All nodes update local cache table contents by exchanging control information during second phase (Cache Table Update) of the proposed algorithm. Notice that the initial neighbor table of an L node stores local topology information based on discovered bidirectional links. The detailed procedures for updating local CT are presented below:

- Each L-node broadcasts its CT content information to its neighbors based on the NT constructed in the initialization phase. The CT information is updated at every node when a new control packet is exchanged between H node and L node. Notice that control information has been exchanged with in the RR and it will be controlled by time-to-live (TTL). Because TTL is very small, exchanging control packets will not incur much overhead to the network. The control packet contains the details of most accessed data items available in the respective RR.
- After constructing local cache table at every L nodes as in step 1, the H nodes wait for any new request from the L node. For every new request, it updates the local CT of each L node by broadcasting the control packets with in the RR. Every L node in the RR must send its request to H node of the requested data is not cached in its local CT.
- H node then computes the access rate from the frequency of new request made with in pre-determined threshold value T_H. For any new data request from an L node in the RR, H node compares it with T_H. If the new access rate is > T_H, the H node set a flag in its CT to reflect the changes in the next control packets exchanges. H node also sends a feedback message to the content server to update its own cache table. Note that if the local CT is full and a new data request exceeds the threshold value, then H will replace with the leased accessed item in the table.
- If the H node fails in a RR and wants to elect a new H node, the next H node will be the one with high capacity and power than the old H node. The mirror image of CT of the old node is stored in the new H node.
- Content Server determines the TTL value for every pre fetched data item adaptively using the equation (1)

  $$TTL = F * IURI (t) \quad \text{Eq. (1)}$$

  where F is a system determined factor and IURI is the inter-update request interval.

In heterogeneous network environment, some nodes may have more cache capacity and power than other nodes. For instance, a laptop can have more processing capacity, power and cache capacity than a cell phone. In such situation, these nodes will be more active and give instant response to other nodes' requests, as they can cache more data items in their local cache and remain active for a longer time. Hence, such a node can be chosen as H node in the RR. This paper does not focus on the selection of H node and how to form the rendezvous regions with in a network topology. Any clustering algorithm can be utilized for this purpose. Network area can be virtually extended such that any RRs have the same size in the network. The size of any RR in the network topology is an important parameter in the network partitioning process. All L nodes in a RR can reach to every other RR in the network at point in time. The value of RR size 'R_z' is derived from the equation 2

$$R_z = (r_L + r_H) / \sqrt{2} \quad \text{Eq. (2)}$$

where, r_L is the transmission range of an L node and r_H is the transmission range of H node ($r_L >> r_H$).

IV PERFORMANCE EVALUATION

The proposed approach was simulated using NS2 discrete event simulator with channel capacity 3 Mbps. The IEEE 802.11 DCF (Distributed Coordination Function) is used as MAC Protocol for Wireless LAN. The link layer notifies the network layer about the link break occurred in the network. The random way point mobility model is used for node mobility in an area of 500 m x 500 m for 100 seconds simulation time. The transmission range of L node is fixed as 100 m and for H node is 250 m, respectively. The variable cluster size is used and the speed of the L nodes is also varied. However, for H nodes, it is assumed to be static. The simulated traffic is assumed to be in Constant Bit Rate (CBR) and the data query and cache updates processes are based on Poisson process. The simulation settings and parameters are summarized in table 1.

Table 1: Simulation settings

Parameters	Values
No. of L nodes	Variable (Between 10 – 100)
No. of H nodes	Fixed
Tx Range for L nodes	100 meters
H nodes	250 meters
Simulation period	100 seconds
Cache Size – L Nodes	1 MB
H Nodes	3 MB
Mobility model	Random way point
Speed	Variable
Inter update request Interval (IURI)	20 seconds
Bandwidth	3 Mbps
TTL Threshold	5 Seconds

The first scenario was simulated by varying the number of nodes with speed of the L nodes. When the density of the nodes increased in a given RR, the query latency and control overheads also increased due to additional caching overheads which causes deficiency in overall packet delivery ratio.

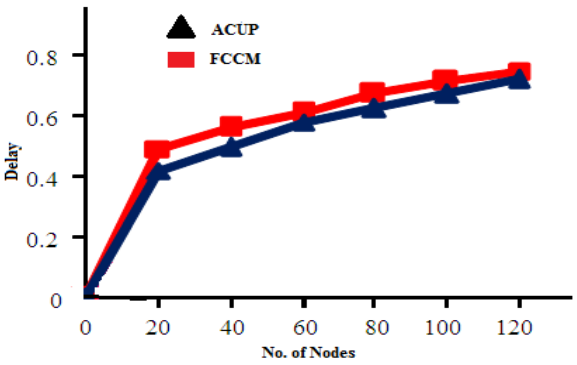

Fig 3 No. of Node Vs Delay

The proposed Adaptive Cache Update Protocol (ACUP) is compared with Flexible Cache Consistency Maintenance (FCCM) [14]. The ACUP shows lower delay than FCCM.

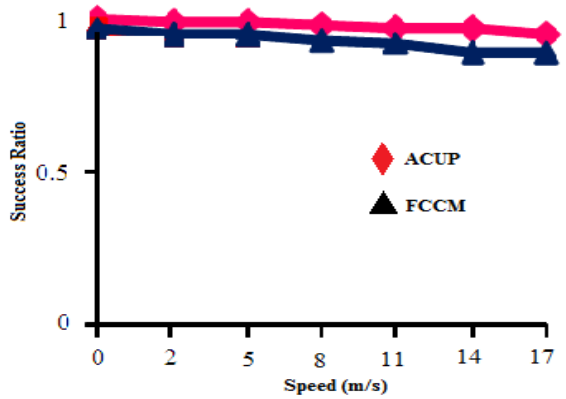

Fig. 4 Speed Vs Success Ratio

The ACUP scheme achieves better success ratio than the FCCM and is illustrated in Fig. 4. The overhead incurred in control message transmission is reduced in ACUP by utilizing cluster based approach in rendezvous region. Finally, the mobile node speed is plotted against latency incurred in query response is illustrated in the figure 5. From the figure, it is evident that the proposed ACUP has less query latency.

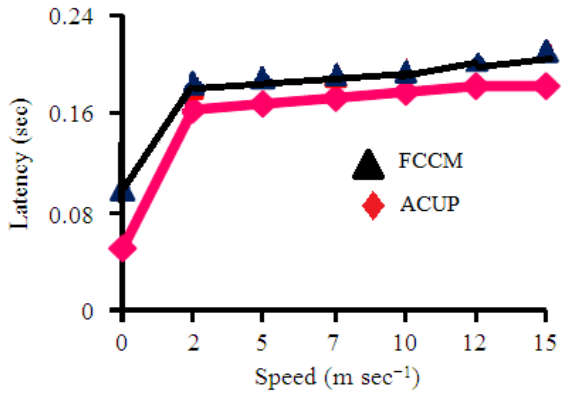

Fig. 5 Speed Vs Latency

From the simulation, it is clear that the proposed APUC scheme reduces latency, control overheads and packet success ratio and out performs than the FCCM scheme.

V CONCLUSION

This paper has been designed to provide the adaptive cache update protocol for Mobile Adhoc Network (MANET) environments. The proposed adaptive approach utilizes a Rendezvous Region (RR) to emulate the cluster based approach. Each RR consists of two types nodes L node and H nodes both contains cache table (CT) to record each data item requested from content server. In heterogeneous MANETs, some nodes may be more efficient and powerful than other nodes which are responsible for maintaining the information in the Cache Table of different nodes belong to the RR boundary. The ACUP provides the consistency of cached data by utilizing a Time-To-Live (TTL) threshold value. The simulation results exhibits that the proposed scheme outperforms well in terms of reduced delay, control overheads and increased packet delivery ratio.

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RuPay : The Indigenous Electronic Card Payment Scheme

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ABSTRACT
RuPay is an Indian domestic card scheme like Visa and MasterCard conceived and launched by National Payments Corporation of India (NPCI). NPCI is an institution driven by Reserve Bank of India(RBI) to support/drive all the retail payment systems in the country. NPCI was founded in 2008 under RBI with ten core promoter banks. It's mission is to fulfill RBI's vision of having a domestic, open loop and multilateral system of payments in India. RuPay hopes to give banks new opportunities to operate in the card payments domain of India. The President of India Shri Pranab Mukherjee on May 8, 2014 dedicates 'RuPay' to the nation. The core objective of the RuPay Payment scheme is to consolidate and integrate the multiple payments systems with varying service levels into nation-wide uniform and standard business process for all retail payment systems. With the introduction of the RuPay card India is one of the few countries to have developed a card system domestically. RuPay can be used at ATMs, at Points of Sale(PoS) or retail shops all over the country and for online shopping as well. It will offer immense convenience to Indian consumers.

I INTRODUCTION

The Indian banking sector has come a long way from its initial technology adoption. Information technology is one of the most important facilitators for the transformation of the Indian banking industry in terms of its transactions processing as well as for various other internal systems and processes. The various technological platforms used by banks for the conduct of their day to day operations, their manner of reporting and the way in which interbank transactions and clearing is affected has evolved substantially over the years.

The technological evolution of the Indian banking industry has been largely directed by the various committees set up by the RBI and the government of India to review the implementation of technological change. No major breakthrough in technology implementation was achieved by the industry till the early 80s, though some working groups and committees made stray references to the need for mechanization of some banking processes. This was largely due to the stiff resistance by the very strong bank employees unions. The early 1980s were instrumental in the introduction of mechanisation and computerisation in Indian banks. This was the period when banks as well as the RBI went very slow on mechanisation, carefully avoiding the use of 'computers' to avoid resistance from employee unions. However, this was the critical period acting as the icebreaker, which led to the slow and steady move towards large scale technology adoption.

ATMs were introduced to the Indian banking industry in the early 1990s initiated by foreign banks. Most foreign banks and some private sector players suffered from a serious handicap at that time- lack of a strong branch network. ATM technology was used as a means to partially overcome this handicap by reaching out to the customers at a lower initial and transaction costs and offering hassle free services. Since then, innovations in ATM technology have come a long way and customer receptiveness has also increased manifold. Public sector banks have also now entered the race for expansion of ATM networks.

Development of ATM networks is not only leveraged for lowering the transaction costs, but also as an effective marketing channel resource.

In the Asia-Pacific region, India is one of the fastest growing countries for card payments. The share of card payments, both in terms of volume and value has increased significantly in recent years. As per the RBI reports, as on 31 March 2014, there are 19181567 credit cards and 394421738 debit cards are in use in India, which are issued by various banks. According to the RBI, the debit card transactions in India have increased by around 22% in 2013-14 to reach Rs 85,770 crore from about Rs 66,940 crore in 2012-13 and the number of debit cards in use also rose by 30.48% during this period. Despite the decline in the number of outstanding credit cards, the volume and value of transactions using credit cards have increased by 13.2% and 18.1% respectively in 2010-11. In 2013-14 there are 461.05 million transactions using Credit card having the amount of Rs. 1454.87 billion.

The increasing Internet penetration and availability of more payment options boosted the e-commerce industry in 2013. According to the survey, India's e-commerce market, which stood at $ 2.5 billion in 2009, reached $ 8.5 billion in 2012 and rose 88% to touch $ 16 billion in 2013. The survey estimates the country's e-commerce market to reach $ 56 billion by 2023, driven by rising online retail1.

Table 1
Growth of ATMs, Credit Cards and Debit Cards in India

Year	No of ATMs	No of Outstanding Credit Cards (in million)	No of Outstanding Debit Cards (in million)
2005-06	21,523	17.33	49.76
2006-07	27,088	23.12	74.98
2007-08	34,789	27.55	102.44
2008-09	43,651	24.70	137.43
2009-10	60,153	18.33	181.97
2010-11	74,505	18.04	227.84
2011-12	95686	17.65	278.28
2012-13	114014	19.55	331.19
2013-14	160055	19.18	394.42

Upto 31 March 2014

Table 2
Card Payments at Point of Sale Transactions in India

Year	Credit Cards			Debit Cards		
	Number of transactions (in million)	Amount (in billion)	Growth (in%)	Number of transactions (in million)	Amount (in billion)	Growth (in%)
2005-06	156.09	338.86		45.69	58.97	
2006-07	169.54	413.61	18.1	60.18	81.72	27.8
2007-08	228.20	579.85	28.7	88.31	125.21	34.7
2008-09	259.56	653.56	11.3	127.65	185.47	32.5
2009-10	234.24	618.24	-5.7	170.17	264.18	29.8
2010-11	265.14	755.16	18.1	237.06	386.91	31.7
2011-12	287.44	883.73	14.55	306.68	465.34	16.85
2012-13	356.16	1112.17	20.54	456.72	669.40	30.48
2013-14	461.05	1454.87	23.55	569.81	857.70	21.95

Up to 31 March 2014[2]

RBI did an analysis of the card transactions happened in India and concluded that most of the card transaction done by Indians were in India only but due to using the services of multinational brands like Visa and MasterCard for payment solutions Indian banks & customers are ending up paying these multinationals So, in order to fix up this issue, RBI asked the Indian Bank Association (IBA) to launch a non-profit payment solutions company keeping in mind the requirements of Indian banks. And the outcome of this effort was RuPay. With the launch of RuPay, now Co-operative banks and smaller commercial banks will also start issuing card which were earlier not issuing due to high cost of initial participation fee and quarterly minimum processing fees to get payment solution service from global payment processing firms.

Rupay is an Indian domestic card scheme conceived and launched by National Payments Corporation of India (NPCI) on the lines of China's UnionPay on 26thMarch 2012. NPCI is an institution driven by RBI to support/drive all the retail payment systems in the country. NPCI was founded in 2008 under RBI with ten core promoter banks The core objective is to offer a domestic, open-loop, multilateral system which will allow all Indian banks and financial institutions in India to participate in electronic payments. NPCI will soon provide a full range of card payment services including the RuPay ATM, RuPay MicroATM, Debit, Prepaid and Credit Cards which will be accepted in India and abroad

II NATIONAL PAYMENTS CORPORATION OF INDIA (NCPI)

Reserve Bank of India, after setting up of the Board for Payment and Settlement Systems in 2005 released a vision document incorporating a proposal to set up an umbrella institution for all the Retail Payment Systems in the country. The core objective was to consolidate and integrate the multiple systems with varying service levels into nation-wide uniform and standard business process for all retail payment systems. This led to the formation of National Payments Corporation of India, (NPCI)[3].

The NPCI has ten core promoter banks (State Bank of India, Punjab National Bank, Canara Bank, Bank of Baroda, Union bank of India, Bank of India, ICICI Bank, HDFC Bank, Citibank and HSBC). It has been incorporated as a Section 25 company under Companies Act and is aimed to operate for the benefit of all the member banks and their customers[2].

The vision of NPCI being able to provide citizens of our country anytime, anywhere payment services which are simple, easy to use, safe, and secure, fast and also cost effective. NPCI aims to operate for the benefit of all the member banks and the common man at large.

The main objectives in developing of the India's own payment system are as follows:

(a) To handle India-specific electronic retail payment system
(b) To facilitate an affordable payment mechanism to benefit the common man across the country and help financial inclusion
(c) Reduce overall transaction cost for the banks in India by introducing competition to international card schemes
(d) Provide card payment service option to many banks who are currently not eligible for card issuance under the eligibility criteria of international card schemes
(e) Build environment whereby payment information of the country remains within the country
(f) Shift Personal Consumption Expenditure (PCE) from cash to electronic payments

III WHY RUPAY CARD?

RBI's Vision Document 2009-12[4] has stated that the need for a domestic payment card system and Point of Sale (POS) switch network for issuance and acceptance arises from two major considerations: (1) the Indian banks have to bear the high cost of affiliation with international card associations in the absence of a domestic payment system,

(2) around 90% of our card-based transactions are routed through a switch located outside the country.

As there is no domestic card, banks do not have an option but to tie up with Visa or MasterCard for connectivity between cardholders, merchants and issuing banks across the globe. Every transaction done using a debit or credit card issued by a domestic bank is routed through network switches owned by Visa or MasterCard, which are based outside the country. All these transactions involve some charges which goes into the pockets of Visa and Mastercard for providing these services. On an average, banks pay around Rs 500 crore every year to Visa and MasterCard for processing all debit and credit card payments[5]. The Rupay initiative imposes the setting up of a network switch, which acts as a payment gateway that connects all the ATMs and points-of-sale terminals. The domestic system will eventually displace payment settlement providers like MasterCard and Visa.

India is one of the few countries to have developed a card system domestically. RuPay is 7th payment network in the world after Visa, MasterCard, American Express, Discover, Diners Club, and JCB[6]. On May 8, 2014, President Pranab Mukeherjee dedicated the payment network to the nation. In the speech Mr. President says -

"*An indigenous system like RuPay will, hopefully, not only reduce the dependence on cash and cheque modes of settlement but will also make it easier to offer products based on specific requirements of diverse user sets within the country,"* he said, *while adding that India is one of the few countries in the world to meet domestically the need for card payment system*.

Table 3
Top 10 Banks with Highest Number of ATM & POS Installed in India

Top 10 Banks with highest Number of POS installed		
Bank Name	No. of POS	% Share
ICICI Bank Ltd.	283162	26.95
Axis Bank Ltd.	248482	23.65
HDFC Bank Ltd.	215524	20.51
State Bank of India	135853	12.93
American Express Bkg. Corp.	20347	1.93
Citibank	17844	1.69
IDBI Ltd.	14726	1.40
Corporation Bank	13501	1.28
HSBC	12497	1.18
Bank of Baroda	10998	1.04
Others Bank	77389	7.36
Total (As on 31st March. 2014)	1050323	100

The term RuPay was coined from Rupees and Payment[7]. It's India's answer to growing plastic money floating around the world. RuPay works to enable electronic payment at all Indian banks and financial institutions. It will reduce drastically the need to use cash for financial transactions. Currently 12.6 per cent of GDP worth cash and coins are in circulation which is quite high[8]. RuPay can be used at ATMs, at Points of Sale or retail shops all over the country and for online shopping as well. It will offer immense convenience to Indian consumers. There are plans in the offing to tie up with international institutions and take the card overseas. It will be available at much lesser cost as compared to international cards. This is because the processing will happen domestically and it will save a lot of money in clearance and settlement, thus reducing the processing fees drastically. Banks will not pay in foreign currency but in Indian currency. It is being seen as a tool to reach out to the rural unbanked. Within two years of launch, NPCI has issued over 17 million RuPay cards as of end March 2014.

The growing popularity of electronic payments is evident from the fact that the RuPay card scheme which was launched by NPCI in 2012, already has twelve million cards in circulation in the country. 50% of RuPay cards are used by the semi-urban and rural population which gives access to Tier-2 and Tier-3 cities. NPCI's commitment to electronify payments in the country is visible by the fact that RuPay cards are now accepted at all the ATMs in the country and over 10 lakh POS terminals nationwide i.e. nearly 100% POS acceptance. Mr. A P Hota, (MD & CEO, NPCI) affirms that "*RuPay definitely has potential to change dynamics in due course of time by striking a chord with the semi-urban and rural population. The impact of e-commerce is evident from the fact that State Bank of India, the largest issuer in the country wanted RuPay to go live on e-commerce in order to begin the issuance of RuPay cards.*" Soon you can book train ticket on IRCTC (Indian Railway Catering and Tourism Corporation) through RuPay pre-paid card. RuPay network is just like Visa and Master Card and provides an alternative system for banks to provide debit card service. RuPay, like any other debit card, works on three channels, ATMs, Point of Sales (PoS) and online sales beside Aadhar-based micro ATM.

To support financial inclusion, NPCI is offering Aadhar-enabled Rupay cards to public sector banks for their no-frill account holders[9]. NPCI is also in talks with state owned lenders to issue cards to regional rural banks (RRBs). Using an Aadhar-enabled RuPay card, a customer can withdraw money from both, normal and micro ATMs, with the help of biometric technology. So far, NPCI has offered such cards to Bank of India, Corporation Bank and Union Bank of India.

So far, 31 scheduled commercial banks based in public and private sector, 49 regional rural banks and 175 co-operative have issued over 2 crore RuPay cards. This card is accepted at all the 1.6 lakh ATMs, 95 per cent of point of sales terminals (9.45 lakh+) and most of the online merchants (about 10,000) in the country. RuPay card is accepted at all ATMs (1.6 lakh plus), 95 percent of PoS terminals (9.45 lakh plus) and many of the eCom merchants (about 10,000) in the country.

A variant of the card called 'Kisan Card' is now being issued by all the public sector banks in addition to the mainstream debit card which has been issued by banks. Further, a separate card for payment of milk purchases has also been launched.

NPCI's RuPay PaySecure solution has integrated with 500-plus merchant websites across multiple categories that would accept RuPay card for online payment services. NPCI is aiming to cover 100% of e-commerce market by this year-end, for which, significant efforts are being made consistently.

Fig 1 : The RuPay Card Issued by Gramin (Rural) Banks

IV BENEFITS OF RUPAY CARD

The new card will bring a paradigm shift in the payment system in India as the objective of the RuPay card is to encourage more debit card usage in the country, especially in rural and semi-urban areas. At present, the debit and credit card penetration is concentrated in Tier-1 and Tier-2 cities as many of the cooperative banks and RRBS from Tier-3 and Tier-4 cities are unable to issue debit cards to their customers, mainly on account of higher joining fees and a minimum quarterly fee levied by international schemes. With RuPay, rural banks and small cooperatives banks will be able to offer debit card services and will also get access to the wider ATM network spread across the country.

Though the challenges in India Market are high, Indian market offers huge potential for cards penetration. The needs of Indian consumers, merchants and banks will be addressed by Rupay, . The benefits of RuPay debit card are the flexibility of the product platform, high levels of acceptance and the strength of the RuPay brand-all of which will contribute to an increased product experience.

As far as safety and security is concerned the NPCI has procured a state-of-the-art fraud monitoring solutions for RuPay scheme and its risk management team is implementing the system in stages. The rules for alerts and monitoring are framed on real time and near real time basis.

For providing internet transactions to RuPay cardholders NPCI has tied up with a US based company to provide internet-based card payment system technology. Thus, soon the RuPay card-holders can make transactions at various e-commerce sites with the two factor authentication, which will be more secure than the internet transactions under the current 3-D secure mode.

(a) **Lower cost and affordability***:* Since the transaction processing will happen domestically, it would lead to lower cost of clearing and settlement for each transaction. This will make the transaction cost affordable and will drive usage of cards in the industry.

(b) **Customized product offering***:* RuPay, being a domestic scheme is committed towards development of customized product and service offerings for Indian consumers.

(c) **Protection of information related to Indian consumers***:* Transaction and customer data related to RuPay card transactions will reside in India.

(d) **Provide electronic product options to untapped/unexplored consumer segment:** There are under-penetrated/untapped consumers segments in rural areas that do not have access to banking and financial services. Right pricing of RuPay products would make the RuPay cards more economically feasible for banks to offer to their customers. In addition, relevant product variants would ensure that banks can target the hitherto untapped consumer segments.

(e) **Inter-operability between payment channels and products:** RuPay card is uniquely positioned to offer complete inter-operability between various payments channels and products. NPCI currently offers varied solutions across platforms including ATMs, mobile technology, cheques etc and is extremely well placed in nurturing RuPay cards across these platforms. The NPCI is planning to integrate payments through various channels - cards, mobile, money transfer, etc, and will have special emphasis on integrating mobile payment system using the RuPay scheme

Some of the benefits of RuPay over global brand like Visa & Master Card are as follows:

- This will make more people use cards for payments which will lead to electrification of payments.
- RuPay is a non-Profit company which will allow banks to use this service without any participation or quarterly processing fee.
- RuPay will help banks to reduce their cost of issuing debit cards.
- RuPay will help in extending payment network in rural and semi-rural areas also.
- RuPay will remove the extra 2% charge which customers have to pay on making payment using card.

- RuPay will reduce the cost of transaction processing by 40% as compare to international schemes.
- RuPay will take all fees in Indian currency as compare to global companies which take fees in foreign currency.

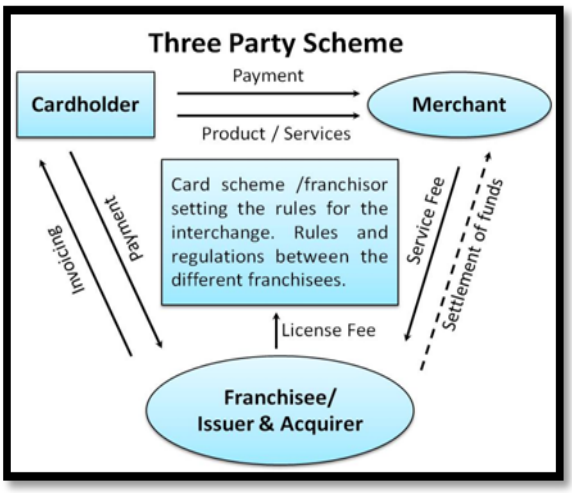

Fig 2 (A) – Three Party Scheme

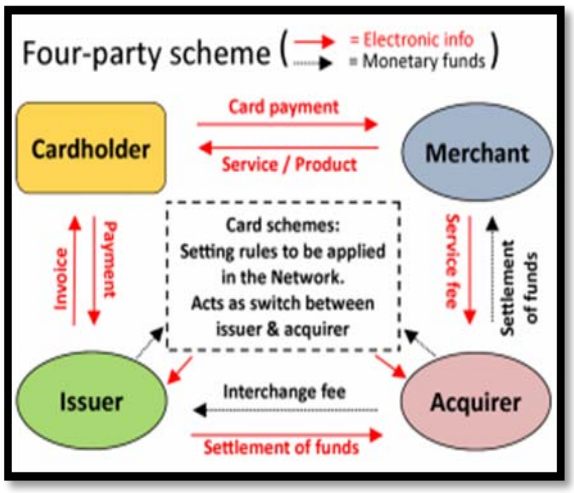

Fig 2 (B) – Four Party Scheme

- The fee structure under RuPay scheme is transparent and not subject to one-on-one negotiation with member banks.
- RuPay will help reducing the cost of banks, a part of benefit may be passed to customers by way of reduced customer charges.

V TECHNICAL DETAILS OF RUPAY PAYMENT CARD SCHEME

Technically, there are two types of schemes is applicable to all card payment - a **three-party scheme** (or **closed scheme**) or a **four-party scheme** (or **open scheme**).

A three-party scheme consists of three main parties as described in the figure 1. In this model, the issuer (having the relationship with the cardholder) and the acquirer (having the relationship with the Merchant) is the same entity. This means that there is no need for any charges between the issuer and the acquirer. Since it is a franchise setup, there is only one franchisee in each market, which is the incentive in this model. There is no competition within the brand; rather you compete with other brands. Examples of this setup are Diners Club, Discover Card, American Express and other closed loop system like restaurant checks

In a four-party scheme, the issuer and acquirer are different entities, and this scheme is open for other members of the scheme to join in the competition. This signifies card schemes such as Visa ,MasterCard and RuPay. There is no limitations as to who may join the scheme, as long as the requirements of the scheme are met.

You can use your RuPay debit card for online transactions using the *PaySecure* payment service on Internet. The *PaySecure* allows the customer to use his ATM PIN to make the payment online. It uses a simplified yet secure architecture. It offers additional security measures wherein the mode of validation is by selecting an image and passing a phrase[10].

PaySecure is the first software-only service that allows consumers to use PIN debit for Internet purchases. PIN debit is a popular payment method at the retail point of sale because it is secure and convenient but until PaySecure, PIN debit has never been offered as an online payment option. PaySecure brings the convenience and security of PIN debit to the Internet with a simple to use service that's just like using PIN debit at the retail point of sale. All you need is your debit card and PIN. There's no enrollment, no sign-up or special passwords, and no redirection to another website.

RuPay PaySecure conforms to the RBI mandate of two factor authentication- firstly, it uses two security parameters to authenticate a customer and authorize transaction through the participating banks, and secondly, the solution uses ‘image selection’ for ensuring additional security of every single transaction. This innovative authentication methodology simplifies and improves the existing e-commerce experience of the cardholder as they don’t need to remember complicated passwords or suffer through transaction drops or time-outs, thus making the service more user-friendly and quicker.

PaySecure is the most customer-friendly debit card payment service on the market, simply requiring the entry of the PIN the cardholder already knows, allowing you to quickly authenticate the customer without the need for enrollment in a separate authentication service, a new password/one-time PIN, or redirection from your website. The Figure 3 describes how the customer can use RuPay PaySecure to make online transactions[11]:

VI RUPAY ROADMAP

RuPay is well poised to support issuance of debit and prepaid cards by banks in India and thereby supporting the growth of retail electronic payments in India. RuPay is also working towards enhancing the acceptance ecosystem in the country. Further RuPay is well poised to explore innovative payment opportunities such as Contactless to facilitate and increase the efficiency of increasing the small ticket payments electronically.

RuPay envisions becoming a prominent player in the Indian card payments industry by increasing its acceptance at various retail payment touch points. Various stages of the RuPay roadmap are as follows[12]:

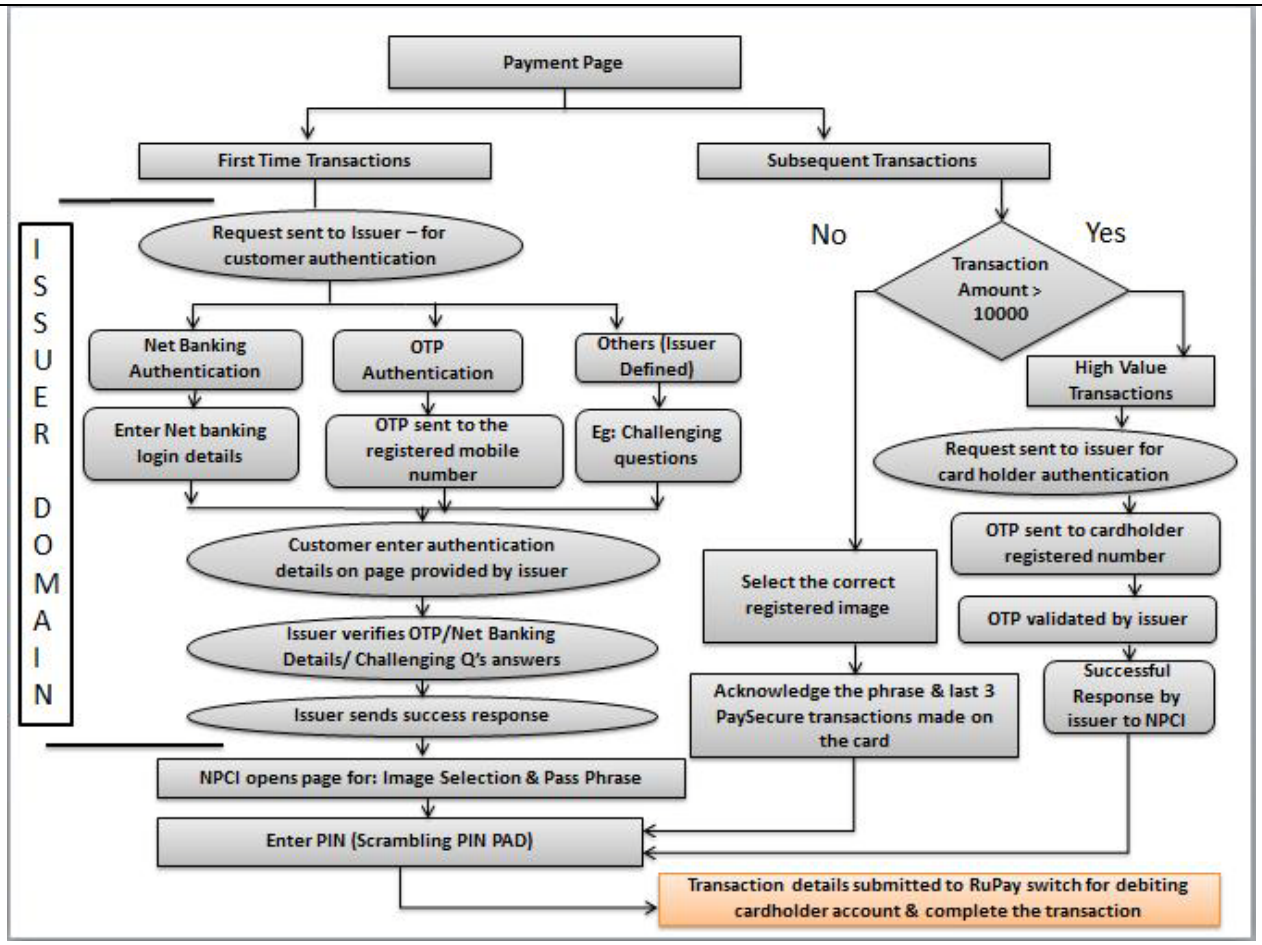

Fig 3 : Process flow and how the customer can use RuPay PaySecure to make online transactions

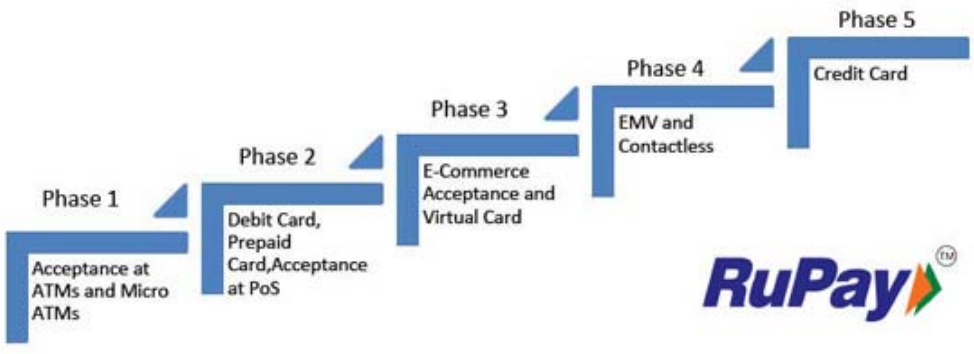

Fig 4 – Rupay Roadmap

(a) Acceptance at ATMs and micro-ATMs.
(b) Debit card, prepaid card, acceptance at PoS.
(c) E-Commerce acceptance and Virtual Card.
(d) EMV and contactless.
(e) Credit card.

VII CONCLUSION

With the RuPay scheme India could also witness a cashless revolution which would lower transactions costs coupled with enhanced security and transparency leading to better governance. With the NPCI'S three distinct value propositions - pricing, governance and control - the RuPay scheme will further strengthen the payment system of the country all leading to promote orderly economic development and growth. RuPay PaySecure not only provides a platform for e- transactions but also gives the customers a complete_unique shopping experience. The RuPay Card can be used at all ATMs, merchant establishments in India for online transactions and payments.

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Studies of Nano-crystals at High Pressures-A Brief Guideline

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ABSTRACT
Nanoparticles are known to have distinct properties than their bulk counterparts. Besides, metastable or even amorphous phases of bulk materials with new properties can be synthesized in nanosize form. Both the understanding of nanomaterials properties and the synthesis of new phases of nanomaterials can be undertaken with the help of the application of static high pressures. High pressure techniques allow a precise control of interatomic distances in materials which is an invaluable way to investigate many fundamental and unique properties of nanoparticles. Furthermore, studies of nanocrystals at high pressures can lead to the synthesis of new nanomaterials since many high-pressure phases of bulk materials can be metastably recovered at ambient conditions after a high-pressure treatment of nanomaterials. In this work, we will review some of the capabilities of high pressure studies to understand nanoparticle properties and to create new nanomaterials by providing some examples. We will also present some of the most recent advances in the study of nanomaterials at high pressures.

I INTRODUCTION

Nanomaterials are materials with a length scale between 1 nm and 100 nm. They include 2D materials (nanolayers or monolayers like graphene), 1D materials (nanotubes and nanowires) and 0D materials (nanocrystals and quantum dots) but also 3D materials with framework structures with nanocages (fullerites, zeolites and chlathrates). The different chemical properties of nanomaterials compared to bulk materials are related to the high surface/volume ratio of nanomaterials which results in a high surface energy which can be comparable to the volume energy. The different physical properties of nanomaterials compared to bulk materials are related to the occurrence of confinement of particles and quasiparticles in nanomaterials, like electron or phonon confinement. Therefore, the different properties of nanomaterials with respect to bulk materials depend very much on the system (surface energy of a certain crystal or amorphous structure, mean-free paths, scattering or coherent lengths) and it has been shown that many nanomaterials with sizes above 50 nm have properties similar to bulk materials. In general it can be stated that most nanomaterials display different chemical properties than bulk materials below 50 nm while most nanomaterials display different physical properties than bulk materials below 20 nm.

Nanomaterials are extremely sensitive to interactions with the environment due to the large number of atoms at their external or internal (porous) surfaces; therefore, the physical and chemical properties of nanomaterials can be very different from bulk materials and are highly dependent on the size, impurity or defect concentration and surface pasivation. Furthermore, the high surface energy of nanomaterials opens new paths for chemistry of new phases not available in bulk materials.

II PRESSURE EFFECTS

Pressure, like temperature, is an important thermodynamic parameter which allows an increase of matter density by reducing volume. The reduction of volume leads to an overall decrease of interatomic and intermolecular distances that allows exploring in detail atomic and molecular interactions. It is well known that changes in physical properties with increasing temperature are due to both volume changes (expansion at high temperatures) and phonon interactions (higher phonon energies available and higher population at high temperatures). However, changes in physical properties with increasing pressure are only due to volume changes; therefore, pressure is a more clean variable than temperature in order to explore the change in properties. Consequently, studies of materials at high pressures can provide a deep understanding of the materials properties at ambient conditions in order to design materials with improved properties.

III RESULTS AND DISCUSSION

The values of pressures in laboratory which can be applied to materials (10^6 bar) exceeds by three orders of magnitude the changes in temperature which can be applied to materials (10^3 K). Therefore, application of high pressures can induce changes in the free energy of materials that exceed those of the strongest chemical bonds present at

ambient pressure (>10 eV) thus leading to phase transitions which can result in new phases of materials (many of them recoverable at ambient conditions) with new properties. The most common example is diamond, a meta-stable phase of carbon at ambient conditions which can be obtained by pressurizing graphite at high temperatures. In this respect, it is noteworthy to mention that pressure can completely redistribute electronic densities and change the nature of the chemical bonds thus leading to profound changes in materials, like converting insulators into metals and soft chemical bonds into stiff bonds. Therefore, the Periodic Table of Elements gets a new dimension at high pressures since elements under compression develop redefined affinities, electronegativity and reactivity.

On the other hand, studies of materials at high pressures are very important for technological applications. For instance, the determination of the lattice parameters or the phonons of a material at high pressures allows the estimation of the tensile or compressive strain suffered by thin layers in a number of devices. Similarly, the determination of the stability of a phase of a certain material at high pressures is important to foresee the conditions of applications of that material under tensile or compressive strains.

The studies of nanomaterials at high pressures date back to 1967 [1] but gained a renewed interest in the last two decades. Among the studies of nanomaterials at high pressures we can distinguish between those corresponding to physical and chemical properties.

Physical properties can be subdivided into structural and mechanical properties, vibration properties, optical properties, transport properties and thermal properties. In particular, structural properties have shown different lattice parameters and bulk modulus of nanomaterials than in bulk materials and different phase transformations and phase transformation pressures in nanomaterials than in bulk materials [2, 3]. Vibration properties have shown abnormal effects due to internal and external compensation of pressures in nanocrystals and phonon confinement effects [4]. Finally, optical properties have shown electron and hole confinement effects [4] and enhancement of photoluminescence in some nanomaterials.

IV CONCLUSION

Studies of chemical properties at high pressures in nanomaterials have shown many synthesis routes of new nanomaterials. In particular, it has been shown the transformation of nanomaterials either by collapse of open framework structures [5] or due to phase transformations (crystal-crystal, crystal-amorphous, amorphous-amorphous). Chemical reactions between nanomaterials have been observed like polymerization of fullerenes or nanomaterials [6]. Finally, the interaction between the nanomaterial and the pressure-transmitting medium in high-pressure studies has been observed to lead to intercalation of the medium in nanostructures or nanocages [7], or to chemical reactivity of nanomaterials and the medium, which depends on surface passivation of nanomaterials.

Finally, it must be highlighted that new experimental techniques are being developed in the last years which open new and exciting possibilities to study nanomaterials at high pressures [8-10]

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Grid Interactive Renewable Power in India

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ABSTRACT
Energy is critical, directly or indirectly, in the entire process of evolution, growth and survival of all living beings and it plays a vital role in the socio-economic development and human welfare of a country. Energy has come to be known as a `strategic commodity' and any uncertainty about its supply can threaten the functioning of the economy, particularly in developing economies. Achieving energy security in this strategic sense is of fundamental importance not only to India's economic growth but also for the human development objectives that aim at alleviation of poverty, unemployment and meeting the Millennium Development Goals (MDGs). Holistic planning for achieving these objectives requires quality energy statistics that is able to address the issues related to energy demand, energy poverty and environmental effects of energy growth. Renewable energy represents an area of tremendous opportunity for India. Energy is considered a prime agent in the generation of wealth and a significant factor in economic development. Energy is also essential for improving the quality of life. Development of conventional forms of energy for meeting the growing energy needs of society at a reasonable cost is the responsibility of the Government. Limited fossil resources and associated environmental problems have emphasized the need for new sustainable energy supply options. India depends heavily on coal and oil for meeting its energy demand which contributes to smog, acid rain and greenhouse gases' emission. Last 25 years has been a period of intense activities related to research, development, production and distribution of energy in India.

Keywords: compound annual growth rate (CAGR), Renewable energy, Energy conservation**.**

I INTRODUCTION

The Indian economy has experienced unprecedented economic growth over the last decade. Today, India is the ninth largest economy in the world, driven by a real GDP growth of 8.7% in the last 5 years (7.5% over the last 10 years) [1]. In 2010 itself, the real GDP growth of India was the 5th highest in the world. This high order of sustained economic growth is placing enormous demand on its energy resources. The demand and supply imbalance in energy is pervasive across all sources requiring serious efforts by Government of India to augment energy supplies as India faces possible severe energy supply constraints. Combustible renewable and waste constitute about one fourth of Indian energy use. This share includes traditional biomass sources such as firewood and dung, which are used by more than 800 million Indian households for cooking. Energy exploration and exploitation, capacity additions, clean energy alternatives, conservation, and energy sector reforms will, therefore, be critical for energy security. Energy conservation has also emerged as one of the major issues in recent years. Conservation and efficient utilization of energy resources play a vital role in narrowing the gap between demand and supply of energy.

II INSTALLED GENERATING CAPACITY OF ELECTRICITY

The total installed capacity for electricity generation in the country has increased from 16,271 MW to 23,6,387 MW registering a compound annual growth rate (CAGR) of 6.58% [2] . There has been an increase in generating capacity of 29,861 MW over the last one year, which is 14.46% more than the capacity of last year. The highest rate of annual growth (18.91%) from 2010-11 to 2011-12 in installed capacity was for Thermal power followed by Hydro Power (3.79%)[3].The total Installed capacity of power utilities in the country increased from 14,709 MW in 1970-71 to 1,99,877MW as on 31.3.2012, with a CAGR of 6.41 % over the period. At the end of March 2012, thermal power plants accounted for an overwhelming 66% of the total installed capacity in the country, with an installed capacity of 1,56,107 MW. The share of Nuclear energy was only 2.02% (4.78 MW [2].Hydro power plants come next with an installed capacity of 38,990 MW, accounting for 16.49% of the total installed Capacity. On-utilities accounted for 15.45% (36510 MW) of the total installed generation capacity.

Improving energy efficiency is one of the most desirable options for bridging the gap in the short term .

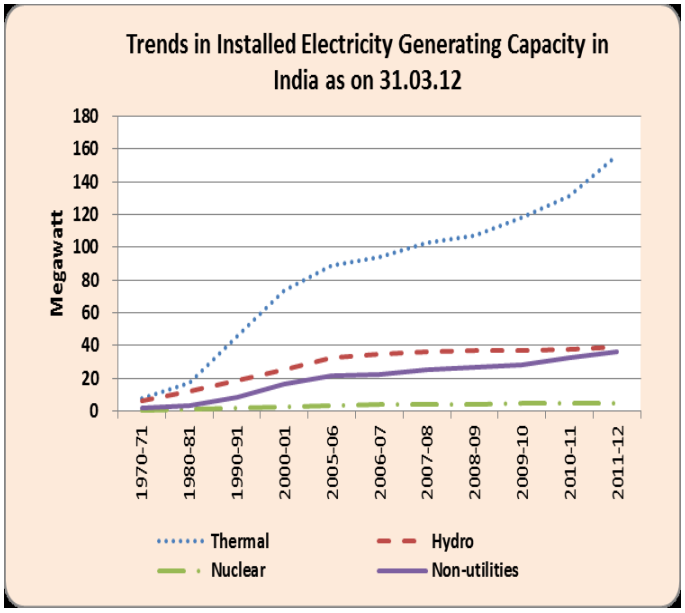

Fig. 1 Trends in installed electricity generating capacity

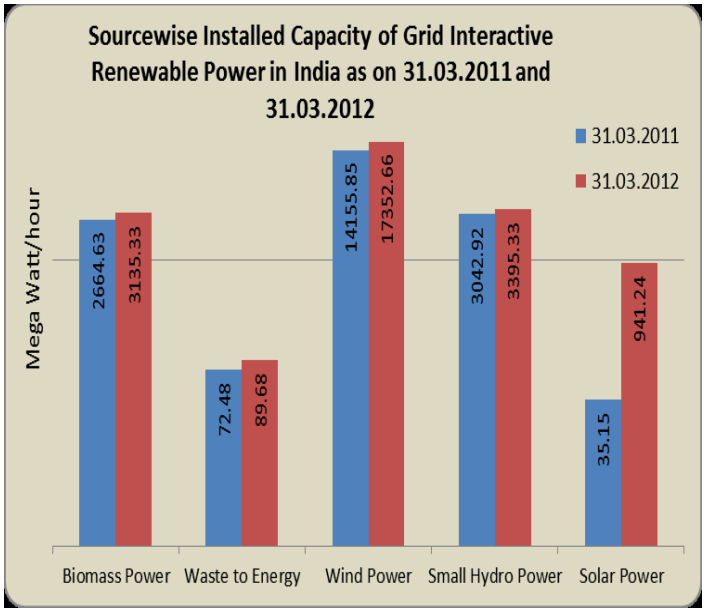

Fig.2 Installed capacity of grid interactive renewable power [9]

III GRID INTERACTIVE RENEWABLE POWER

The total installed capacity of grid interactive renewable power, which was 19,971.03 MW as on 31.03.2011 had gone up to 24,914.24 MW as on 31.03.2012 indicating growth of 24.75% during the period [3].Out of the total installed generation capacity of renewable power as on 31-03-2012, wind power accounted for about 69.65%, followed by small hydro power (13.63%) and Biomass power (12.58%).Tamil Nadu had the highest installed capacity of grid connected renewable power (7,664.03 MW) followed by Maharashtra (3,644.05 MW) and Gujarat (3,607.27 MW), mainly on account of wind power. As on 31.03.2012 out of total Biogas plants installed (45.45 lakh), Maximum number of such plants installed were in Maharashtra (8.24lakh) followed by Andhra Pradesh, Uttar Pradesh, Karnataka and Gujarat each with more than 4 lakh biogas plants. Out of 1,221.26 MW Solar Cookers installed as on 31.03.2012, 824.09 MW wereinstalled in Gujarat and 222.9 MW in Rajasthan. As on 31.03.2012 there were 1,352 water pumping Wind mills systems installed and 7,286 remote villages and 1,874 hamlets were electrified [9].

IV RENEWABLE ENERGY GROWTH

Global demand for renewable energy continued to rise during 2011 and 2012. Total renewable power capacity worldwide exceeded 1,470 GW in 2012, up about 8.5% from 2011.Hydropower rose 3% to an estimated 990 GW [11], while other renewable grew 21.5% to exceed 480 GW. Globally, wind power accounted for about 39% of renewable power capacity added in 2012 [8], followed by hydropower and solar PV, each accounting for approximately 26% **Cumulative deployment of various Renewable Energy Systems/ Devices [6]**

V CONCLUSION

Electricity consumption in India has been increasing at one of the fastest rates in the world due to population growth and economic development. India's economy faces increasing challenges because energy supply is struggling to keep pace with demand, and there are energy shortages (as much as 15 percent daily)

Table: 1
Cumulative deployment of various renewable energy systems

Renewable energy system	Target for 2013-14	Deployment during October, 2013	Total Deployment in 2013-14	Cumulative achievement up to 31.10.2013
Wind Power	*2500*	52.25	880.73	19933.68
Biomass Power	105	-	20.0	1284.80
Small Hydro Power	300	20.0	114.50	3746.75
Solar Power	1100	-	395.13	2079.97

almost everywhere in the country. The highest rate of annual growth (18.91%) from 2010-11 to 2011-12 in installed capacity was for Thermal power followed by Hydro Power (3.79%) [5]. The share of Nuclear energy was only 2.02% (4.78 MW).Hydro power plants come next with an installed capacity of 38,990 MW, accounting for 16.49% of the total installed Capacity [6]. For economic as well as environmental reasons India needs to shift to non-polluting renewable sources of energy to meet future demand for electricity. Renewable energy is the most attractive investment because it will provide long-term economic growth for India. Renewable energy also has the advantage of allowing decentralized distribution of energy — particularly for meeting rural energy needs, and thereby empowering people at the grass roots level.

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Effects of Reinforced Particulates on Properties of Aluminium Metal Matrix Composite

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ABSTRACT
The Aluminium alloy has excellent properties such as high thermal conductivity and low density. These properties make its application wide in the field of automotive, aerospace and mineral processing industries to make their products .In spite of these properties the main drawback of aluminium alloys are poor wear resistance behavior, harness and strength. To overcome this drawback, these types of alloys are reinforced with some other materials so that its hardness, Young's modulus and abrasion wear resistance can increased to the desired limit. This paper presents an overview of different reinforced materials in Aluminium Metal Matric Composites (AMMCs) system and their effect on different properties.

Keywords: AMMCs, Wear, Hardness, Young's modulus.

I INTRODUCTION

The Composite is a material is a material made out of two or more constituent materials which are chemically and physically different. Constituent materials are the individual materials which makes the composite. There are two categories of them as matrix and reinforcement. Usually matrix material supports the reinforcement material. The constituent materials stay separately within the finished structure because they are chemically and physically different, to mix with each other. The Composites can be synthetic or naturally occurring materials. Wood is a natural composite. It is made up of cellulose fibers and a matrix of lignin. When preparing composites, normally both matrix and reinforced materials are combined and compacted. After this, the shape of the composite is set, and it won't change unless it is affected by certain conditions. The basic difference between alloys and composite are alloy is a homogenous or a heterogeneous mixture whereas composites are heterogeneous. There is at least one metal in alloy, but it is not necessary to have metals in composites. In the field of material science this is the era of composite and smart materials as the industrial demand and application. Every industry required high performance material, so that the component can perform better service at desired condition. In the category of light weight high performance material, the Aluminium matrix composites (AMCs) are widely used by several industries. The composites formed out of aluminum alloys are of wide interest owing to their high strength, fracture toughness, wear temperature application when reinforced with ceramic particle. The important reinforcement materials used in the aluminium metal matrix composites are carbon/ graphite, silicon carbide, alumina, zirconia and zircon in particulate, whisker or fibre form. Major fabrication methods used for aluminium metal matrix composites are stir casting, squeeze casting, compocasting, infiltration, spray deposition, direct melt oxidation process and powder metallurgy.

II REINFORCEMENT MATERIALS

In Aluminum matrix composites (AMCs) the ceramic reinforcements are generally oxides or carbides or borides (Al_2O_3 or SiC or TiB_2).Their microstructure, physical properties, tribological properties and others desired properties of composite depends upon their processes root of manufacturing and shape, size, chemical affinity with matrix material of reinforcement materials in composite. The Wetting of reinforcement by molten metal, an important aspect in MMC synthesis, is favored by the formation of strong chemical bonds at the interface. The presence of oxide films on the surface of molten metal and the adsorbed contaminant on the reinforcement surface generally leads to non-wetting of the reinforcement with molten metal. The lower wettability adversely affect the properties of composite. Some of the techniques to improve metal-reinforcement wettability include metallic coatings on the reinforcements, addition of reactive elements, such as magnesium, calcium or titanium, to the melt and heat treatment of particles before addition.

(a) Titanium Diboride (TiB_2):

It has superior hardness and corrosion resistance with a high melting point (>2900°C) and good oxidation resistance to 1000°C. Titanium diboride is an extremely hard ceramic compound composed of titanium and boron which has excellent resistance to mechanical erosion. TiB_2 is also a reasonable electrical conductor.

Properties:

(i) Extreme Hardness nearly as hard as diamond when its sintered.

(ii) TiB_2 is tough enough to be used as military armor and improves the fracture toughness of ceramic cutting tools and other components.
(iii) As an excellent conductor of both electricity and heat, TiB2 is valuable in electronic and specialty applications.
(iv) TiB_2 enhances thermal conductivity when used as a filler in polymeric matrices.
(v) Chemical resistance.
(vi) Titanium diboride will not react with molten, nonferrous metals including Cu, Zn and Al.
(vii) TiB_2 is used as crucibles, vacuum metallization components and electrodes for processing these materials.

Applications:

(i) Electrically conductive composites such as aluminum evaporation boats.
(ii) Additives for producing specialty ceramic composite materials.
(iii) Refractory material and antioxidant additive that is nonreactive to most molten nonferrous metals and alloys.
(iv) Thermal management materials.

(b) 2.2 Silicon Carbide (SiC):

The aluminium-SiC composite system finds potential applications as structural elements in the automotive and aerospace industries. These composites possess unique properties such as improved strength, modulus and wear resistance and good resistance to corrosion. But several drawbacks of these materials such as low temperature, ductility and poor toughness hinder their wide range of application. The causes for the remarkable drop in ductility and toughness of the composite are believed to be related to the structure at the interface region and the processing factors. The major problems encountered during the fabrication of SiC-reinforced aluminium matrix composites are the reactivity of SiC with molten aluminium at higher processing temperatures and the poor wettability of SiC at lower processing temperature (900-1000 K). The reaction between SiC and liquid aluminium during processing causes significant degradation in the properties of the composites [1-2]. In order to prevent the degradation of SiC (particles, whiskers or fibres) and improve wettability, various treatments and coatings have been attempted. The metallic coatings given to SiC are copper [3-4], nickel [4-6], antimony [5] and silver [4]. Investigation by Moon and Lee [4] has shown that the wettability of copper-, nickel- and silver-coated SiC fibre with aluminium is better than as received fibre, copper and silver coatings being between metallic thin film and the liquid aluminium.The influence of various ceramic coatings as a possible barrier against degradation of SiC particles with aluminium, has been understood. more effective. The driving force for wetting has been considered to be increased by the interfacial reaction. In silicon carbide-reinforced aluminium metal matrix composites, SiC is thermodynamically unstable in molten aluminium at around temperatures exceeding 1000 K [7]. The SiC reacts with molten aluminium [8, 9] to form Al4C3 and rejecting metallic silicon. These reaction products have also been observed to cover SiCp by Lee *et al*. [10]. However, the above reaction can be suppressed by having a matrix alloy containing a higher silicon content and maintaining the proper melt temperature [11].

(c) Alumina (Al_2O_3):

The alumina-reinforced aluminium metal matrix composites find wide application next to carbon and silicon carbide-reinforced composites in the areas of automotive and aerospace industries. Al-Al_2O_3 metal matrix composites possess high elevated-temperature strength, wear resistance, damping properties, electrical conductivity, thermal conductivity and coefficient of thermal expansion. The alumina can be in the form of particulates, whiskers and fibres. The alumina in a pure aluminium matrix is considered to be the ideal dispersoid with no chemical reactions. But, when aluminium alloys are used as the matrix, the Al_2O_3 reacts with alloying elements such as magnesium. The other major problem is its lower wettability below 900K [12]. In order to enhance its wettability, metallic coatings such as nickel [13, 14], cobalt [15, 18] and palladium [17] have been applied to alumina. MgO-coated alumina particles [18] have been found to improve the properties of composites compared to as received ones. The deposition of nickel on alumina is made by nickel ions from a solution under hydrogen pressure in the presence of ammonia as a complexing agent. Cobalt coating increases its wettability during processing. The evaluation of tensile properties and fracture behavior of cobalt-coated Al_2O_3 fibre-reinforced 2024 Al alloy composites has shown improved properties compared to that with uncoated fibres.

III PROPERTIES AND REINFORCEMENT MATERIALS

G. B. Veeresh et. al.[22], they prepare two composite Al6061-SiC and Al7075-Al_2O_3 with varying wt % of particles from 2 to 6 by using vortex stir casting and investigated mechanical and found increased to 60-97VHN & 80-109VHN respectively. The tensile strength of composite increased 68% & 24% increased respectively. Conclusion of their finding is Al6061-SiC exhibit superior mechanical and tribological properties due to Sic reinforcement. **Do-Suck Han, et.l[38],** they studied the wettability of SiC in Al alloys. According to them wetting of silicon carbide (SiC) or wettability of SiC to aluminum and aluminum alloys is an important phenomenon in processing of SiC reinforced aluminum metal matrix composites. Many parameters affect the wettability such as free silicon in silicon carbide, wetting angle and kinetics of SiC. **M. Kobashi and T. Choh[41],**

they made a study to find the wettability and the reaction for silicon carbide particle and aluminum alloy system. They found that silicon carbide particles did not incorporate into the liquid aluminum immediately. This indicates that the silicon carbide particles gradually wetted by liquid aluminum. Thus the incorporation time represents duration, which is necessary for full particulate wetting. The incorporation time can be shortened by alloying magnesium and titanium. **G. G. Sozhamannan & S. Balasivanandha Prabu[32],** evaluated of interface bonding strength of Al/Si carbide at different temp. The aluminum/silicon carbide specimens were prepared at different processing temperature with constant holding time through melt joining process. They found that the interface bond strength increased with increase in processing temp. Due to increase in concentration of Si at the interface which minimizes the formation of Al_4C_3 at the SiC surface as a result the wettability of SiC become uniform in composite as depicted in fig.1.

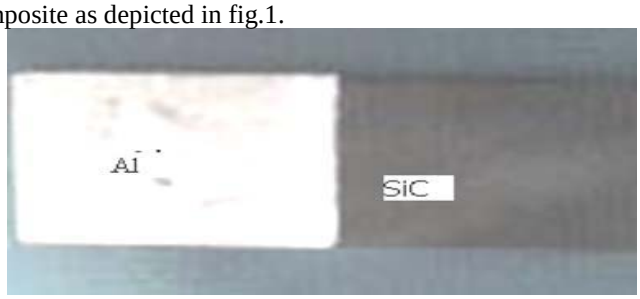

Fig 1: Al/SiC interface bonding.

- Tensile strength of Al/SiC specimen

Materials	Temperature (°C)	Tensile strength (MPa)
6061 Al/SiC	700	0.241
6061 Al/SiC	750	0.352
6061 Al/SiC	800	0.41

T.V. Christy et.al.[23], prepared Al6061-TiB_2 (12%wt)composite using the in-situ salt-metal reaction process and compare the mechanical properties and the microstructure of Al 6061 alloy & composite. The hardness, tensile strength and young's modulus of composite increased but ductility of the composite was found to be slightly lower than that of the aluminium 6061 alloy.

Material	Hardness (BHN)	Tensile Strength (Mpa)	Young's Modulus (Gpa)	% Elongation
Al-6061	62.8	134.8	79.8	8.0
Al-TiB2	88.6	173.6	94.2	7.0

David L Mc Danels[43], examined mechanical properties and stress-strain behavior for several fabricated aluminum matrix composites containing up to 40 vol. % discontinuous silicon carbide whisker, nodule or particulate reinforcement. The four types of aluminum matrices are used: 6061, 2024/2124, 7075 and 5083. Silicon carbide reinforced into the matrix material in a form of discontinuous, whisker, nodule and particulate. They found that the modulus of elasticity increased with increasing reinforcement content. When the factors influencing strength are considered, the effect of the matrix type is found to be the most important. The SiC/Al composites with as 2024/2124 or 7075 Al, has higher strengths but lower ductility. Composites with a 6061 Al matrix showed good strength and higher ductility. **E.E.S. Moraes, M.L.A. Graça & C.A.A. Cairo,** In their studies the wettability of SiC by aluminium alloys was investigated under argon and vacuum atmosphere. They found that the contact angle was no measure in tests with argon atmosphere because the argon doesn't prevent the formation of the film oxide at the surface of aluminium alloys. The silicon contents decreases the contact angle

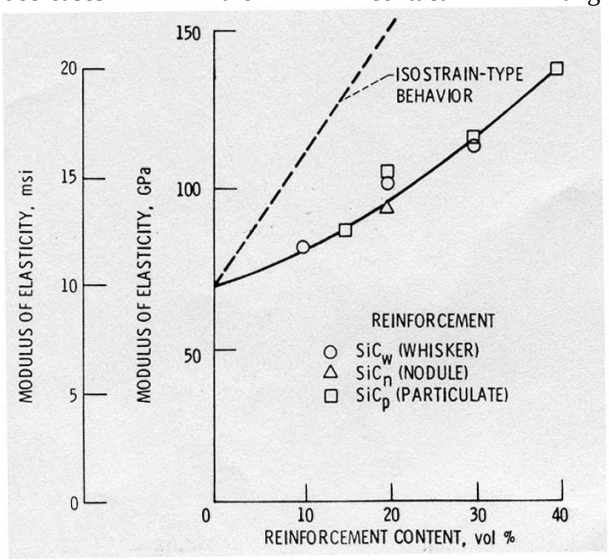

Fig 2(a): Effect of aluminum matrix alloy on elasticity behavior of composites with 20 vol% SiCw reinforcement.

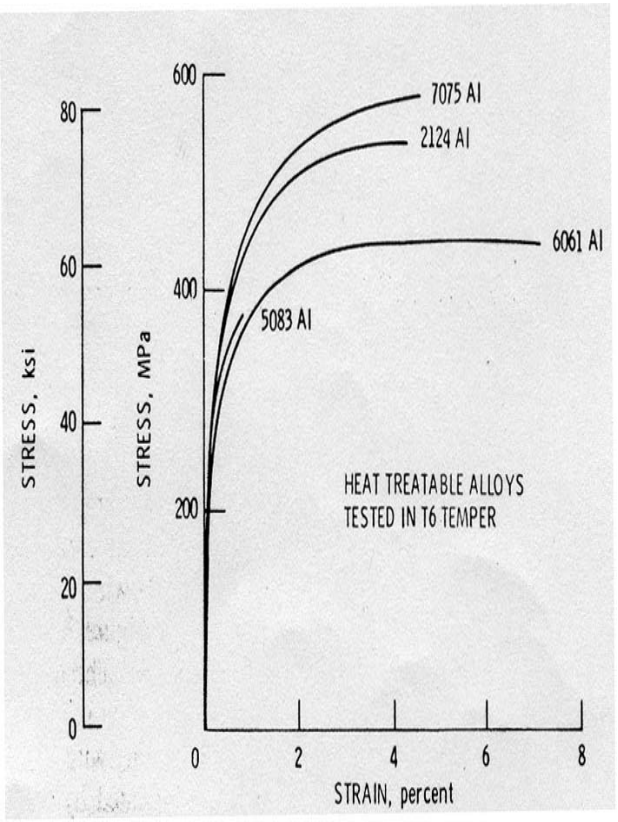

Fig 2(b): Effect of aluminum matrix alloy on stress-strain behavior of composites with 20 vol% SiCw reinforcement.

during heating, because affects the fluidity positively. The magnesium increases the driving force for wetting, reactions consumes the oxygen present on surface of the metal enhancing the wetting. **A. Sreenivasan. et.al[24],** they prepared Al6061-TiB_2 (5,10,15%wt) composite using combo stir casting technique and microstructure and wear characteristics of TiB_2 reinforced aluminium metal matrix composites (MMCs) was examined. The result showed that the wear rate was decreased with increase in TiB_2 content in the Al/TiB_2MMC specimens as depicted in fig.3. **L.Lu et.al[45],** the composite of Al/TiB_2/B_2O_3 prepared by in situ process exhibit yield and ultimate stress increased with increase of TiB_2 in composite. When the percentage of TiB_2 in composite is 15% the yield and ultimate stress increased 53% and 44% respectively as compare to its unreinforced. **ZHU He-guo, WANG Heng-zhi et.al[46],** the composites prepared by exothermic dispersion reaction in Al-TiO_2-B_2O_3 system noticed that when the B_2O_3/TiO_2 mole ratio is below 1, the reaction products are composed of particle-like α-Al_2O_3, TiB_2 and rod-like Al_3Ti. The α-Al_2O_3 crystallites, resulting from the reaction between Al and TiO_2 or B_2O_3, are segregated at the grain boundaries due to a lower wettability with the matrix.When the B_2O_3/TiO_2 mole ratio is around 1, the Al_3Ti phase almost disappears in the composites, and the distribution of α-Al_2O_3 particulates is improved evidently. **M.D. Kulkarni, et.l[44],** examined the role of percentage volume of SiCp on the tensile properties and fracture behavior of Al 7075 Al alloys at various test temperatures. They found that as the percentage of SiC increases the yield strength, ultimate strength and young's modulus of composite increases. **Alakesh Manna & B. Bhattacharayya[33],** In this research, machinability of LM6Mg15SiC-Al-metal matrix composite was investigated during turning using a rhombic uncoated carbide tool CCGX-09-T3-04 Al-H 10 type inserts. Their finding was the cutting speed, feed and depth of cut having equal influence on the surface roughness characteristics, i.e. R*a* and R*t*. High speed, low feed rate and low depth of cut were recommended for achieving better surface finish during turning of Al/SiC−MMC using CCGX-09-T3-04-Al-H 10 type insert. The cutting speed zones between 60 m/min to 150m/min were recommended for machining of Al/SiC−MMC. The research work findings also provide useful economic machining solution by utilizing fixed rhombic tooling during processing of Al/SiC−MMC, which is otherwise usually machined by costly Polycrystalline Diamond (PCD) tools. **N. Muthukrishnan & M. Murugan & K. Prahlada Rao[31],** invested machinability of fabricated aluminum metal matrix composite (A356/SiC/10p) during continuous turning of composite rods using medium grade polycrystalline diamond (PCD 1500) inserts. The composite was prepared by stir casting. They found that higher cutting speeds result in relatively easier removal of the hard SiC particles, resulting in better surface finish. The steady low values of Ra and Rz at a cutting speed of 400 m/min over the entire tool life span makes high speed finishing of MMC possible. **Metin Kök[34],** investigated the effects of cutting speed, size and volume fraction of particle on the surface roughness in turning of 2024Al alloy composites reinforced with Al_2O_3 particles. Particle sizes of 16 and 66 μm, 7.3 and 23.3 vol.% Al2O3 particles. The plan of experiments, based on Taguchi method, was performed machining with different cutting speeds using coated carbide tools K10 and TP30. They found that the surface roughness value of the K10 tool was higher than that of the TP30 tool. The surface roughness increased with an increase in the cutting speed while it decreased with increasing the size and volume fraction of particles for both tools in all cutting conditions. The dependency of the surface roughness on the cutting speed was smaller when the particle size was smaller. **N. Muthukrishnan & M. Murugan & K. Prahlada Rao[31],** studied the machinability of Al/SiC composite containing 15%wt of SiC in turning using different grades of poly crystalline diamond (PCD) inserts. The material was provided by Defense Materials and Research Laboratory (DMRL), Hyderabad, India. The material was turned by using PCD inserts of three different grades given below:-

Specification of the cutting tool (PCD insert):-

- Insert PCD (grades 1300,1500, & 1600)
- Substrate (for PCD) Tungsten Carbide , Type CNMA 1204
- Nose Radius 0.8 mm, Shank size 25*25 mm , Product name Diapax.

In their study it was observed that the 1600 grade PCD inserts performed better surface finish and less specific power consumption closely followed by the 1500 grade. **Yahiya Altunpak & Mustafa Ay & Serdar Aslan[35]**, In this work, the influence of cutting parameters on cutting force and surface roughness in drilling of Al/20%SiC/5%Gr and l/20%SiC/10%Gr was investigated. The composite was fabricated by vortex method. The drilling tests are conducted with diamond-like carboncoated cutting tools. The results indicate that inclusion of graphite as an additional reinforcement in Al/SiCp reinforced composite reduces the cutting force. The feed rate is the main factor influencing the cutting force in both composites. The surface roughness value is proportional with the increase in feed rate while inversely proportional with cutting speed in both composites. For all cutting conditions, Al/20%SiC/10%Gr composite has lower surface roughness values than Al/20%SiC/5%Gr composite. **Ay Mustafa & Tanju[25],** In this study, an experimental investigation on surface roughness, cutting temperature and cutting forces in turning of Al7075 – T651 alloy using diamond like carbon (DLC) coated cutting tools was presented. In order to optimize the experimental results, Taguchi optimization method was employed. The optimal values of cutting parameter were as below:-

- The surface roughness values were between 0.8 to 3.6 μm.
- The optimum cutting force value was reached at f = 0.20 mm/rev, V = 150 m/min and d =1.5 mm.
- The optimum heat generation value was reached at f = 0.15 mm/rev, V =
- 150 m/min and d = 0.75 mm.

V. Anandakrishnan & A. Mahamani [36], They investigated flank wear, cutting force, and surface roughness in the machining of Al-6061–TiB_2 in situ metal matrix composites produced by flux-assisted synthesis. Their finding was higher TiB_2 reinforcement ratio produces higher tool wear, surface roughness and minimizes the cutting forces. The machinability of in situ MMC is better from traditional MMC, because of the presence of fine and uniformly distributed reinforcement, which reduces flank wear. The rate of flank wear, cutting force, and surface roughness were high when machining with a higher depth of cut. An increase in feed rate increases the flank wear, cutting force and surface roughness. The hardness of the composite also increased with increase of the ratio of TiB2 in composite. **Chen Tijun, Li Jian and Hao Yuan[28],** The Al3Ti intermetallic reinforced with pure Al, Al-13Si and Al-17Cu matrix composites were prepared by casting method. Their microstructures and dry sliding wear behaviors at room temperature and 100℃ were particularly investigated. The Al-Cu matrix composite had the best wear resistance, while the pure Al matrix composite showed the worst for the same Ti content. The wear resistance for pure Al matrix composite increases with increasing Ti or Al_3Ti content. **Rajesh Kumar Bhushan & Sudhir Kumar & S. Das[30],** investigated the influence of cutting speed, depth of cut, and feed rate on surface roughness during machining of 7075 Al alloy and 10 wt.% SiC (particle size 20–40 μm) particulate metal-matrix composites. The composite was prepared by Stir casting process. The experiments were conducted on a CNC Turning Machine using tungsten carbide and polycrystalline diamond (PCD) inserts. For optimum surface roughness they recommended that turning operation on Al alloy composite by carbide insert should be carried out at cutting speed within the range of 180 to 220 m/min, feed rate within range of 0.1 to 0.3 mm/rev, and DOC within range of 0.5 to 1.5 mm. For minimum flank wear in the carbide insert, machining should be carried out at cutting speed of less than 200 m/min, feed rate of 0.1 mm/rev. and DOC 0.5 mm. Based on the results of surface roughness in the work piece and flank wear in the tool, it is recommended that turning operation on Al alloy composite by PCD insert should be carried out at cutting speed higher than 220 m/min but at a feed rate of less than 0.2 mm/rev and DOC less than 1.0 mm. **E. Uhlmann • et.al[26],** They Analysed the tool wear and residual stress of CVD diamond coated cemented carbide tools in the machining of aluminium silicon alloys. The materials were aluminium silicon alloys G-$AlSi_9Cu_4Mg$ and G-$AlSi_{17}Cu_4Mg$, with 9 and 17% silicon respectively. The turning tests were carried out on a CNC Lathe Type 180 C-U. The tools are EMT100 substrates (6% cobalt) and EMT210 (10% cobalt). They found that EMT100 substrates (6% cobalt) consistently had higher tool lifetimes than the EMT210 (10% cobalt) substrates because those coatings deposited on the tungsten carbide substrates with 10% cobalt exhibited tensile stresses, while those on substrates with 6% cobalt possessed compressive stresses. The compressive residual stresses in CVD diamond coated tools allow better film adhesion and thus longer tool lifetimes to be

achieved. **Gül Tosun[27],** They analysed process parameters for surface roughness in drilling of 2124 Aluminum–SiCp composite containing 17 vol.% SiC particulate reinforced material provided by Aerospace Metal Composites Limited (UK). The experimental studies were conducted under varying spindle speed, feed rate, drill type, point angle of drill, and heat treatment. The settings of drilling parameters were determined by using Taguchi experimental design method. The experimental parameters and their values are Drill type HSS, TiN, carbide , Drill point angle (°) 90, 118, 130, Heat treatment as-received, peak age, overage, Feed rate (mm/rev) 0.08, 0.16 ,Spindle speed (rpm) 260, 1330. They found that the optimal drilling performance for the surface roughness was obtained at 0.16 mm/rev feed rate, 260 rev/min spindle speed, 130° drill point angle, carbide drill type, and as-received heat treatment settings.

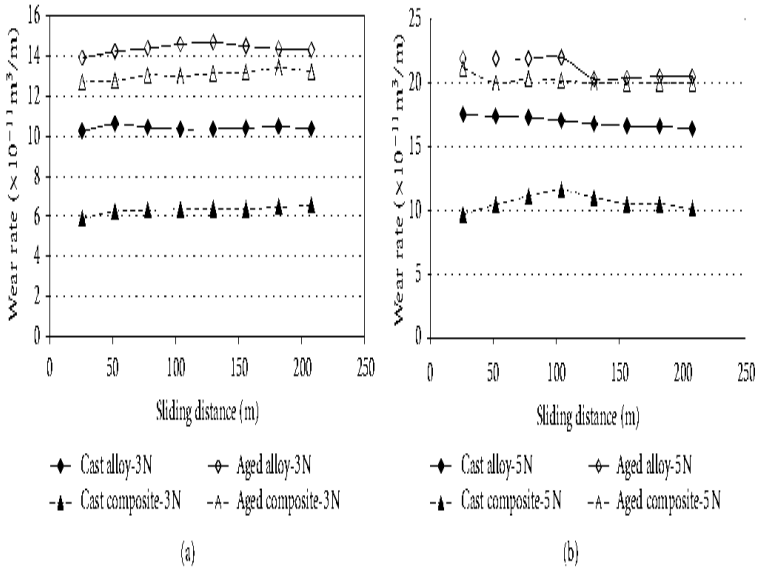

Fig 3 (a) wear rate behavior between cast and aged conditions for 7075 alloy system (a) alloy (b) composite.

IV CONCLUSION

The properties of aluminuim metal matrix composite depend upon the various parameters such as process rout, temperature, alloys elements of matrix materials, types of reinforcement materials with their shape, size, wettibility, wt and volume percentage and reaction during composite preparation. The various results show that composite materials always exhibit superior properties than the conventional material and have great potential in various fields of applications. The stir casting process for making the composite is most popular amongst the researcher but the composite made by in-situ and other process exhibits superior properties than this process. The most of the researcher used SiC and Al_2O_3 as reinforcement material

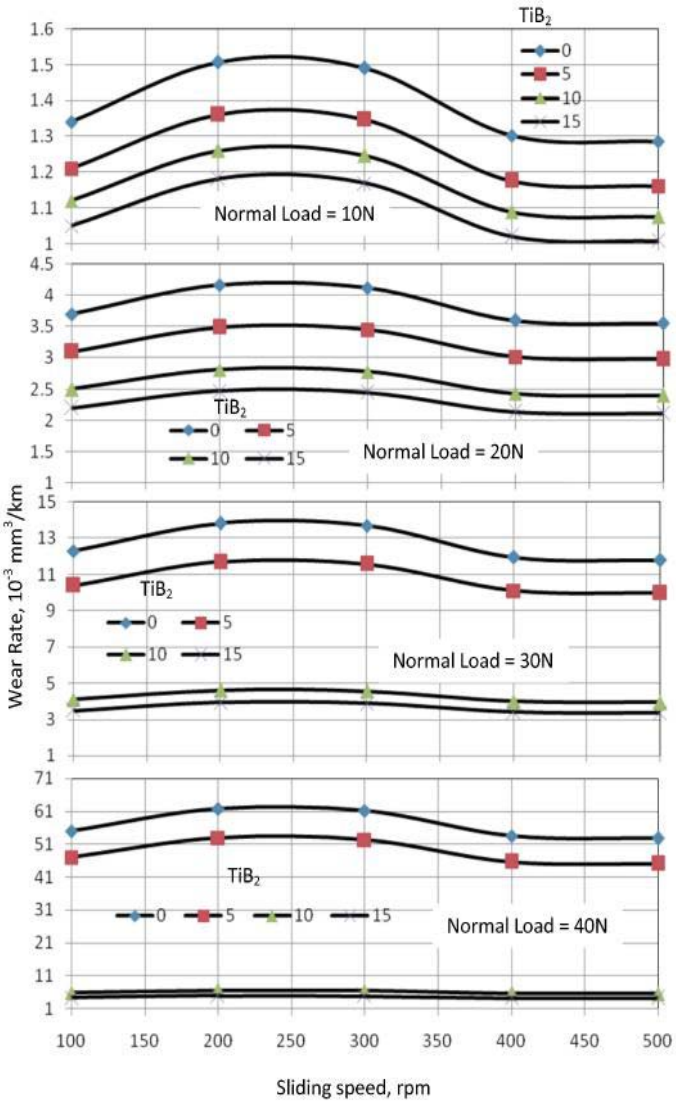

Fig 3 (b) Wear rate of Al matrix and Al/TiB_2 MMCs as the function of sliding speed for different normal load.

and result shows these materials are very reactive with aluminium and high affinity to temperature and their percentage volume in matrix material. The TiB_2 does not react with aluminium and composite exhibit superior properties than the SiC and Al_2O_3.The selection of composite required lot of attention for a particular application because cost of composite material and their manufacturing cost are very high and make the component expensive.

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Fuzzy Logic an Effective Tool for Environmental Impact Assessment of Mining Projects

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ABSTRACT
Evaluation of the Environmental Impact Assessment (EIA) report of a mining project is required to ensure the environment friendly development. Experts draw conclusion not only on the basis of the scientific data but their decisions are influenced by political and social values. Impact significance is at the core of probable impact identification, prediction, evaluation and decision making in Environmental Impact Assessment (EIA). Degree of subjectivity is high in the present EIA decision making process. It is difficult to model the qualitative human thinking process for decision making. Fuzzy logic is a recognized tool which has ability to model qualitative human thinking process using words. This paper attempts to use fuzzy logic as a decision making tool for mining projects proposed in the state of Madhya Pradesh.

I INTRODUCTION

Environment Impact Assessment (EIA) of a mining project involves impact prediction and assessment of significance of the project on environment. The EIA involves scoping, studying baseline data, identifying possible impacts of the proposed project and suggest a Environmental Management Plan (EMP). The baseline condition (i.e. existing environmental condition) is referred as a basis for evaluation of impacts. The idea of impact prediction is to forecast the effects of an identified impact through methods like subjective judgment (commonly used), mathematical models and statistical models etc. Significance of environmental impact is evaluated on the basis of forecasted impact by the State Level Environmental Impact Assessment Authority (SEIAA) of Madhya Pradesh for the proposed mining projects having mining area up to 50 Hect., in the state.

II CONCEPT OF SIGNIFICANCE

Impact significance is at the core of probable impact identification, prediction, evaluation and decision making in Environmental Impact Assessment (EIA). The ultimate aim of EIA, is to arrive at a conclusion whether a project is likely to cause significant environmental effect or not. Concept of significance has been widely discussed and many authors have proposed various definitions. Even though a number of definitions of the concept of significance exist, there is some degree of commonality found in these definitions. Following common elements are recognized [3].

- Environmental significance is a value judgment.
- The degree of environmental significance depends upon the nature of the impact.
- The importance is rated in terms of both biophysical and socioeconomic values.
- Determining significance involves the amount of change to the environment perceived to be acceptable to affected communities.

III OVERVIEW OF PRESENT PROCESS OF CLEARANCE

The EIA notification of 14th September 2006 states that a mining project requires a prior environmental clearance from a regulatory authority of the Ministry of Environment and Forest. With a view to speed up the clearance process a national level regulatory authority for clearing “A” (More then 50 Hect. area) category projects have been constituted at Ministry level whereas for the clearance of “B” (Area between 5 to 50 Hect.) category projects, the regulatory authorities have been constituted at state level consulting the concerned State Govt. These SEIAAs have been delegated powers to accord prior environmental clearance to B category Projects at state level. The SEIAA will base its

decision on the recommendations of state level expert appraisal committee (SEAC) constituted as per the provisions of the same EIA notification. The SEAC will comprise of the experts from various fields, who can assess the possible threats to the environment by proposed mining activity. The environmental clearance process will comprise of four stages namely [1]:

a. Screening (only for "B" category projects)
b. Scoping.
c. Public consultation.
d. Appraisal.

(a) Screening

This stage deals with the scrutiny of the application submitted in the prescribed form I for determining, whether the project requires further environmental studies for preparation of environmental impact assessment (EIA) before granting a prior environmental clearance to the project. This will further categorize the project into B1 or B2 (B1 requiring EIA report while B2 does not require it).

(b) Scoping

All the B1 category projects need to be suggested a comprehensive terms of reference (TOR) addressing all relevant environmental concerns in respect of the proposed activity. The SEAC will finalize the TOR on the basis of the information furnished by the project proponent.

(c) Public Consultation

It is the most important step involved in the whole process. The public consultation has been included in the process to ascertain the concerns of the affected local people and others who have a possible stake in the environmental impacts of the proposed project. In the public consultation process objections and suggestions are collected from the public during meeting at proposed site or received in writing.

(d) Appraisal

It means the detailed scrutiny of the application, final EIA report submitted by the proponent and the objections and suggestions raised during public consultation. The expert appraisal committee has to take a final decision about granting or rejecting the prior environmental clearance on the basis of above information. The committee can also call the proponent or his representative for any clarification if required. The committee shall make categorical recommendations to regulatory authority for grant of prior environmental clearance on necessary terms and conditions or rejection of application mentioning reasons for same.

IV GRANT OR REJECTION OF PRIOR ENVIRONMENTAL CLEARANCE

(i) The regulatory authority shall consider the recommendations of the appraisal committee and convey its decision to the proponent.
(ii) In normal circumstances, the recommendations of the expert appraisal committee shall be accepted by the regulatory authority. In case of disagreement, the regulatory authority can send the proposal back to the expert appraisal committee for reconsideration.
(iii) The expert appraisal committee shall reconsider the proposal and will send its views to the regulatory authority.
(iv) The decision of the regulatory authority after considering the views of expert appraisal committee shall be final and communicated to the proponent. If the proponent has not been communicated the decision by the regulatory authority within the stipulated time period mentioned above; the applicant is free to proceed as if the environmental clearance has been granted / denied as per the final recommendation of the expert appraisal committee.

V CHALLENGES BEFORE THE DECISION MAKERS

SEIAA and SEAC are functional in the state of Madhya Pradesh for about last five years. During this period many projects were accorded prior environmental clearance. After detailed study of the working of SEIAA & SEAC, it was realized that following challenges are faced during EIA appraisal at state level.

(a) Non availability of guidelines for classification in to B1 and B2

It is mentioned in the EIA notification of 14th Sept. 2006 that the Ministry of Environment and Forest will issue guidelines to SEIAAs and SEACs for classification of B cat. projects in to B1 or B2. It should be decided on the basis of probable impact of the proposed project. If a project requires further environmental studies for preparation of environmental impact assessment (EIA) before granting a prior environmental clearance to the project, it should be classified as B1. Other projects expected to put lesser impact

on environment should be kept in B2 category [6].

In the present process of environmental clearance, the SEIAAs and SEACs do not have a clear guideline or a tool even after the existence of EIA Notification for the last more than six years. The author of the paper made a presentation before State Level Expert Appraisal Committee (SEAC) of Madhya Pradesh on 10th April 2013. The concept of developing a comprehensive mathematical model for assessment of EIA report was discussed with the members of SEAC. It came up during discussion that the model which is being developed will be an effective tool for categorizing projects in to B1 or B2. It will show the impact significance factor of various parameters due to proposed project. The model is based on Fuzzy Logic.

(b) Inadequate and non authentic baseline data

The accuracy and authenticity of the EIA report depends on the base line data. In the absence of a central data bank, the proponent collects the data on his own to suit his convenience. The decisions of SEAC and SEIAA are based on the EIA reports generated on the basis of this data. It is learnt that most of the existing units are conducting periodic monitoring and maintaining the data for their own requirement. But the availability and reliability of this data is again doubtful [2].

(c) Improper monitoring and compliance by proponent

Environmental Management Plan (EMP) is an out come of the EIA study, proposed to mitigate the impacts of the activity on the environment [7]. Strict follow-up of the provisions of EMP depends on the sincere efforts of the project management towards the society. Most of the EMP does not spell out clearly the activities in details and the fund allocation for the same. Regulatory authorities have been assigned the duty of monitoring and compliance of EMP and the conditions imposed during grant of the clearance. But it is observed that due to lack of resources and manpower the above job has not been carried out to the extent required [7]. The proponents take undue advantage of the situation, in implementing the conditions of EC and EMP to suit their convenience.

(d) Ineffective public participation

Public consultation has been made mandatory in almost all the activities covered under the EIA Notification of 2006. It is envisaged that the public consultation is an effective tool in the process of decision making. The socio economic conditions of our country is different, as compared to the developed countries like US, where public consultation has been introduced at all levels i.e. screening, scoping, decision making etc. Most of the population is not aware about their environmental problems. The one time public consultation has not proved to be effective in Indian context at present. It seems to be simply a bureaucratic requirement [2].

(e) Poor quality EIA reports

Earlier the process of EIA was centralized at national capital. In due course of time the national level consultants developed the skill of producing a fair quality EIA, which is a basis of decision making. After the introduction of the EIA notification of 2006, the power of granting environmental clearance was decentralized. The state authorities (SEIAAs) were constituted at state level. It is observed that there was a drastic increase in the no of projects to be cleared by SEIAA, while in proportion no of qualified and skilled consultants did not increase. The persons doing liaison work started environmental consultancy at state level. EIA produced, were merely compilation of data with extensive use of cut and paste facility available in the computer. Interpretation and analysis of the data was hardly present in a report. The above observation was made public by the then Union Minster for, Environment Shri Jairam Ramesh in Hydrabad (Times of India Nagpur report dt 20/03/2011) [2].

(f) Lack of coordination and poor decision making

It is observed that lack of coordination between SEIAA, SEAC, State Pollution Control Board, MOEF's Regional office and the State Govt. results in delay in decision making. Most of the members of SEIAA and SEAC are retired personals. The process of their selection is also not very clearly defined in the notification. As per the provision, the State Govt has to recommend the names of chairman and members of SEIAA and SEAC to MOEF for their nomination. The above process has made SEIAA and SEAC as the rehabilitation centers of the retired bureaucrats. In Madhya Pradesh SEIAA was not functional from Aug 2010 to Nov 2010 due to delay in finalization of names. Present process exerts great political and bureaucratic pressures, each time SEIAA and SEAC is reconstituted. Lack of availability of a decision making tool and non availability of the subject specific experts in SEIAA/SEAC result in poor

quality decision making. All sectors are not represented by an expert in SEAC.

All the above challenges have bearing on the decisions of SEAC and SEIAA of Madhya Pradesh. Most of the decisions regarding issue of TORs are common in almost all the mining cases. Very rare case specific TORs are issued to the proponents. While each case should be specifically assessed for the possible impacts and its significance. In the absence of clear guidelines issued by the ministry or a tool which can guide SEAC to assess the impacts, decisions are taken by the experts on the basis of their experience. This gives rise to high degree of subjectivity in the whole process. If a mathematical model is developed for EIA evaluation, a quick scientific decision with a high degree of objectivity can be achieved.

VI WHAT IS FUZZY LOGIC

In recent years, the use of Fuzzy Logic has increased significantly. It is widely used in consumer products like camera, washing machine, microwaves, industrial process control, decision support systems etc. In narrow sense, fuzzy logic is a logical system, which is an extension of multivalued logic. However in wider sense, fuzzy logic is almost synonymous with the theory of fuzzy sets, a theory which relates to classes of objects with unsharp boundaries in which membership is a matter of degree [4].

VII USE OF FUZZY LOGIC

Two sources of subjectivity in EIA originate in estimating the relative importance of environmental factors and evaluating the impacts induced by a project. Both are concerned with balancing economic developments, environmental risk and social values, in which considerable subjective judgment are required because expertise, in addition to political values and social acceptability, has a significant role. Therefore some degree of subjectivity is inevitable in EIA [8]. Looking to the high degree of subjectivity in the present process, it was decided to develop a comprehensive mathematical model so that a high degree of objectivity in the process may be achieved. To develop the model, EIA reports of various mining projects proposed in the state of Madhya Pradesh were studied. Various important parameters responsible for considerable impact on the environment were selected. It was realized that the overall impact of a mining project on environment can be assessed by evaluating following three important factors.

1. Environmental factors
2. Ecological factors
3. Socio Economic factors

To arrive at the overall impact of a mining project on environment, these three major factors were divided in to few important indicators. The overall impact on environmental condition of a mine site will depend on the following 8 indicators. Air, Water, Noise and Soil and Solid waste will be covered under environmental factor. Terrestrial and Aquatic animals and species will be covered under ecological factors while economic and societal conditions will be covered under Socio economic factor.

Sr. no.	Factors	Indicators
1.	Environmental	1.Air
		2.Water
		3.Noise
		4. Soil and Solid waste
2.	Ecological	5.Terrestrial
		6.Aquatic
3.	Socio Economic	7.Economic
		8.Societal

These indicators are further divided in to 19 sub indicators listed below-

a. SO_2
b. Nox
c. PM 10
d. pH value
e. Total dissolved solids (TDS)
f. Occupational noise
g. Community noise
h. Fertility of soil
i. Overburden
j. Threatened plants
k. Threatened animals
l. Endangered species
m. Threatened animals
n. Endangered species
o. Land use
p. Rehabilitation & Resettlement (R&R)
q. Employment generation
r. Community facility
s. Occupational health

Out of the above 19 sub indicators, some are quantifiable while the others can be assessed in linguistic terms. A decision support framework for EIA of a mining project has been envisaged on the basis of the study of various EIA reports of mining projects. This frame work considers all the above factors / indicators and sub indicators. Fuzzy logic is employed to infer the significance of impact, because it can imitate human thinking process. An impact significance factor for all these indicators has been evaluated to arrive at the overall impact significance of the proposed project. The level of significance (Sigf.) is represented as a score ranging from 0 (i.e. insignificant) to 100 (i.e. very significant). A decision support framework for EIA of a mining project using fuzzy logic (Fig. 1) has been proposed.

The proposed model for EIA evaluation based on fuzzy logic is derived on the basis of study of various EIA reports of mining projects considered by SEAC and SEIAA of Madhya Pradesh. This model has a possibility of improvement / change realized by the experts. There is always a possibility of inclusion of new parameters, deletion of already considered parameters, redefining their range, patterns and of course the if-then rules.

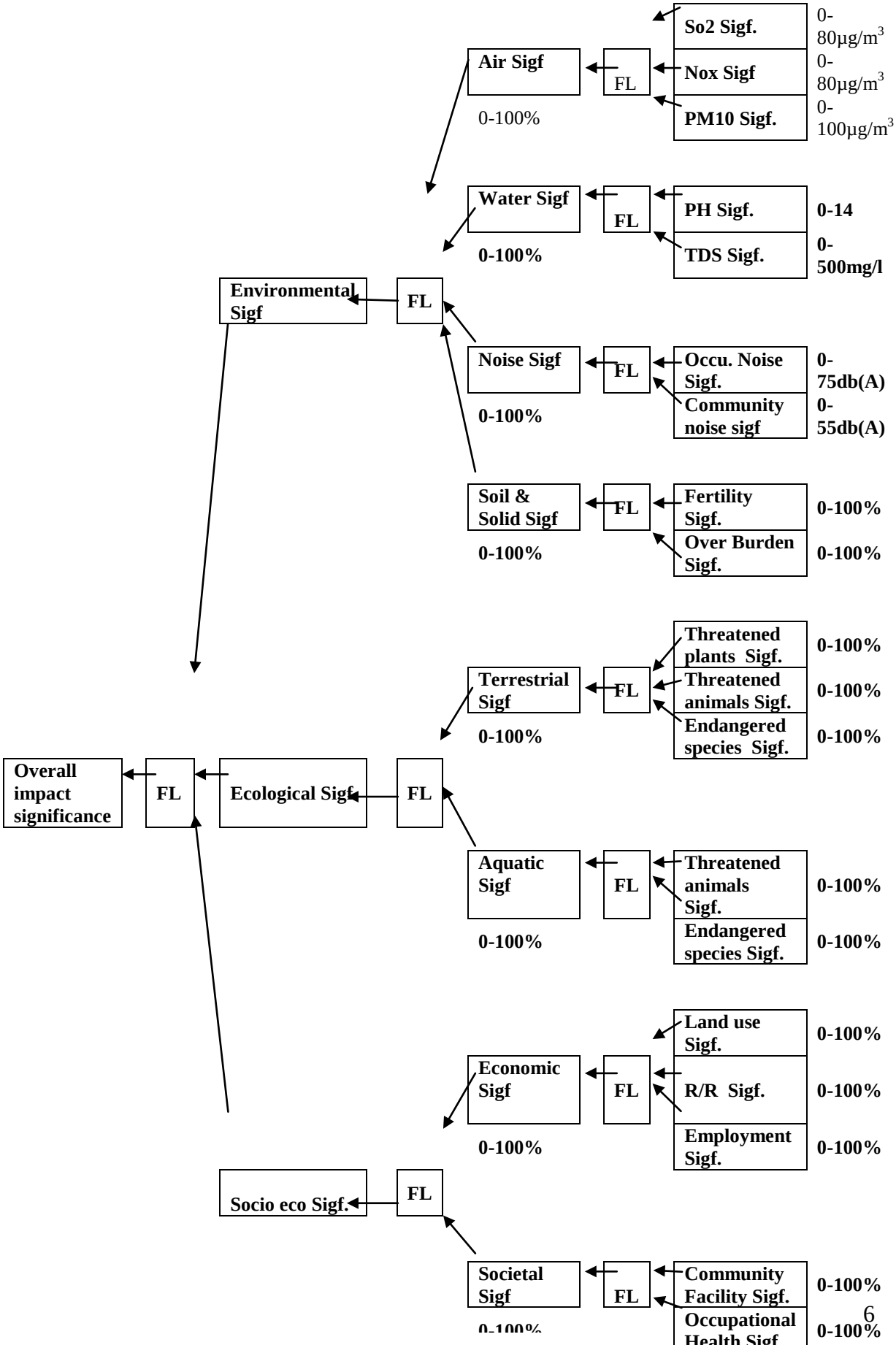

Fig 1 A decision support framework for EIAs of mining projects based on fuzzy logic

To determine overall impact significance of a mining project, 12 rule bases containing 252

fuzzy rules were produced: 27 rules for air; 9 rules for water; 9 rules for noise; 9 rules for soil and solids; 27 rules for terrestrial; 9 for aquatic; 27 rules for economic; 9 rules for societal; 81 rules for environmental; 9 rules for ecological; 9 rules for socioeconomic; 27 rules for over all impact significance. These 12 rule bases and their corresponding membership functions are constructed on the basis of experience and these fuzzy inference systems are evaluated using MATLAB Fuzzy Logic Toolbox [4].

VIII HOW IT IS EFFECTIVE

The proposed process of EIA evaluation is based on the probable impact on environment due to a particular mining activity. Various important indicators and sub indicators will be studied in a specific EIA report and its significance shall be evaluated using this scientific model. At each step, we would know the impact significance of a particular sub indicator or indicator. In other words it is possible to assess the contribution of an individual indicator or sub indicator in the overall impact significance due to a specific mining activity. This can be a guiding factor to finalize TORs initially and the conditions to be imposed while granting environmental clearance to the project finally.

IX CONCLUSION

The current general practice of EIA evaluation adopted by SEAC and SEIAA of Madhya Pradesh is based on combination of scientific methods and experience and judgment of EIA evaluation team. The evaluation of significance will remain contentious even when based on above things. Therefore prediction of impact and assessment of its significance should include consideration of value judgment. The proposed model for EIA evaluation based on fuzzy logic is derived on the basis of study of various EIA reports of mining project. It is being used for assessment of few mining projects as case study and will be published in subsequent papers. This model has always a possibility of improvement / change realized by the experts. There is always a possibility of inclusion of new parameters, deletion of already considered parameters, redefining their range, patterns and of course the if-then rules.

The present environmental clearance (EC) requirement seems to be considered as a bureaucratic requirement only. Because the proponent feels that without getting it, the project can not be executed. A sense of social responsibility towards the protection of environment is missing in most of the cases. This proposed new model will bring a sense of faith among the proponents about the process of EIA evaluation, ultimately giving it a high degree of acceptability by all the stake holders.

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Nanotechnological Treatment of Water and Its Impact on Biota- An Overview

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ABSTRACT
There is the huge hope that nanotechnological applications and products will lead to a cleaner and healthier environment [1], maintaining and re-improving the quality of water, so that the Earth will be able to support human and other life. The scarcity of water, in terms of both quantity and quality, poses a significant threat to the well-being of people, especially in developing countries. Great hope is placed on the role that nanotechnology can play in providing clean water to these countries in an efficient and cheap way [2]. On the other hand, the discussion about the potential adverse effects of nanoparticle has increased steadily in recent years and is a top priority in agencies all over the world. When nanoparticle eventually enter the environment, the catalytic activity of a nanoparticle can be advantageous when used for the degradation of pollutants, but can induce a toxic response when taken up by a cell. The high sorption capacity of certain nanoparticles is exploited for the removal of organic and inorganic pollutants while this property may also mobilize sequestered pollutants in the environment The engineering of nanoparticles that are easily taken up by cells will have a huge impact on medicine and pharmacological research, but the dispersion of such particles in the environment can lead to unwanted and unexpected effect. This paper will give a general overview of potential environmental applications of nanotechnology and nanoparticle and will also give a short overview of the current knowledge about possible risks for the environment.

Keywords: Nanotechnology, Degradation, Catalysis, pollutant, Nanoparticles.

I INTRODUCTION

Clean water is a requirement for all properly functioning societies worldwide, but is often limited. New approaches are continually being examined to supplement traditional water treatment methods. These need to be lower in cost and more effective than current techniques for the removal of contaminants from water. In this context also nanotechnological approaches are considered. In this section the following application areas will be covered: nanoparticles used as potent adsorbents, in some cases combined with magnetic particles to ease particle separation; nanoparticles used as catalysts for chemical or photochemical destruction of contaminants; nanosized zerovalent iron used for the removal of metals and organic compounds from water; and nano filtration membranes.

II TREATMENT OF WATER BY USING SORBENTS

Sorbents are widely used in water treatment and purification to remove organic and inorganic contaminants. Examples are activated carbon and ion-exchange resins.
The use of nanoparticle may have advantages over conventional materials due the much larger surface area of nanoparticle on a mass basis. In addition, the unique structure and electronic properties of some nanoparticle can make them especially powerful adsorbents. Many materials have properties that are dependent on size [3].

Hematite particles with a diameter of 7 nm, for example, adsorbed Cu ions at lower pH values than particles of 25 or 88 nm diameters, indicating the uniqueness of surface reactivity for iron oxides particles with decreasing diameter [4]. However, another study found that normalized to the surface area the nanoparticle had a lower adsorption capacity than bulk TiO2 [5]. Several types of nanoparticle have been investigated as adsorbents: metal-containing particles, mainly oxides, carbon nanotubes and fullerenes, organic nanomaterials and zeolites. For the removal of metals and other inorganic ions, mainly nanosized metal oxides, but also natural nanosized clays have been investigated. Also,oxidized and hydroxylated CNTs are good adsorbers for metals. This has been found for various metals such as Cu, Ni, Cd and Pb. Adsorption of organometallic compounds on pristine multi-walled CNTs was found to be stronger than for carbon black [6].

Chemically modified nanomaterials have also attracted a lot of attention, especially nanoporous materials dues to their exceptionally high surface area[7]. The particle size of such materials is, however, not in the nano-range but normally 10–100 mm.

Another option is to modify chemically the nanoparticle itself [8]. TiO_2functionalized with ethylenediamine was, for example, tested for its ability to remove anionic metals from ground water.

CNTs have attracted a lot of attention as very powerful adsorbents for a wide variety of organic compounds from water. Examples include dioxin [9], polynuclear aromatic hydrocarbons (PAHs) , DDT and its metabolites , PBDEs chlorobenzenes and chlorophenols , trihalomethanes, bisphenol A and nonylphenol, phthalate esters, dyes , pesticides (thiamethoxam, imidacloprid and acetamiprid) and herbicides such as sulfuron derivatives , atrazine and dicamba . Cross-linked nanoporous polymers that have been copolymerized with functionalized CNTs have been demonstrated to have a very high sorption capacity for a variety of organic compounds such as p nitrophenol and trichloroethylene. It was found that purification (removal of amorphous carbon) of the CNTs improved the adsorption. The available

adsorption space was found to be the cylindrical external surface; neither the inner cavity nor the inter-wall space of multi-walled CNT contributed to adsorption. Unlike the case with fullerenes, no adsorption–desorption hysteresis was observed, indicating reversible adsorption [10].

Fullerenes have also been tested for adsorption of organic compounds. Adsorption depends to a great extent on the dispersion state of the C60, which are virtually insoluble in water. Because C60forms clusters in water there are closed interstitial spaces within the aggregates into which the compounds can diffuse, which leads to significant adsorption–desorption hysteresis. Fullerenes are only weak sorbents for a wide variety of organic compounds (e.g. phenol)

III WATER TREATMENT THROUGH MAGNETIC NANOPARTICLE

Magnetic nanoparticle offer advantages over non-magnetic nanoparticles because they can easily be separated from water using a magnetic field. Separation using magnetic gradients, the so-called high magnetic gradient separation (HGMS), is a process widely used in medicine and ore processing [11]. This technique allows one to design processes where the particles not only remove compounds from water but also can easily be removed again and then be recycled or regenerated. This approach has been proposed with magnetite (Fe3O4), maghemite (g-Fe2O3) and jacobsite (MnFe2O4) nanoparticle for removal of chromium (VI) from wastewater. Water-soluble CNTs have been functionalized with magnetic iron nanoparticles for removal of aromatic compounds from water and easy separation from water for re-use.

IVWATER TREATMENT BY NANOFILTRATION

Nanofiltration membranes (NFmembranes) are used in water treatment for drinking water production or wastewater treatment [12]. NF membranes are pressure-driven membranes with properties between those of reverse osmosis and ultrafiltration membranes and have pore sizes between 0.2 and 4 nm. NF membranes have been shown to remove turbidity, microorganisms and inorganic ions such as Ca and Na. They are used for softening of groundwater (reduction in water hardness), for removal of dissolved organic matter and trace pollutants from surface water, for wastewater treatment (removal of organic and inorganic pollutants and organic carbon) and for pretreatment in seawater desalination. Carbon nanotubes have been arranged to form a hollow monolithic cylindrical membrane [13], which was efficient for the removal of bacteria or hydrocarbons and that can easily be regenerated by ultrasonication or autoclaving.

V DEGRADATION OF POLLUTANTS BY NANOSIZED TIO2

The semiconductor TiO2 has been extensively studied for oxidative or reductive removal of organic pollutants. Illumination promotes an electron to the conduction band, leaving a hole in the valence band. This process produces a potent reducing and oxidizing agent. In water, photo-oxidation occurs primarily through hydroxyl radicals. Because TiO_2requires ultraviolet light for excitation, it has been sensitized to visible light by dyes, through incorporation of transition metal ions or by doping with nitrogen. The degradation rate of several dyes by nanosized $TiO_2$was found to be 1.6–20 times higher than for bulk TiO_2particles. Several types of compounds such as dyes and organic acids [14] have been shown to be rapidly degraded. A special type of TiO2photocatalysts is Titania nanotube materials, which were shown to have superior activity [15].

VIWATER TREATMENT THROUGH ZEROVALENT IRON

Laboratory research has established that nanoscale metallic iron is very effective in destroying a wide variety of common contaminants such as chlorinated methane, brominated methanes, trihalomethanes, chlorinated ethenes, chlorinated benzenes, other polychlorinated hydrocarbons, pesticides and dyes [16]. The basis for the reaction is the corrosion of zerovalent iron in the environment:

$2FeO + 4H + 2O_2 \rightarrow 2Fe^{2+} + 2H_2O$

$Fe0 + 2H_2O \rightarrow Fe + H_2 + 2OH^-$

Contaminants such as tetra chloroethane can readily accept the electrons from iron oxidation and be reduced to ethenes: However, nanoscale Zerovalent iron (nZVI) can reduce not only organic contaminants but also the inorganic anions nitrate, which is reduced to ammonia , per chlorate (plus chlorate or chlorite), which is reduced to chloride , selenate ,arsenate arsenite and chromate. nZVI is also efficient in removing dissolved metals from solution, e.g. Pb and Ni . The reaction rates for nZVI are at least 25–30 times faster and also the sorption capacity is much higher compared with granular iron . The metals are either reduced to Zerovalent metals or lower oxidation states, e.g. Cr (III), or are surface complexed with the iron oxides that are formed during the reaction. Some metals can increase the dechlorination rate of organics and also lead to more benign products, whereas other metals decrease the reactivity [17].

The reaction rates for nZVI can be several orders of magnitude faster on a mass basis than for granular ZVI. Because the reactivity of ZVI towards lightly chlorinated and brominated compounds is low and because the formation of a passivating layer reduces the reactivity with time, many approaches have been explored where the surface is doped with a catalyst

(e.g. Pd, Pt, Cu, Ni) to reduce the activation energy. The same approach has also been tested for nZVI. Surfacenormalized reaction rates for such materials were found to be up to 100 times faster than for bulk ZVI . The nanoscale iron particles can be produced either by a top-down approach (e.g. milling of iron filings) or by direct chemical synthesis. A common method for synthesis of iron nanoparticle is by reduction of an aqueous ferric solution by reducing agents such as sodium borohydride or sodium hypophosphite [18].

VII SOIL AND GROUNDWATER REMEDIATION

The use of nZVI for groundwater remediation represents the most widely investigated environmental nanotechnological technique. Granular ZVI in the form Move reactive barriers has been used for many years at numerous sites all over the world for the remediation of organic and inorganic contaminants in groundwater. With nZVI, two possible techniques are used: immobile nZVI is injected to form a zone of iron particles adsorbed on the aquifer solids (or mobile nZVI is injected to form a plume of reactive Fe particles that destroy any organic contaminants that dissolve from a DNAPL (dense non-aqueous phase liquid) source in the aquifer. With this technique, the formation of a pollutant plume is inhibited. The successful results of field demonstrations using nZVI have been published, with reported reductions in TCE of up to 96% after injection of 1.7 kg of nanoparticles into the groundwater. A larger test was conducted where 400 kg of nZVI was injected and significant reductions in TCE soil concentration (>80%) and dissolved concentrations (57–100%) were observed. To date approximately

VIII RISK FACTOR IN USE OF NANOPARTICLES FOR WATER TREATMENT

The use of nanoparticles in environmental applications will inevitably lead to the release of nanoparticles into the environment. Assessing their risks in the environment requires an understanding of their mobility, bioavailability, toxicity and persistence. Whereas air-borne particles and inhalation of nanoparticles have attracted a lot of attention, much less is known about the possible exposure of aquatic and terrestrial life to nanoparticles in water and soils . Nanoparticles agglomerate rapidly into larger aggregates or are contained within other materials (e.g. polymers). Cations, for example, are able to coagulate acid-treated CNTs with critical coagulation concentrations of 37 mM for Na, 0.2 mM for Ca and 0.05 mM for trivalent metals (e.g. La3þ). Aggregation of CNTs added as a suspension to filtered pond water has been reported. Sedimentation and therefore removal from water can be expected under such conditions. The coagulation and interception by surfaces also determine the fate of nanoparticles in porous media and rapid removal has been observed in many, but not all, cases. However, a recent study shows that humic and fulvic acids are able to solubilize CNTs under natural conditions and that stable suspensions are obtained [19].

Most nanoparticles in technical applications are functionalized and therefore studies using pristine nanoparticles may not be relevant for assessing the behavior of the actually used particles. As mentioned above in Section 1.5 on groundwater remediation, functionalization is often used to decrease agglomeration and therefore increase mobility of particles. Very little is known to date about the influence of functionalization on the behavior of nanoparticles in the environment.

IX ECOTOXICOLOGY

A consistent body of evidence shows that nanosized particles can be taken up by a wide variety of mammalian cell types, are able to cross the cell membrane and become internalized. The uptake of nanoparticles is size dependent. Most of the toxicological studies have been carried out with mammalian cells and therefore were carried out in a cell culture medium containing a mixture of proteins and other biological compounds. In this medium, nanoparticles are coated with proteins and have a negative surface charge irrespective of the charge of the pristine particles. Results from such studies therefore cannot be directly transferred to environmental conditions.

Ecotoxicological studies show that nanoparticles are also toxic to aquatic organisms, both unicellular (e.g. bacteria or protozoa) and animals (e.g. daphnia orfish).

Whereas bulk TiO2is considered having no health effects on aquatic organisms, this is clearly not the case for nanosized TiO2. This was found both for inorganic nanoparticle such as TiO2, CeO2 and ZnO and for carbon containing particles such as fullerenes and CNTs . The observed effects ranged from higher activity of certain stress-related genes, lipid peroxidation and glutathione depletion and antibacterial activity (growth inhibition) for microorganisms to increased mortality and reduced fertility at high particle concentrations.Inorganic nanoparticular TiO2had a toxic effect on bacteria and the presence of light was a significant factor increasing the toxicity. In copepods purified CNTs did not show any effect whereas unpurified CNTs with all their byproducts increased mortality. Organisms are able to use a lipid coating of CNTs as a food source and therefore alter the solubility and toxicity of the CNT in the organism [20].

Nanosized CeO2particles were adsorbed on the cell wall of E.Coli but the microscopic methods were not sensitive enough to discern whether internalization had taken place. Nanosized ZnO was internalized by bacteria. Nanoparticles that damage bacterial cell walls have been found to be internalized, whereas those without this activity were not taken up. CNTs have been shown to be taken up by a unicellular protozoan

and they induced a dose-dependent growth inhibition. The CNTs were localized with the mitochondria of the cells. These results from ecotoxicological studies show that certain nanoparticles will have effects on organisms on the environment, at least at elevated concentrations. The next step towards an assessment of the risks of nanoparticles in the environment will therefore be to estimate the exposure to the different nanoparticles.

X CONCLUSION

This paper was intended to give an overview of the various aspects of nanotechnology and the environment, mainly looking at it from the side of applications rather than from the risk side. It should have become clear that nanotechnology in general and nanoparticles in particular will have important impacts on various fields of environmental technology and engineering. However, we should always keep in mind that nanotechnology has a Janus face and that each positive and desired property of nanomaterials could be problematic under certain conditions and pose a risk to the environment. A careful weighing up of the opportunities and risks of nanotechnology with respect to their effects on the environment is therefore needed.

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Development of Nanomaterial Adsorbent Media and Packed Bed Column for the Arsenic Removal from Water: A Review

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ABSTRACT
Metal oxides nanomaterials can be synthesized using multiple synthesis techniques and the resulting media (titanate nanofibers, nanostructured spheres, and nanoparticle impregnated surfaces) can be assessed for their potential to remove an important environmental pollutant in water (arsenate). The hypothesis is that nanotechnology offers the ability to control, characterize, and tailor the fabrication of materials for specific applications. Arsenic is selected as a representative environmental pollutant because of recent regulatory changes to a lower maximum contaminant level and its ability to form strong inner-sphere complexes with metal (hydr)oxides. A comparison of different types of metal (hydr)oxide nanomaterials indicate that titanium, zirconium, and iron (hydr)oxides are the most suitable materials because of their ability to remove arsenic and low toxicity of the base metal, which potentially be released into drinking water. Several metal (hydr)oxide nanomaterial media based upon titanium, zirconium and iron can be synthesized to create hybrid ion exchange media, modified granular activated carbon media, metal (hydr)oxide nanofibers and extremely porous nanostructured spheres. Each synthesis platform produces nanomaterial media capable of being used in a pack-bed continuous flow configuration, including titanate nanofibers because they are fused together by precipitation and drying into strong media. The field of nanotechnology is rapidly evolving, and this work demonstrates how a small mass quantity of nanomaterials can be synthesized and characterized to provide data to scale-up in order to facilitate comparisons against existing technologies. The protocol includes the use of batch arsenic adsorption experiments, short bed adsorber column tests, and calculate pore surface diffusion models.

***Keywords**:* Nanomaterial, packed bed continuous flow configuration, arsenate, HIX media,percolate, pore surface diffusion model.

I INTRODUCTION

There are 20 countries where groundwater arsenic contamination episodes in the world are known. However, the world's 4 biggest cases of groundwater contamination and the worst sufferings of the people have been in Asia. **Warangal is one of the major towns in Andhra Pradesh with a population of more than 10 lakhs and several toxic pollutants are released by various ways of human activities.** Arsenic can exist in air, water, soil, or food, and all of these present potential pathways for human exposure. Very low concentrations of arsenic are common in soil; however, in areas within the vicinity of arsenic-rich deposits, the natural concentration of arsenic in soil can increase over a thousand fold. In these areas, it is common to find ground water that is also contaminated with high concentrations of arsenic. For this reason, concentrations of arsenic in ground water are often much higher than those in surface water. This is a particular problem in India, where naturally occurring arsenic contaminates wells used by millions of people. Since the discovery of the buckyballs by Curl, Kroto, and Smalley in 1985, the new field of nanotechnology has rapidly emerged in the past 20 years (Curl *et al*. 2001)**.** Nanotechnology, which is defined as "understanding and control of matter at dimensions of roughly 1 to 100 nanometers, where unique phenomena enable novel applications," is making significant impact on our everyday lives (Martin and Mitchell, 1998; Narr *et al*., 2007)**.** The unique phenomena that enable novel applications of the nanomaterials are direct consequence of the dimensions of the nanomaterials. The new promises that nanotechnology offers have spurred the industry to focus their research and investments on developing new applications for the nanomaterials. Although used in many fields such as medicine, biotechnology and electronics, the beneficial applications of nanotechnology in drinking water treatment are only recently initiated (Roco, 2005; Yonzon *et al*., 2005; Simon, 2005; Stylios *et al*., 2005; Glenn, 2006). According to Narr *et al*. (2007), current research attempts in water and wastewater nanotechnology are aimed at using photocatalytic properties of TiO_2 to remove nitrates or non-biodegradable organics, and using zero valent iron to remove halogenated hydrocarbons. Although research in the area of heavy metal removal by nanomaterials is also underway, very little attention has been dedicated to this important issue (Narr *et al*., 2007). As a result of their size, nanomaterials can exhibit an array of unique novel properties which can be utilized in development of new heavy metal treatment technologies and improvement of existing ones. Some of their properties, such as high surface area, self assembly, high specificity, and other properties make them an excellent candidate for removal of heavy metals from water by adsorption. Metal hydroxide nanomaterials could allow for better heavy metal removal properties of an adsorbent compared to conventional porous metal hydroxide adsorbents. Two common approaches for using nanomaterial adsorbents in full-scale application are either suspended adsorbent or packed bed reactors. Unfortunately, it may be extremely difficult to remove essentially 100% of the nanomaterials in suspended

adsorbent reactors, even if the nanomaterials have unique properties (e.g. magnetic) (Colvin, 2006). It is far more likely that packed bed reactors with some form of aggregated nanomaterial adsorbent media may be utilized to prevent release of nanomaterials into finished water. One potential platform to use nanomaterials in packed bed reactors is to aggregate the nanomaterials using binding agents. These new materials may become intra-particle diffusion limited, would limit the overall removal performance of the treatment media in a packed bed system. As such, addressing the issue of contaminant mass transport is critical in assessing the viability of nanomaterial adsorbents in full-scale systems. It may be possible to minimize mass transport resistance by synthesizing nanostructured adsorbents (eg. nanofibers, nanostructured spheres etc.) or nanomaterial deposited surfaces. Nanomaterial packed bed adsorbing media could be engineered to maximize mass transfer kinetics by allowing rapid access of the contaminants to high surface area and by controlling the type of internal mass transport. Pore diffusion, for example, could be facilitated by engineering an adsorbent with high porosity. The external mass transport could be controlled by engineering the adsorbent particle size during the fabrication process considering that external mass transport is in large dependent on the adsorbent particle size. Nanomaterials deposited on specific surfaces could yield hybrid materials exhibiting other properties in addition to the initial properties of nanomaterials. In brief, by utilizing nanomaterials as adsorbent media, more efficient packed bed absorbers could be engineered allowing for less expensive and smaller treatment systems capable of economically removing contaminants from drinking water at a municipal treatment scale or in a single dwelling point of use applications. Arsenic is a Class A human carcinogen classified by the International Agency for Research on Cancer (IARC), and has been one of the major concerns associated with water in many regions of the world as an emerging contaminant (Dutta *et al*., 2004; Nikolaidis *et.al*., 2004; Xu *et.al*., 2002). Arsenic is naturally found in the soil and the water, but it is also accruing as a result of anthropogenic sources (Matschullat, 2000; Smedley and Kinniburgh, 2002).

Consequences of Excess Arsenic in drinking water:

(a) Arsenic poisoning can produce effects on skin and nerves

(b) The skin may become dry and hard, peripheral nerves can start getting affected and muscle weakness can result. It can also lead to cancer.

(c) If a continuous dose of arsenic is taken though drinking water, it leads to death primarily due to kidney failure.

Fig 1 Effects of arsenic exposure

II TECHNOLOGIES & LIMITATIONS

Arsenic removal technologies all suffer from one or more drawbacks**,** limitations and scope of application. Adsorption is evolving as a front line of defense. Selective adsorption utilizing biological materials, mineral oxides, activated carbons, or polymer resins, has generated increasing excitement (Benjamin *et.al.*, 1996). The use of carbon extends far back into history. Its origin is impossible to document. Charcoal was used for drinking water filtration by ancient Hindus in India, and carbonized wood was a medical adsorbent and purifying agent in Egypt by 1500 b.c. (Cheremisinoff *et.al.*,1980). Modern activated carbon industrial production was established in 1900–1901 to replace bone-char in sugar refining (Bansal et al., 2005). Powdered activated carbon was first produced commercially from wood in Europe in the early 19th century and was widely used in the sugar industry. Activated carbon was first reported for water treatment in the United States in 1930 (Mantell, 1968). Activated carbon is a crude form of graphite with a random or amorphous highly porpus structure with a broad range of pore sizes, from visible cracks and crevices, to crevices of molecular dimensions *(*Hamerlinck *et.al.*, 1994). Carbon surface chemistry has been reviewed (Bansal *et.al.*, 2005). Brunori *et.al.*, (2005) also utilized red mud for treating contaminated waters and soils with particular attention to the Italian regulatory system. The sorption of arsenic (III) by acid treated spent bleaching earth, an industrial waste produced during the bleaching of crude palm oil was studied to examine the possibility of utilizing this material in

water treatment systems (Mahramanlioglu et al., 2004). Maximum adsorption occurred at pH 9.0. The adsorption capacity was 0.46 mmol/g. The column studies were also carried out to simulate water treatment processes. The capacity values obtained in column studies were found to be greater than the capacity values obtained in batch studies.

Manganese oxides minerals have important environmental chemistry uses. They readily oxidize and adsorb many reduced species such as As (III) (Manning et al., 2002). Synthetic birnessite has been extensively investigated because it is representative of many naturally occurring manganese oxides. Na^- and K^- substituted birnessites are phyllomanganates, possessing layered sheet structures with edge-sharing Mn octahedral (Drits et al., 1997). Arsenic removal from drinking water by monocomponent fixed-bed adsorption of phosphate and arsenate using two natural manganese oxides was investigated by Ouvrard et al. (2002). This surface chemistry depends upon the activation conditions and temperatures employed. Activation refines the pore structure. Mesopores and micropores are formed yielding surface areas up to 2000 m^2/g (Mohan, et al., 2005). Acidic and basic activation carbon exists according to the Steenberg's classification (Mattsom., 1971). The acidic groups on activated carbons adsorb metal ions (Corapcioglu., 1987). Surface area may not be a primary factor for adsorption on activated carbon. High surface area does not necessarily mean high adsorption capacity (Perrich,, 1981). Nanocrystalline titanium dioxide's (TiO_2) ability to remove arsenate and arsenite and to photocatalytically oxidize As(III) was evaluated (Pena et al., 2005). The nanocrystalline TiO_2 was prepared by hydrolysis of a titanium sulfate solution (Meng et al.,2003). The adsorption mechanism for As(III) and As(V) on nanocrystalline titanium dioxide was also established using electrophoretic mobility (EM) measurements, Fourier transform infrared (FTIR) spectroscopy, extended X-ray absorption fine structure (EXAFS) spectroscopy, and surface complexation modeling (Pena et al., 2006). Jing et al. (2005) investigated the adsorption mechanisms of monomethylarsonic acid [$CH_3AsO(OH)_2$] (MMA) and dimethylarsinic acid [$(CH_3)_2AsO(OH)$] (DMA) on nanocrystalline titanium oxide (TiO_2) using X-ray absorption spectroscopy (XAS), surface charge and zeta potential measurements, adsorption edge, and surface complexation modeling. The experimental data was explained by the charge distribution multi-site complexation model (Machesky et al., 2001) with the triple plane option under the constraint of the XAS evidence. The monolayer adsorption capacity was not calculated. Bang et al. (2005) studied a novel granular titanium dioxide (TiO_2) for groundwater arsenic removal. More arsenate was adsorbed than arsenite on TiO_2 at pH 7.0. The adsorption capacities for As(V) and As(III) were 41.4 and 32.4 mg/g TiO_2, respectively. This TiO2 had similar adsorption capacities for As(V) and As(III) (approximately 40 mg/g) using simulated Bangladesh groundwater. Nakajima et al. (2005) also investigated the combined use of TiO_2-photocatalyst and an adsorbent with high adsorption ability for As(V), under photo-irradiation. Swedlund and Webster (1999) synthesized ferrihydrite and studied its use to remove As(III) and As(V) from water. Synthesis was performed by rapidly raising the pH from 2.0 to 8.0 for different concentrations of $Fe(NO_3)_3 \cdot 9H_2O$ and 0.1M $NaNO_3$ by the addition of NaOH (0.1–5.0 M). The oxide formed as a red/brown, loose gelatinous precipitate, aged for 18–24 h prior to adsorption experiments. X-ray diffraction of the freeze-dried product showed two broad characteristic ferrihydrite peaks. Application of Fe(II) instead of Fe(III) was advantageous, because the dissolved oxygen used for oxidation of Fe(II) causes partial oxidation of As(III). Furthermore iron(III) (hydr)oxides formed in this way have higher sorption capacities. Multiple additions of Fe(II) followed by aeration further increase As(III) removal. A competitive co-precipitation model with As(III) oxidation was established. Roberts et al.(2004) studied the arsenic removal by oxidizing naturally present Fe(II) to iron(III) (hydr)oxides by aeration. These iron(III) species precipitated with adsorbed arsenic. Jezeque and Chu (2006) investigated titanium dioxide for pentavalent arsenate removal from water. Adsorption isotherms measured at pH 3 and 7 generally followed the Langmuir model. The maximum uptake capacity ranged from 8 mg/g at pH 3 to 2.7 mg/g at pH 7. Addition of phosphate resulted in a significant reduction in arsenate adsorption.

Most remediation methods discussed more effectively remove arsenic from water containing high initial arsenic concentrations (usually >100 mg/L) but residual arsenic concentrations exceed the 0.05 mg/L water quality standard used in most countries. Conventional and non-conventional treatment technologies for aqueous arsenic remediation were compared (Vigneswaran et al.,2002). In villages in India, a highly successful technology may not succeed in rural areas unless it fits into the rural circumstances and is well accepted by the masses. Technology development is only possible when a partnership exists involving proper village level participation.

Experiments studied the metal trapping ability of treated red mud and the subsequent release of these trapped metals at low pH conditions. The treated red mud exhibited a high metal trapping capacity and metal release at low pH was generally low. The removal capability of treated red mud was increased using more mud in contact with the solution. After 48 h, only 35% of As (corresponding to an absolute value of 230 g/L) was removed with 2 g/L, but the percentage significantly increased up to 70% (corresponding to an absolute value of 400 g/L) with 10 g/L.

Modified calcined bauxite was also used for As(III) and As(V) remediation from ground water (Ayoob et al., 2007) in batch and column modes. The optimum pH was 7.0 for both As(III) and As(V). Adsorption was unaffected by temperature variations (Bhakat et al., 2006).

The concentration variations at the column outlet were deduced simply by conductivity and pH measurements. These macroscopic-scale data enabled phenomenological information to be obtained on the surface reactions involved. Two behaviors were found. When surface complexation alone occurred, adsorption isotherms could be rapidly and accurately measured by a series of column experiments. However, when surface complexation was coupled with anion exchange, the system was far more complex. Direct detection of arsenate breakthrough from the conductivity and pH signals was no longer possible. Column experiments were conducted using different particle sizes and flow rates. Transport was influenced by non-linear adsorption and intraparticle diffusion. Total adsorption capacity varied with the flow rate and particle size. Results were interpreted using the effective diffusivity of arsenate in the grain as a single adjustable parameter by a transport model including the Langmuir adsorption and mass transfer. Diffusivities between 0.6 and 7.0×10^{-11} m^2 s^{-1} were calculated which included intraparticle diffusion. Batch adsorption and oxidation experiments were conducted with TiO_2 suspensions in 0.04M aqueous NaCl. The challenge water contained phosphate, silicate, and carbonate competing anions. The adsorption followed pseudo-second-order kinetics. The TiO_2 was effective for As (V) removal at pH < 8. Maximum As (III) removal occurred at pH7.5. The adsorption capacity of nanocrystalline TiO_2 of As(V) and As(III) was much higher than that for fumed TiO_2 (Degussa P25) and granular ferric oxide. More than 0.5 mmol/g of As (V) and As(III) was absorbed by the TiO_2 at an equilibrium arsenic concentration of 0.6Mm. Competing anions had a moderate effect on the adsorption capacities of the TiO_2 for As(III) and As(V) at a neutral pH. In the presence of sunlight and dissolved oxygen, As(III) (26.7Mm or 2 mg/L) completely photocatalytically oxidized within 25 min to As(V) in a 0.2 g/L TiO_2 suspension. The adsorption of As(V) and As(III) decreased the point of zero charge of TiO_2 from 5.8 to 5.2, suggesting the formation of negatively charged inner-sphere surface complexes for both arsenic species. The EXAFS study indicated that As(V) and As(III) formed bidentate binuclear surface complexes as evidenced by an average Ti–As(V) bond distance of 3.30 °A and Ti–As(III) bond distance of 3.35A° . The FTIR bands caused by vibrations of the adsorbed arsenic species remained at the same energy levels at different pH values. Consequently, the surface complexes on TiO_2 maintained the same non-protonated speciation at pH values from 5 to 10, and the dominant surface species were $(TiO)_2AsO_2^-$ and $(TiO)_2AsO^-$ for As(V) and As(III), respectively. Adsorption of As(V) and As(III) on commercially available titanium dioxide (TiO_2) suspensions (Hombikat UV100 and Degussa P25) was investigated versus pH and initial adsorbate concentration (Dutta et al., 2004). More As(V) and As(III) adsorb onto Hombikat UV100 particles than onto Degussa P25 particles. Adsorption of As(V) was >As(III) onto TiO_2 suspensions at pH 4 while the capacity of As(III)was greater at pH 9. The Langmuir and Freundlich isotherm equations interpreted the adsorption of arsenic onto TiO_2 suspensions. XAS data demonstrated that MMA and DMA formed bidentate and monodentate inner-sphere complexes with the TiO_2 surface, respectively. The charge and zeta potential behaviors of TiO_2 as a function of ionic strength suggested that the point of zero charge (PZC) and the isoelectric point of TiO_2 were identical at pH 5.8. Adsorption of MMA and DMA on TiO_2 shifted the isoelectric point to pH 4.1 and 4.8, respectively. This indicated the formation of negatively charged surface complexes occurred. An effective oxidation of As(III) into As (V) was obtained when As (III) solution was stirred and irradiated by sunlight or xenon lamp in the presence of TiO_2 suspension resulting 89% As (V) removal after 24 h. Lanthanum hydroxide (LH), lanthanum carbonate (LC), and basic lanthanum carbonate (BLC) remove As (V) from aqueous solutions. These lanthanum compounds were effective at a concentration of <0.001 Mm. Dissolution was appreciable at initial pH values <4.3, <4.3, and <4.0 for LH, LC and BLC, respectively. Arsenic removal followed first-order kinetics in the neutral pH range, and the order of the rate constants was LH > LC > BLC. The optimum pH range was 3–8 for LH, 4–7 for LC, and 2–4 for BLC. Two arsenic uptake mechanisms were proposed: (i) adsorption by the exchange of CO_3^{2-} and (or) OH groups with arsenic ions in neutral to alkaline pH where La does not dissolve and (ii) precipitation of insoluble lanthanum arsenate, $LaAsO_4$, in acidic pHs. Iron oxides, oxyhydroxides and hydroxides, including amorphous hydrous ferric oxide (FeO-OH), goethite (_-FeO-OH) and hematite (_-Fe2O3), are promising adsorbents for removing both As(III) and As(V) from water (Saha et al., 2005). Amorphous Fe(O)OH has the highest adsorption capability since it has the highest surface area. Surface area is not the only criterion for high removal capacities of metal ions and other mechanisms (ion exchange, precipitation) play an important role. Most iron oxides are fine powders that are difficult to separate from solution after. Therefore, the EPA has proposed iron oxide-coated sand filtration as an emerging technology for arsenic removal at small water facilities (Thirunavukkarasu et al., 2003). Another shortcoming of amorphous FeOOH is its tendency to form low surface area crystalline iron oxides during preparation, greatly reducing its As removal capacity. Different types of ferrihydrites, ion hydroxide and iron oxides were prepared and tested. Some recent studies are now discussed. Ranjan et al.(2003) synthesized hydrous ferric oxide, for arsenic sorption. As(V) sorption strongly depended on the system's concentration and pH, while As(III) sorption was pH insensitive.

Till now no work was found on use of nanotechnology in water treatment in a continuous flow packed bed column and earlier research was not concentrated on modeling of packed bed configuration for arsenic removal. Arsenic is a poisonous element and is a cumulative poison. So far **very limited technologies are available** to reduce the Arsenic content to acceptable levels of 0.02 ppm or lower.

III OBJECTIVES & METHODOLOGY

(a) OBJECTIVES:

(i) Evaluate the feasibility of using titanate based nanofiber matrices as media in a packed bed column.

(ii) Develop porous nanostructured ZrO_2 spheres suitable for arsenate treatment in a packed bed column setup.

(iii) Develop the iron (hydr)oxide nanomaterials with different structures to obtain hybrid ion-exchange (HIX) media.

(iv) Evaluate the impact of synthesis conditions on the arsenic removal.

(v) Evaluate the impact of synthesis conditions on the distribution of iron (hydr)oxide nanomaterials derived from Fe(II) inside GAC media oxidized with $KMnO_4$, and the consequent impact on arsenic removal.

(vi) Develop a model to predict the arsenic breakthrough curve of an adsorber packed with adsorbents fabricated using the two platforms: (1) nanostructured adsorbents and (2) nanomaterial deposited surfaces.

(b) METHODOLOGY:

(i) Commercially available metal oxide nanopowders can be obtained and Stock suspensions with concentrations of 1 g/L can be prepared by suspending the nanopowders in nano-pure water with conductivity < 1.1 µS/cm and sonicating for 15 minutes in an ultrasonic bath at 90 W/L to allow disaggregation of the particles and homogenization of the suspension. Nanopowder removal can be evaluated by separating the nanopowder from the suspension via centrifugation and filtration with 0.2 µm and 2.5 µm pore size filters. The concentrations of the nanopowder supernatant and the filtrate can be evaluated. To select one nanopowder media, the adsorption capacities of the commercial nanopowders exhibiting the highest arsenate removal in the screening experiments can further be studied through isotherm experiments.

(ii) Based on the findings from the nanoparticle characterization experiments, the nanoparticle aggregates can be separated from the suspension by filtration. A proprietary synthetic method, developed by SolmeteX, using a solution of $FeCl_3$ in alcohol can be used to synthesize HIX by precipitation of Fe(III) as iron (hydr)oxide under alkaline conditions. Short bed adsorber (SBA) tests can be conducted on the HIX and virgin IX media with the highest adsorption capacities.

(iii) Arsenate can be analyzed using a graphite furnace atomic absorption spectrophotometer (GF-AAS). The development and design of hybrid ion exchange media containing nanoparticles should consider the impact of the nanoparticle impregnation process onto the ion exchange performance of the media. Fabrication methods that can allow more even distribution of the nanoparticles throughout the media pores could contribute to a higher adsorption capacity and separation factor of the HIX media. Nanostructured zirconium oxide spheres can be fabricated by modifying a synthesis method developed for the preparation of a porous resin loaded with crystalline hydrous ZrO_2.

(iv) Modeling is useful tools to mathematically describe and predict adsorption of a contaminant in equilibrium and continuous

(v) flow setting. Although many different models can be used to describe the equilibrium adsorption, Freundlich adsorption isotherm model can be selected for the purposes of the work because the parameters describing the adsorption can be used in pore surface diffusion model. The pore surface diffusion model can be used to validate and predict the contaminant breakthrough of continuous flow column adsorbents.

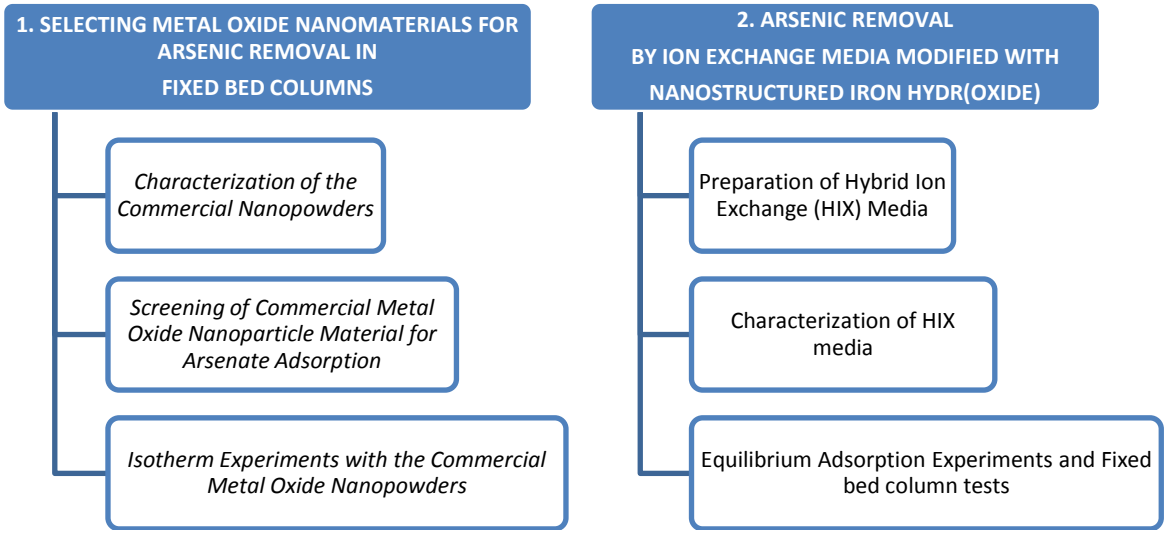

Fig 2

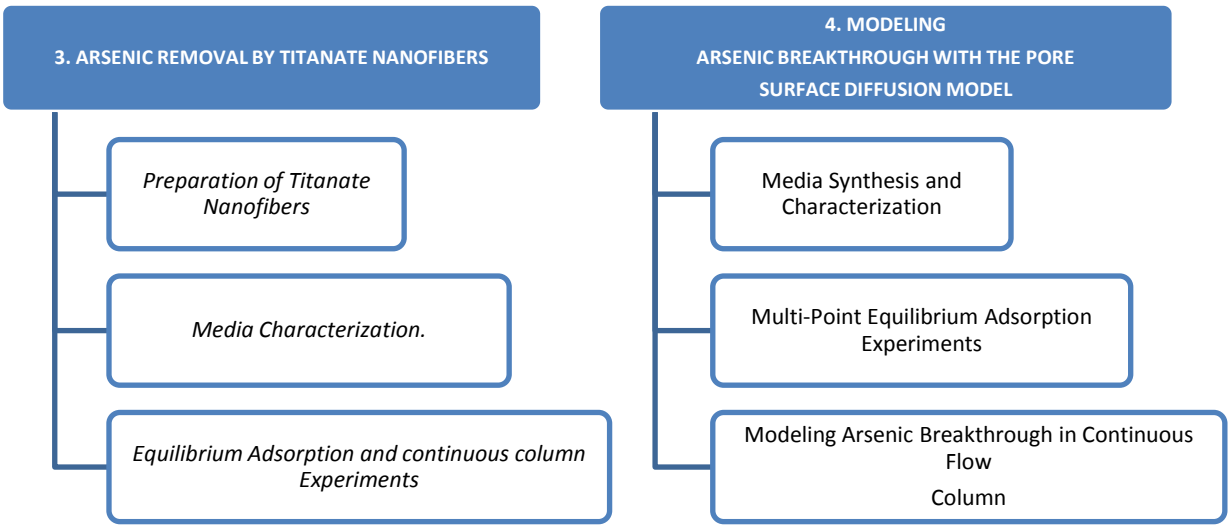

Fig 3

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Next Generation Infrastructure for Big Data - A Challenge

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ABSTRACT
The Internet has engender an explosion in data growth in the form of Data Sets, called Big Data that are so large they are difficult to store, manage, and canvass using traditional RDBMS which are tuned for Online Transaction Processing (OLTP) only. Not only is this new data heavily unstructured, voluminous and stream rapidly and difficult to tackle but even more importantly. The infrastructure cost of Hardware and Software required to crackle it using traditional RDBMS to drive any analytics or business intelligence online (OLAP) from it is prohibitive. To capitalize on the Big Data trend, a new maker of Big Data technologies (such as Hadoop, Google App Engine, Microsoft Azure and others) many combines have emerged which are leveraging new parallelized processing. Commodity hardware, open source software, and tools to capture and analyse these new data sets and provide a price/performance that is 10 times better than existing Data Warehouse/Business Intelligence system. This paper presents an overview of the cloud computing scenario today. It provides the advantages and disadvantages of cloud, different examples of the cloud services, different enterprises in the field of cloud computing are being mentioned in the paper.
Keywords: Cloud computing, Big Data, OLTP, Hadoop, Map Reduce, RTAP.

I INTRODUCTION

Big data is [1] [2] [3] certainly one of the biggest buzz phrases in IT today. Combined with virtualization and cloud computing, big data is a technological capability that will force data centres to significantly transform and evolve within the next five years. Similar to virtualization, big data infrastructure is unique and can create an architectural upheaval in the way systems, storage, and software infrastructure are connected and managed. Unlike previous business analytics solutions, the real-time capability of new big data solutions can provide mission critical business intelligence that can change the shape and speed of enterprise decision making forever. Hence, the way in which IT infrastructure is connected and distributed warrants a fresh and critical analysis. Numerous technological innovations are driving the dramatic increase in data and data gathering. This is why big data has become a recent area of strategic investment for IT organizations. For example, the rise of mobile users has increased enterprise aggregation of user statistics geographic, sensor, capability, data that can, if properly synthesized and analyzed, provide extremely powerful business intelligence. In addition, the increased use of sensors for everything from traffic patterns, purchasing behaviours, and real-time inventory management is a primary example of the massive increase in data. Much of this data is gathered in real time and provides a unique and powerful opportunity if it can be analyzed and acted upon quickly. Machine-to-machine interchange is another often unrecognized source of big data. The rise of security information management (SIM) and the Security Information and Event Management (SIEM) industry is at the heart of gathering, analyzing, and proactively responding to event data from active machine log files. At the heart of this trend is the ability to capture, analyze, and respond to data and data trends in real time. Although it may be clear that new technologies and new forms of personal communication are driving the big data trend, consider that the global Internet population grew by 6.5% from 2010 to 2011 and now represents over two billion people. This may seem large, but it suggests that the vast majority of the world's population has yet to connect. While it may be that we never reach 100% of the world's population online (due to resource constraints, cost of goods, and limits to material flexibility), increasingly those that are online are more connected than ever. Just a few years ago, it was realistic to think that many had a desktop (perhaps at work) and maybe a laptop at their disposal. However, today we also may have a connected smartphones and even a tablet computing device. So, of today's two billion connected people, many are connected for the vast majority of their waking hours, every second generating data:

In 2011 alone, mankind created over 1.2 trillion GB of data.
(a) Data volumes are expected to grow 50 times by 2020.
(b) Google receives over 2,000,000 search queries every minute.
(c) 72 hours of video are added to YouTube every minute.
(d) There are 217 new mobile Internet users every minute.
(e) T witter users send over 100,000 tweets every minute (that's over 140 million per day)
(f) Companies, brands, and organizations receive 34,000 "likes" on social networks every minute.

International Data Corporation (IDC) predicts that the market for big data technology and services will reach $16.9 billion by 2015 with 40% growth over the prediction horizon. Not only will this technology and services spend directly impact big data technology providers for related SQL database technologies, Hadoop or Map Reduce file systems, and related software and analytics software solutions, but it also will impact new server, storage, and networking infrastructure that is specifically designed to leverage and optimize the new analytical solutions.

II BIG DATA

Big data refers [4] to the collection and subsequent analysis of any significantly large collection of data that may contain hidden insights or intelligence (user data, sensor data, machine data). When analyzed properly, big data can deliver new business insights, open new markets, and create competitive advantages. Compared to the structured data in business applications, big data (according to IBM) consists of the following three major attributes:

(a) **Variety—**Extends beyond structured data and includes semi-structure or unstructured data of all varieties, such as text, audio, video, click streams, log files, and more.

(b) **Volume—**Comes in one size: large. Organizations are awash with data, easily amassing hundreds of terabytes and petabytes of information.

(c) **Velocity—**Sometimes must be analyzed in real time as it is streamed to an organization to maximize the data's business value.

III USE CASES OF BIG DATA

There are many examples [5] [6] of big data use cases in virtually every industry imaginable. Some businesses have been more receptive of the technologies and faster to integrate big data analytics into their everyday business than others. It is evident that organizations embracing this technology not only will see significant first-mover advantages but will be considerably more agile and cutting edge in the solutions and adaptability of their offerings. Use case examples of big data solutions include:

(a) Financial services providers are adopting big data analytics infrastructure to improve their analysis of customers to help determine eligibility for equity capital, insurance, mortgage, or credit.

(b) Airlines and trucking companies are using big data to track fuel consumption and traffic patterns across their fleets in real time to improve efficiencies and save costs.

(c) Healthcare providers are managing and sharing patient electronic health records from multiple sources imagery, treatments, and demographics and across multiple practitioners. In addition, pharmaceutical companies and regulatory agencies are creating big data solutions to track drug efficacy and provide more efficient and shorter drug development processes.

(d) Telecommunications and utilities are using big data solutions to analyze user behaviours and demand patterns for a better and more efficient power grid. They are also storing and analyzing environmental sensor data to provide insight into infrastructure weaknesses and provide better risk management intelligence.

(e) Media and entertainment companies are utilizing big data infrastructure to assist with decision making around customer lifecycle retention and predictive analysis of their user base, and to provide more focused marketing and customer analytics.

There are productized use cases and concrete examples of big data for every industry and company size. Therefore, whether or not your business currently is using a big data solution, your competitors likely are. The real question is how can you better optimize your environment to create a faster, more efficient solution that gives you a competitive edge? Why is this so pressing? According to research by McKinsey Global Institute (MGI) and reported by McKinsey's Business Technology, analyzing large data sets will become and has already become for a large number of businesses a key planning tool. With the caveat that the correct policies and enablers must be considered and implemented, big data will become a critical tool in developing plans for:

(i) Competitive planning and research
(ii) Future productivity and product growth
(iii) Product and services innovation
(iv) Customer satisfaction (or as delineated in the study, "Consumer Surplus")

IV EXAMPLES OF BIG DATA

This section provides with some of the real life examples of cloud computing services.

(a) Social Networking: The fig. 1 most famous example of cloud computing [7] are the social networking websites like Facebook, Twitter, My space, LinkedIn and many others which doesn't seems to be a part of cloud computing at first glance. In social networking user finds people he already knows or like to know and shares information with them. As the user shares information with people related to him, he ultimately shares the information with peoples who are running the service. Social networking can also be used by business for its promotion among its customers.

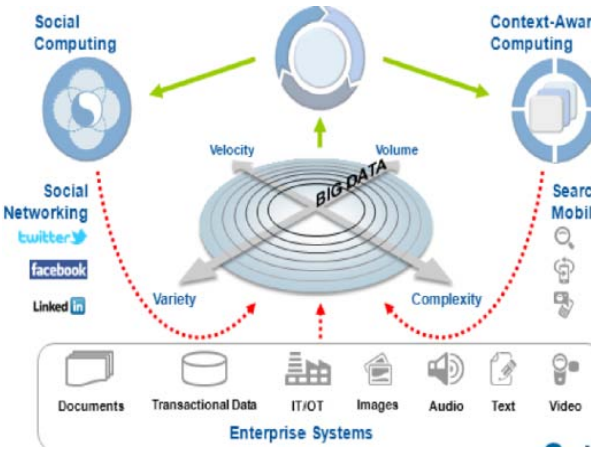

Fig. 1 Cloud Computing System

(b) Email: Some of the biggest cloud computing services are Web-based e-mail. Microsoft's Hotmail or Windows Live Mail is examples of cloud based email service. Using a cloud computing e-mail solution allows the mechanics of hosting an e-mail server and it is maintained by the people running the service. This means that we can access our e-mail from anywhere in the world.

(c) Document/Spreadsheet/Other hosting Services: Google Docs allow users to keep and edit their documents online. Making use of Google Docs allows access and sharing of the documents from anywhere. The same document can be worked by multiple people simultaneously. Google's Picasa and Yahoo's Flickr provides hosting for the photographs that individual wants to share with other people. Comments can be placed on the photographs in the similar manner as on Facebook. But for the photographic enthusiast's some perks are provided by these photo hosting services. YouTube , a video sharing site has brought a great revolution in the field of entertainment but Although, it is not only in entertainment. DailyMotion, MetaCafe and Vimeo are some of the names in this field. In this service the users are permitted to upload their videos and the service provider take care of putting it online in a form that is easily viewed by the users.

(d) Backup Services: Services like JungleDisk, Carbonite, and Mozy allow public to automatically back up all their data to servers spread around the country or world for a surprisingly low price.

V BIG DATA CHALLENGES

In any big data project, [see fig. 1] storage capacity to accommodate the datasets must increase. However, simply adding raw capacity, without taking other infrastructure issues into account, can lead to problems and inefficient use of resources. [8] [9] The field of the life sciences provides examples of the potential impact of big data on an IT infrastructure. They include:

(a) Interdependencies of Infrastructure elements: Life sciences organizations are increasingly turning to virtualization to reduce operating costs, consolidate servers, and simplify the deployment and management of applications.

Server fig. 5 cluster nodes based on multi-core processors are now commonly used in conjunction with virtualization software to enable dozens or more applications to run as virtual machines on each physical server. Open source software, such as Hadoop and NoSQL, gives companies a way to leverage these clusters to run big data analytics.

As this architecture becomes more widely used, organizations must address several other infrastructure issues because new performance issues crop up. A single server accessing a single storage device generates predictable workloads. But matters become much more complex in a cluster running dozens of virtualized applications. The key issue becomes how to best integrate servers, storage, and network elements. The numerous applications running on the cluster all need simultaneous access to the data on storage devices. That means the storage solution will have to accommodate multiple concurrent workloads without degradation. Additionally, the network switches and adapter cards must offer the throughput and IO to sustain the required performance levels.

This places new demands on both the storage solution and the network. In particular, big data analytics requires that storage be flexible and capable of being dynamically grown to meet varying capacity and performance requirements. Because virtualized applications can be quickly and easily set up and torn down, the associated storage must support easy, dynamic provisioning. Additionally, provisioning and addition of new storage capacity must not involve taking systems offline.

From the networking perspective, server virtualization and big data analysis can change the dynamics of traffic flow within the data center network. Network links to the servers can become congested, impacting network performance and throughput. A common solution is simply to add more links. But this increases the number of switch ports needed and adds to the administrative burden on the IT staff. What is needed is a network that offers high performance scalability.

(b) Unpredictable workloads: Another infrastructure issue to consider relates to the change in the way data is accessed in a big data workflow. Efforts to derive decision-making information from big data sources typically use a number of analysis tools,

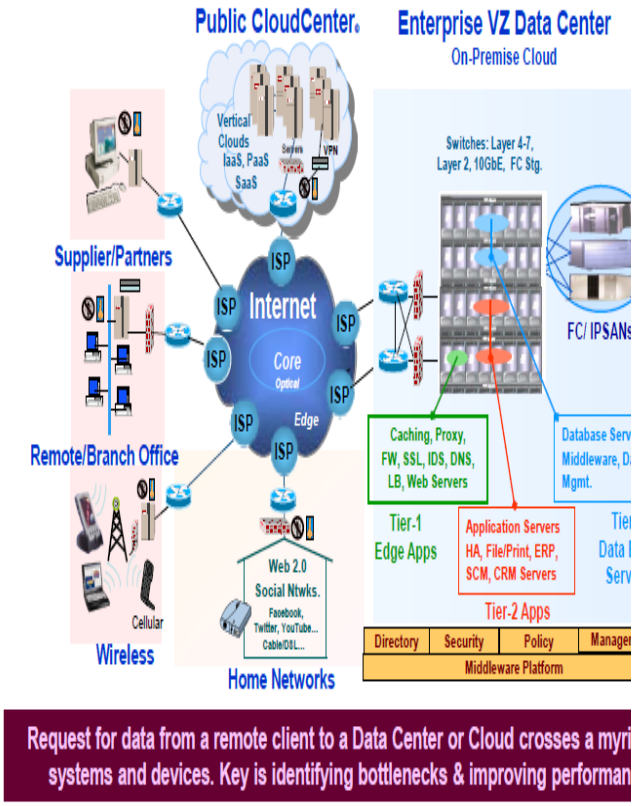

Fig. 2 System & Devices in Cloud Computing System

applied at different stages of a computational workflow. For example, in the life sciences, newer lab equipment, such as next-generation sequencers, produces a much richer set of data. This makes the raw output from today's lab equipment of interest to a more diverse group of researchers.

Each group of researchers subjects the data to a wide variety of analysis tools, all with different IO and throughput requirements. Depending on the type of analysis being performed, the workflows and applications will likely have diverse performance requirements. All of this makes big data workflows highly unpredictable.

What is required is an infrastructure that can support diverse workflows, offering high sustained throughputs. Specifically, the infrastructure must be able to handle large sorts, which are quite common in big data workflows. With large sorts, the files are typically larger than system memory and therefore cannot be retained in local cache. As a result, large sorting workloads require a file system and storage solution that can deliver high throughput and IO. The storage system must also be able to provide low latency access to file system metadata.

(c) Data management: Life sciences research has become more multi-disciplinary and more collaborative. This complicates data management and makes computational workflows more complex. As noted above, the richness of data from newer lab equipment makes it of interest to more types of researchers. Some groups might need instant analysis of the data in early stage research to determine which new drug candidates to move along and evaluate further. Other groups might need to re-examine the original data months or years later when a candidate moves into clinical trials or is being studied for potential adverse effects.

VI INFRASTRUTURE NEEDED

Operators could use their data access to [10] [11] [12] enhance internal processes, such as knowing customers' value, what type of content they prefer, and the type of device they carry. Similarly, decisions on the rolling out of networks and sales channels should consider the location and demographic data of potential customers. Customer care departments should use data to predict when a customer is at risk of churn and act on it. Customer data will also allow operators to reduce their losses from customer or dealer commission fraud.

Mobile operators are in a sweetspot for data generation and analysis. Data is generated every time a customer makes a call, navigates the Web, interacts with social media, or buys a product using their phone. Simply by having the phone connected to the operator's network, data is being generated, such as location, speed of movement, and even biometric data.

The diversity of data availability allows mobile operators to achieve a depth of customer profiling beyond that of other industries. Operators have the potential to know customers' whereabouts, their network of contacts, content preferences, wealth, and product preferences. It is entirely foreseeable that, in the not-so-distant future, mobile operators will also be able to generate revenues from the packaging and selling of this data. Traditional revenues such as voice and SMS are under pressure from Web-based services and over-the-top (OTT) providers, and with mobile broadband now reaching its peak of profitability in developed economies, telecoms will need to pursue new ventures. But in order to move on to this stage, operators need to set up the basic processes, frameworks, and technical infrastructures needed to capture and manipulate Big Data.

Contact centre text mining and telecom bandwidth throttling. Monitoring real-time contact centre and social media for surges in keyword frequency could be used as a lead indicator to infrastructure bottlenecks and be used as an input for throttling network traffic.

Co-location analysis from cell phone towers. Can we ask "needle in a haystack" queries to isolate collocation events from the massive call detail record (CDR) data ocean using Hadoop and columnar architectures?

Multi device event stream analysis correlating firewall, IDS, and switch activities in real time. How can we get a 360-degree view of an intrusion from the patterns of event data across devices?

VII HADOOP

This section provides some of the managing Big Data.

(a) Hadoop MapReduce and Hadoop Distributed File System (HDFS)

Hadoop is a framework that provides open source libraries for distributed computing

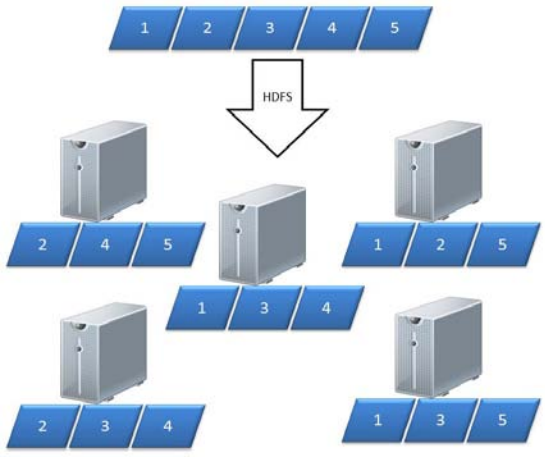

Fig. 4 Illustration of distributed file storage using HDFS

using MapReduce software and its own distributed file system, simply known as the Hadoop Distributed File System (HDFS). It is designed to scale out from a few computing nodes to thousands of machines, each offering local computation and storage. One of Hadoop's main value propositions is that it is designed to run on commodity hardware such as commodity servers or personal computers, and has high tolerance for hardware failure. In Hadoop, hardware failure is treated as a rule rather than an exception. [6] [10]

(b) HDFS

The HDFS is a fault-tolerant storage system that can store huge amounts of information, scale up incrementally and survive storage failure without losing data. Hadoop clusters are built with inexpensive computers. If one computer (or node) fails, the cluster can continue to operate without losing data or interrupting work by simply re-distributing the work to the remaining machines in the cluster. HDFS manages storage on the cluster by breaking files into small blocks and storing duplicated copies of them across the pool of nodes. The figure 2 illustrates how a data set is typically stored across a cluster of five nodes. In this example, the entire data set will still be available even if two of the servers have failed. Compared to other redundancy techniques, including the strategies employed by Redundant Array of Independent Disks (RAID) machines, HDFS offers two key advantages. Firstly, HDFS requires no special hardware as it can be built from common hardware. Secondly, it enables an efficient technique of data processing in the form of Map Reduce.

(c) Map Reduce

Most [11] enterprise data management tools (database management systems) are designed to make simple queries run quickly. Typically, the data is indexed so that only small portions of the data need to be examined in order to answer a query. This solution, however, does not work for data that cannot be indexed, namely in semi-structured form (text files) or unstructured form (media files). To answer a query in this case, all the data has to be examined. Hadoop uses the MapReduce technique to carry out this exhaustive analysis quickly.

Map Reduce is a data processing algorithm that uses a parallel programming implementation. In simple terms, MapReduce is a programming paradigm that involves distributing a task across multiple nodes running a "map" function. The map function takes the problem, splits it into sub-parts and sends them to different machines so that all the sub-parts can run concurrently. The results from the parallel map functions are collected and distributed to a set of servers running "reduce" functions, which then takes the results from the sub-parts and re-combines them to get the single answer.

VIII CONCLUSION

Big Data management is a recent technology which is being used at large level by the infrastructure and services industries focusing to capture potential opportunities. This paper provides the overview of the technology. how it is related with cloud is also discussed.

This paper explores some of the future needs of Big Data which may lead to the improvement and advancement of the technology in near future required large IT infrastructure.

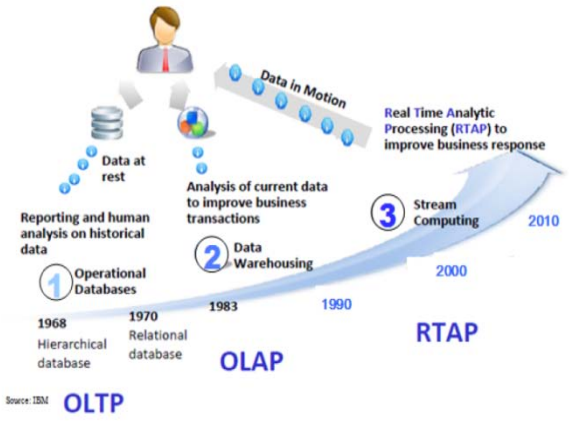

Figure-5

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Study on Energy Based Methods in Medical Image Segmentation

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ABSTRACT
Segmentation is nothing but creation the part of image or any object. Pattern recognition and image analysis are the first step of image segmentation. In the computer vision field and image analysis we can done significant research topic in the segmentation of video with dynamic background.Image segmentation is most of moderator function in image processing and analysis. Medical image segmentation places a crucial role in different medical imaging application. Image segmentation is a process of partitioning a digital image into multiple segments. Segmentation makes the image into something, which are easier to analyse. Segmentation is needed in diagnosis, surgery preparation and other medical applications. Current segmentation approaches are reviewed and reveals its reward and drawback. Different segmentation methods are thresholding, region growing, clustering, artificial neural networks, deformable models, Markov random field models, deformable models, and wavelet. Using the different algorithms the current methodologies of image segmentation is reviewed so that user interaction is possible for images. In this paper, the review of image segmentation is explained by using different techniques. Index Terms— image segmentation, image analysis

I INTRODUCTION

Dynamic backdrop is done by using image segmentation of video. Segmentation of video with dynamic background has been an important research topic in intelligent surveillance and human-machine interface technologies [1]. For the segmentation we need the Images. But the images are either in form of black and white or color. Color images are due to the grey level [2]. As the grey level difference changes the color of color image also changes. Image segmentation plays important role in segmentation of medical images. Medical imagery play vital role in secondary health care which provides health care access patients for treatment. For the medical images, segmentation is crucial as a follows by first step in Medical Image Analysis (MIA) [3]. In image analysis appear errors as image measurement, image show and feature extraction. So that in case of medical image segmentation proper image segmentation is difficult because of size of the head,torce,leg,brain parts, type of bug etc are different. So for the segmentation of medical images we need different algorithms and dissimilar procedure to segment and classification of image. However, depending on the knowledge of radiologist, he can consume time for studying medical images which depends on visual explanation. Segmentation techniques can be stated as the methods that are used for extracting and representing the information from an image. The accuracy of segmentation is determined by the essential success or failure of computerized analysis process. A set of segments that together cover the entire image, or a set of contours extracted from the image is the effect of image segmentation. Each of the pixels in a region is alike with respect to some characteristics or calculates property such as color, intensity or texture. When applied to a stack of images, typical in medical imaging, the ensuing contours after image segmentation can be used to create 3D rebuilding with the help of interpolation algorithms like marching cubes. There are so many requests for image segmentation. The main practical applications include content based image retrieval, Machine vision, Medical Imaging, Object detection, Pedestrian detection, Face detection, Brake light detection, Locate objects in satellite images, Recognition Tasks, Iris recognition, Traffic control systems. The main applications of medical imaging are Locate tumours and other pathologies, Measure tissue volumes, Diagnosis & study of anatomical structure. This paper provides an overview of methods used for medical image segmentation.

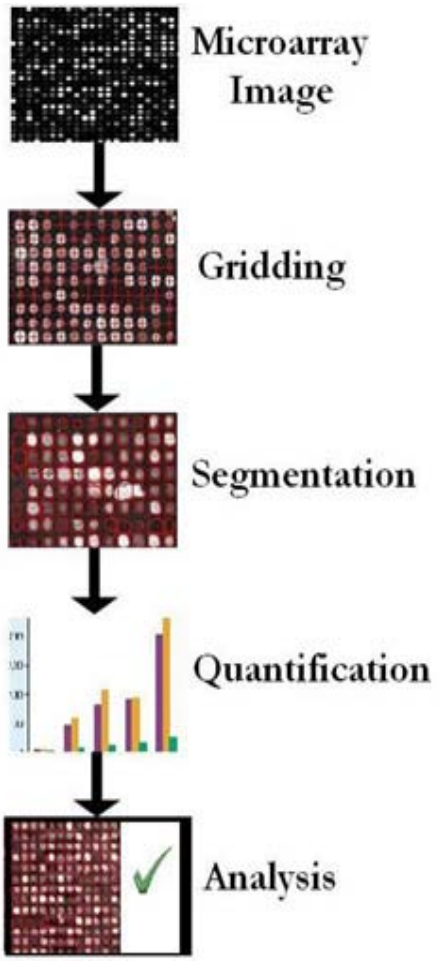

Fig. 1 Steps of Microarray Image Analysis Process.

II LITERATURE SURVEY

Method based on image segmentation evaluation techniques [3]; they are categorized into two types: Categorization and association. Characterization may be seen as a process while comparison technique as an inter-technique one. Based on different technologies, image segmentation [3] approaches are currently divided into following categories, based on two properties of image. A. Detecting Discontinuities The edge detection requires the detecting discontinuities property which includes image segmentation algorithm. Intensity [6] of the image is changed and partitions an image. Edge detection is the segmentation by finding the pixels [7-8] on the region boundary. Edge can be described by the boundary between the adjacent parts of an image [9]. B. Detecting Similarities It means to partition an image into regions that are similar according to a set of predefined criterion [5]; this includes image segmentation algorithms like thresholding, region growing, region splitting and merging.

This section describes several common approaches that have appeared in the recent literatures on medical image segmentation. Each method describes the overview of how it is implemented and also its advantages and disadvantages. Each technique is described separately, different methods can be used together to solve a particular problem [5-6].

Different segmentation methods described in this paper are thresholding approaches, region growing approaches, clustering approaches, deformable models, Markov random field models, multi-agent system approach, and wavelet segmentation.

(a) Thresholding

This is the simplest method of image segmentation. Tresholding is used to create binary image based on intensity of the image. This method attempts to find an intensity called threshold. This technique to partition an input image into two or more pixel value by comparing with the predefined threshold value T [1]. Let I(i,j) be an image, 0 p(i,j) < T
I(i,j) = *1 P(i,j) > T*

Where p(i,j) refers to the pixel value at position (i,j). thresholding can be either locally or globally. Global thresholding partitions the image into two based on the above equation. In local thresholding image is divided into sub images and thresholding properties are derived from the local properties of its pixels. The disadvantages of this methods are difficulty in finding the threshold value, in its simplest form two classes are generated and it cannot be applied to multiple channel images, thresholding does not take into account the spatial characteristics of the image. This causes it is sensitive to noise and intensity inhomogenity, which can occur in magnetic resonance images. Corrupt the histogram of the image, cause the separation more difficult [1].

(b) Region Growing

Region growing is a widely used segmentation technique. Region of an image is connected based on some criteria. These criteria can be intensity information or edges in the image. Region based segmentation is partitioning of an image into similar areas of connected pixels based on some criteria [7]. This technique requires a seed point selected by the operator and extracts the pixels connected to the initial seed with the same intensity value. Te problems of discontinuous edges and no segmentation of objects without edges are eliminated. Its main disadvantage is that manual interaction is needed to obtain the seed point. A seed must be planted for each region to be extracted. This method can be sensitive to noise, so the extracted region may have holes or it may be disconnected.

(c) Clustering

This method is termed as unsupervised method because it does not use the training data. Clustering method train themselves using the available data. Tree commonly used clustering algorithms are K-means clustering, fuzzy e-means algorithm and expectation minimization (EM) algorithm. K-means clustering algorithm clusters data by iteratively computing a mean intensity for each class and segmenting the image by classifying each pixel in the class with closest mean. Fuzzy e-means algorithm allows soft segmentation based on fuzzy set theory. tial modelling. So it is sensitive to noise and intensity inhomogenities.

(d) Deformable Models

These are physically motivated, model-based techniques for delineating region boundaries using closed parametric curves or surfaces that deform under the influence of internal or external influences [2]. A closed curve or surface must be placed near the desired boundary and then allowed to undergo an iterative relaxation process. This help to delineate an object boundary in an image. Internal forces are found from within the curve or surface to keep it smooth throughout the deformation. External forces are usually computed from the image to derive the curve or surface towards the desired feature of interest. The main advantage of this method is their ability to directly generate closed parametric curve or surfaces from images and their incorporation of a smoothness constraint that provides robustness to noise and spurious edges [11]. Disadvantage of this model is that it requires manual interaction to place an initial model and select appropriate parameters.

(e) Markov Random Field Models

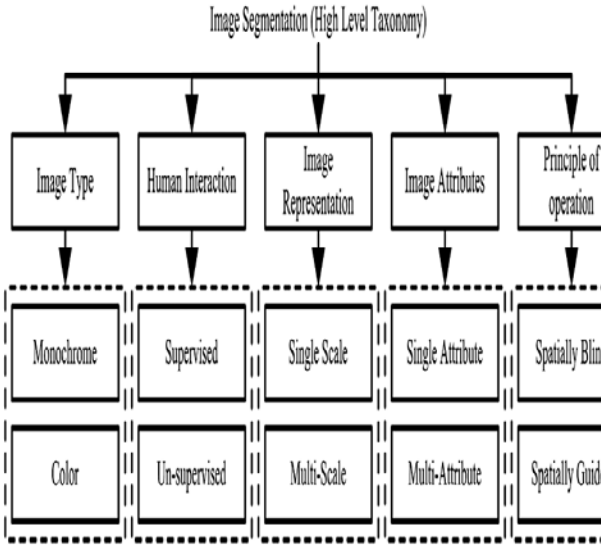

Fig.2 High Level Taxonomy Classification of segmentation

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Markov Random field Models (MRF) itself is not a segmentation method but a statistical model which can be used within segmentation methods. Here specifies the spatial interaction between nearby pixels. These interactions provide a mechanism for modeling a variety of image properties. In medical imaging they are typically used to take into account the fact that most pixels belong to the same class as their neighboring pixels [4]. MRF incorporated into clustering segmentation algorithm such as K-means algorithm. The segmentation is then obtained by maximizing the posteriori probability of the segmentation given the image data using iterative method such as iterated conditional models or simulated annealing. The disadvantage of MRF models is the proper selection of parameters of controlling the strength of spatial interactions. Here loss of important structural details occurs. This method also require computationally intensive algorithm. Despite these difficulties, MRF are widely used not only to model segmentation classes, but also to model intensity inhomogenities that can occur in magnetic resonance images.

III SPATIALLY GUIDED APPROACHES

In contrast to spatially blind methods, spatially guided approaches, as the name suggests, are guided by spatial relations of pixels for segmentation. Their primary objective is to form pixel groupings that are compact or homogeneous from a spatial point of view, irrespective of their relationships in specific feature spaces. region splitting is a technique that is initiated with an inhomogeneous

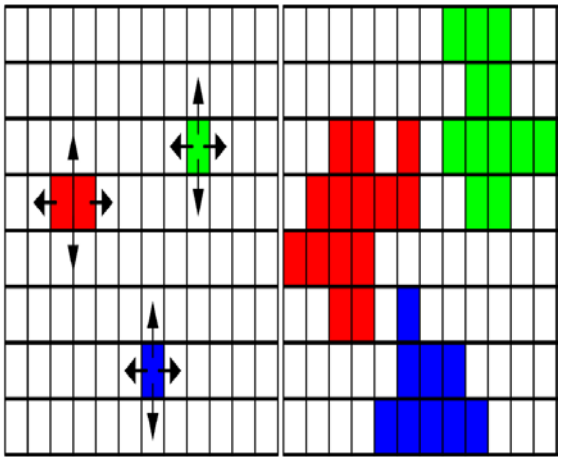

Fig. 3 Seed pixels (left) and region formed after a few iterations of growing (right).segmentation of an image, which is repetitively split until segments satisfying a particular homogeneity criterion are obtained.

Splitting can be achieved via diverse methods such as quadrature tree decomposition, watersheds, or implicitly via region growing when multiple seeds are placed in homogeneous areas that fall under different categories of our lowlevel taxonomy.Region-growing approaches. Fan proposed an automatic image segmentation algorithm that begins with an edge detection scheme, wherein the centroids between the detected edges are chosen as the set of candidate seed points. Subsequently, a growth procedure is utilized to spatially integrate pixels, in a recursive fashion, to an appropriately chosen seed from the entire set until the final segmentation is achieved, Region-merging approaches. Similar to growing, a significant number of approaches have been proposed that explicitly use a merging protocol for region-based segmentation.

Devaux built a unique segmentation architecture that employed the Karhunen-Loeve transform (KLT) in combination with color and textural attributes for regionbased segmentation of color aerial images. The algorithm separately exploited color and texture information to come up with two initial segmentation maps that are subsequently fused together in a merging protocol.Active contours. Within the notion of using edge/contourbased energy, curve evolution methods involving active contours better known as “evolving fronts” have gained tremendous popularity over the last decade. From a high-level viewpoint, active contours can be categorized based on their implementation as being either parametric active contours (PACs) or geometric active contours (GACs). PACs are generally represented in a Lagrangian formulation where the evolving curves are called “snakes,” a concept first introduced by Kass

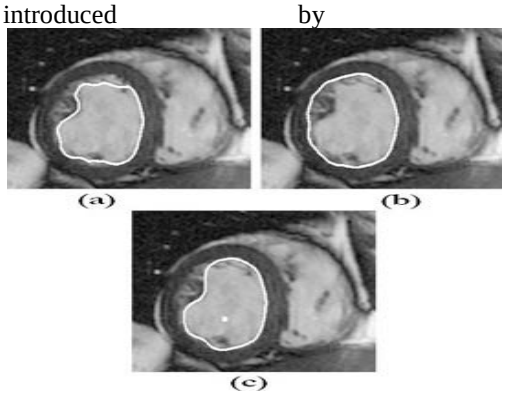

Fig. 4 Classic GAC segmentation (narrow-band, explicit time step): 21.5 seconds. (b) Multiscale GAC segmentation (narrow-band, implicit time step): 3.1 seconds. (c) Globally optimal GAC segmentation: 2.5 seconds.

A snake is defined as a curve or a deformable spline that constantly moves/evolves based on a specific energy model until it attains a shape that best fits an object (or multiple objects) of interest in the scene. This energy functional typically comprises of internal and external energy, whose combined effect drives a snake towards the boundary of an object resulting in the Among PACs, there exists a class of snakes called region-based active contours given that they are designed to attract to boundaries that distinguish homogeneous regions. Since its inception, it has been uncovered that the traditional snake model suffers from two major drawbacks that derail it from converging on the desired object of interest. The first occurs when the contour initialization is far from the true object boundary, and the second is when the object of interest has cavities that are concave in nature. To overcome the first shortcoming, multi resolution methods and pressure forces, as well as several enhanced models such as balloon/distance snake models, have been proposed. On the other hand, methods involving GVF and directional snake models have been offered to account for the second deficiency. PACs have several merits over classical segmentation techniques such as: 1. they are self accommodative in their pursuit for a global energy minimum, 2. they can be designed to be image scale dependent, and finally 3. They are not biased toward any particular object/region shape and consequently are effective for segmenting/tracking objects in spatio-temporal dimensions.

IV CONCLUSION

In this paper, we present an extensive review of recent color segmentation methodologies and highlight prominent contributions in the gray scale realm. Our classification of segmentation approaches fundamentally involves two dominant groups: 1. spatially blind methods that entirely disregard spatial information and 2. Spatially guided techniques that employ information derived from the spatial distribution of pixels. Furthermore, the aforesaid classification is not "hard," owing to the fact that there are a numerous techniques that, in some respect, integrate spatially blind processing with information that is spatially derived or vice versa, consequently fuzzifying the demarcation between them. This fuzzy nature may also be observed within subgroups of the segmentation hierarchy. Nonetheless, we have ensured that all algorithms have been placed in a group/ subgroup to which they are most relevant. Overall, our perspective of the field, based on methods discussed in this paper, have led us to make the following observations: 1. Segmentation continues to be at the forefront of many commercial and research endeavors, and the need for algorithms that perform this task efficiently is exponentially increasing with no sign of subsiding in the near future, 2. among various procedures developed within the last decade, energy-driven schemes involving active contours, Bayesian principles and graph partitioning techniques have received considerable attention relative to other mechanisms, and 3. In contrast to the 1990s, modern segmentation approaches have successfully managed to achieve higher levels of sophistication and quality, due to increased efforts to develop algorithms that combine the strengths of multiple processes to overcome existing drawbacks. While all our observations allude to advances that have been made in the area of image segmentation, we believe there are still significant contributions that have yet to be made.

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Innovation of Power System in India

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ABSTRACT
Power system has significant growth in interest and investment in the India. All activities have led to innovations and developments that simultaneously give power system engineers different challenges and oppurnities.The aim this paper to focus on recent innovations and future outlook of the Indian power systems. Such innovation include: Husk power system, Smart Grid and Renewable energy resources.

Keywords: Husk power system, Power system, Smart Grid, Renewable Energy.

I INTRODUCTION

India is currently one of the world's fastest growing economies with the interest from investors across the globe. At the same time the appetite for energy has left the country hard pressed. Many part of the country still face blackouts and in same villages there is no experience of power. The Indian Government does recognize the impending Energy-Crisis that the Country's growth can faced.

According to International Energy Agency, India relies on coal for about 40% of its total energy consumption, oil for about 24%, and natural gas for 6%, according to the International Energy Agency.

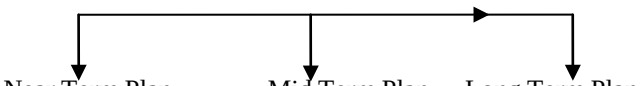
But the country is looking beyond fossil fuels; at nuclear energy and renewable energy in a big way. At the same time, India is looking at the "Smart Grid" also. So what is Smart Grid?
Smart Grid is an automated widely distributed energy delivery network characterized by a two-way flow of electricity and information, capable of monitoring and responding to changes in everything from power plants to customer preferences to individual appliances [1].We can also define Smart Grid as: Electricity delivery system (from the point of production to the point of consumption); integrated with communication and information technology. To better understand smart grids, we can look at the features:

(a) Fully automated power delivery network for monitors and controls electricity flows.
(b) Two-way flows of electricity and information between the power plant and the point consumption.
(c) Lowered carbon footprint and reduced emissions; increased access to renewable energy resources (like solar and wind).
(d) Use of digital technology to save energy, reduce cost and increase reliability.
(e) Improved power quality as per the need of 21st century economy.
(f) Reduced disruptions, improved efficiency and better asset utilization.

Individual categories of innovation discussed in this paper will include Husk power system, renewable energy particularly wind energy – and plug-in hybrid electric vehicles (PHEV) along with electric vehicles (EV). Another key component of the Smart Grid-related innovations is the recent developments in communication that enables intelligent components of the power system to work together to achieve system-wide intelligence.

II DRIVERS OF INNOVATIONS IN POWER SYSTEMS

The effect of Smart Grid towards Indian power sector is promising and fore sighting to transform and develop secure, adaptive, efficient and sustainable system by 2027 to provide the citizens with reliable and competitive energy by usage of innovative technologies and policies to fulfill the needs and aspirations of all by active participation of stake-holders. Smart Grid has a very wide view towards the future and is passionately progressing to achieve the targets and goals propagated in the five year plans [1]. These five year plans are divided as:



(a) The focus of the "Near Term plan" (2012-2017) is :
(i) Renewable integration.
(ii) Wide Area Monitoring.
(iii) Reduction in Power Cuts.
(iv) Efficient Power Exchanges.
(v) Access to "electricity for all".
(vi) Improvement in Power Quality.
(vii) Increase in inter-regional power exchange capacity.
(viii) Reduction of Transmission & Distribution (T&D) losses below 15% in all utilities.
(ix) Standards for smart appliances- energy efficient and Disaster Recovery (DR) ready.
(x) Training and capacity building in utilities and in the industry to build operate and maintain smart grid systems and application. This time period will see some smart grid pilot projects, low cost smart meter specifications finalization and testing: 2012-13, Verification of technology trials in terms of scalability, sustainability and rollout of smart grid projects in major metros.

(b) The goal of the "Mid Term" plan (2017-2022) is:

(i) End of load-shedding.
(ii) Improvement in power quality.
(iii) 1200kV AC system in operation.
(iv) Infrastructure and standards for Electric Vehicles.
(v) Efficient forecasting and dispatching of renewable.
(vi) Reduction of T&D losses to below 10%in all utilities.
(vii) Mandatory standards for appliances regarding readiness, energy efficiency and emission.
(viii) Export of Smart Grid products to overseas. This time period will see Smart Meters for all new connections all across the country, Demand Response for peak load management to avoid power cuts, systems for load forecasting and generation forecasting integrated with weather forecasting, Outage Management Systems and Mobile Crew Management systems, Utility wide smart grid roll-outs in select utilities– metros and large urban areas and Smart (Green) Buildings integration with utilities.

(c) The "Long Term" plan (2022-2027) will look at :

(i) Economically viable utilities,
(ii) Stable 24x7 power supply to all,
(iii) 33% or more renewable in power system,
(iv) EV infrastructure leveraged as Virtual Power Plant (VPP),
(v) Export of Smart Grid products, solutions and services overseas.
(vi) IT network and CRM system for electric utilities provided to other service providers such as water and gas distribution, land revenue collection, etc.During this time period, the industry will experience utility wide smart grid rollout in all major utilities, Real time pricing- price signals and choice of tariff plans to all categories of customers, Smarter Cities– Utility Corridors that can leverage common field infrastructure for automation and control of electricity, water, gas an district cooling/heating networks; common control and command centers, automated mobile crew systems etc, Robotics for live-line maintenance and Trials of superconductivity (HTSS).The plans for beyond 2027 include:
(vii) Smart utilities managing other pieces of vital infrastructure sector. For example, water and gas distribution and surface transport, etc.
(viii) Electrify almost all economic activates including transport and much of agricultural process and decarbonizes the power sector through dramatic increase in renewable and nuclear carbon capture and storage technologies. While India is trying to take its first steps in the Smart Grid area, Ontario State in Canada has already managed to go through the learning cycle of the initiative [1] .

(d) Plans of HPS in India

Husk Power Systems is a rural empowerment enterprise. It focuses on inclusive rural development on the backbone of electric power. Unlike any other effort in the world, it creates a self-sustaining ecosystem in the villages it serves, enabling economic development along with environmental protection, physical well-being and strengthening. .

A humble effort spearheaded by locals from the communities served, HPS strives to touch more than 10 million lives over the next five years, in rural areas across the world, often at the bottom of society's priorities. A business of rural electrification that transcends the conventional ideas around delivery of electrical energy to masses, HPS has created unique models of decentralized electricity generation and distribution that can be well managed by the locals using local resources, thereby bringing the age old wisdom of self-sufficiency.

HPS is a revolution in progress that attempts to channelize the largely dissociated efforts of various stakeholders - communities, investors, entrepreneurs, businesses, government and the society at large - to bring the worldwide impoverished and under-served rural population from the bottom to the top of the list of priorities.

(e) Plans for Renewable energy resources in India

"Promoting freedom from Fossil Fuels…but the time is running out…soon, there will be nothing left to burn on the earth but earth itself".

This is the new take on freedom and green activism for energy consumers and policymakers in India, courtesy the Indian Renewable Development Agency (IREDA), whose website forecasts a fiery death for planet earth. IREDA is merely following the enduring fashion of modern times, one of global green activism and a strongly held belief in the coming era of a new energy revolution. In this twenty-first century coup, clean and green renewable energy sources will soon banish dirty and polluting fossil fuels into the trashcan of history. Some are even convinced that a new messiah will do to renewable energy what John. Rockefeller did to oil and Bill Gates is doing to computers! This global fever is now entrenched firmly in the Indian policy-making establishment.

By the time the Y2K virus slipped into oblivion in 2000, renewable energy sources accounted for 2,000MW of installed capacity in India's power generation sector. This works out to about two percent of the total electric power generation capacity in the country. The Ministry of Power has now set very ambitious targets for the renewable sector; the capacity is slated to go close to 11,000 MW, or, more than five percent of the total electric power generating capacity in India. Look at the renewable ambitions from another angle. During the 1990s, the average annual addition to capacity was about 150MW. In the next ten years the average annual addition to capacity is slated to leapfrog five times to about 750MW [3]. India has abundant untapped renewable energy resources. Abundant access to solar energy that can be harnessed, an expansive coastline and numerous rivers and waterways position the country as an ideal marketplace for renewable energy technologies. These conditions are amply supported by excellent R&D capabilities and policies designed to accelerate the development of renewable energy technologies [4].

III SMART GRID AND ITS MAIN COMPONENTS

(a) Task performed by Smart Grid :

The Smart Grid is defined by [1] as an electrical grid that can perform the following tasks:

(i) Integration of ‘‘smart’’ appliances and consumer devices.
(ii) Provision to consumers of timely information and control options.
(iii) Dynamic optimization of grid operations and resources with full cyber-security.
(iv) Deployment and integration of distributed resources and generation, including renewable resources.
(v) Development and incorporation of demand response, demand-side resources, and energy-efficiency resources.
(vi) Increased use of digital information and controls technology to improve reliability, security, and efficiency of the electric grid.
(vii) Development of standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure serving the grid.
(viii) Deployment and integration of advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air conditioning.
(ix) Deployment of ‘‘smart’’ technologies (real-time, automated, interactive technologies that optimize the physical operation of appliances and consumer devices) for metering, communications concerning grid operations and status, and distribution automation.
(x) Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services. This means that several fields of technology and engineering can validly claim to be part of the Smart Grid, including power systems analysis, telecommunications, control systems, artificial intelligence, etc. In its current state, the Indian power system requires upgrades and careful implementation at all its main components in order to meet the Smart Grid qualifications above.

(b) Distribution and Substation Automation

The distribution system is the part of the power system that most directly affects the customer’s experience, as well as being the level Figure 1. Distribution and Automation of electricity where most of the small-scale disturbances occur. Figure 1. shows Distribution automation schemes have been proposed, simulated, and in some cases implemented in order to improve reliability and optimize system operations. The long-term goal for distribution automation includes self-healing systems, optimized operating conditions, and reduced customer disruptions in fault conditions. A sample of published research on distribution automation systems can be found in references Substation automation is a sub-area that allows for reliable communications and operation of substation equipment. Since all distribution systems originate at substations, a reliable [6-9]. Substation system is essential. Current applications of substation automations rely on a normalized set of communication standards such as IEC 61850, GOOSE message formats, DNP3 protocols, etc., to ensure that automation projects can work with multiple vendors and successfully integrate into the overall power system. An example of visions for the automated distribution system can be seen in reference [10].

(c) Advanced Metering and Metering Communications

The term “Advanced Metering” refers primarily to demand meters that have two-way communication capabilities, which allows for greater load control by the utilities and cost control by the customers. Newer meters going to be installed in the India have some communication capabilities already, thanks to automatic meter reading (AMR) implementations in the past decade. Advanced metering infrastructure (AMI) is a to pick that includes studying communication schemes and standards in order to avoid data congestion and increases reliability [11].Figure 2 shows.

(d) Plug-In Hybrid Electric Vehicles (PHEV) and Electric Vehicles (EV)

Plug-in vehicles – both PHEV and EV constitute an interesting challenge and opportunity for power systems studies in the India. It is expected that electric vehicles will grow over the next decades, and that the growth will place a great strain on the power system due to the increased charging demands. There are currently very few plug-in vehicles on the road in the India, but that will soon change with the debuts of mass-production models from several manufacturers. There have been several predictive and simulation-based studies on the topic of PHEV and EV penetration into the market, and the next few years will provide opportunities to test those hypotheses. The key to integrating PHEV and EV into the system is controlled charging, and to a lesser extent, Vehicle to-Grid (V2G) potentials.

(e) Renewable Energy Resources

Renewable energy resources are possibly the most important aspect of Smart Grid. The most popular – and cost-effective –type of renewable energy in use today is wind energy. (This does not include hydroelectric and nuclear generation in the renewable category).Wind and Solar energies are the most commonly used renewable resources, and each of them exhibit unique dynamic properties that affect the power system in different ways as seen in [12] and [13].Figure 3 shows renewable energy resource.

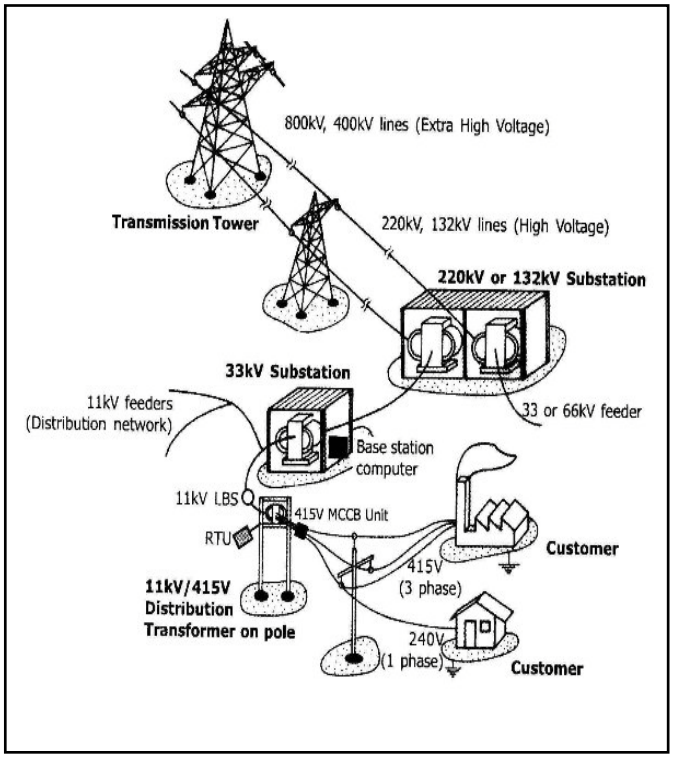


Fig 1

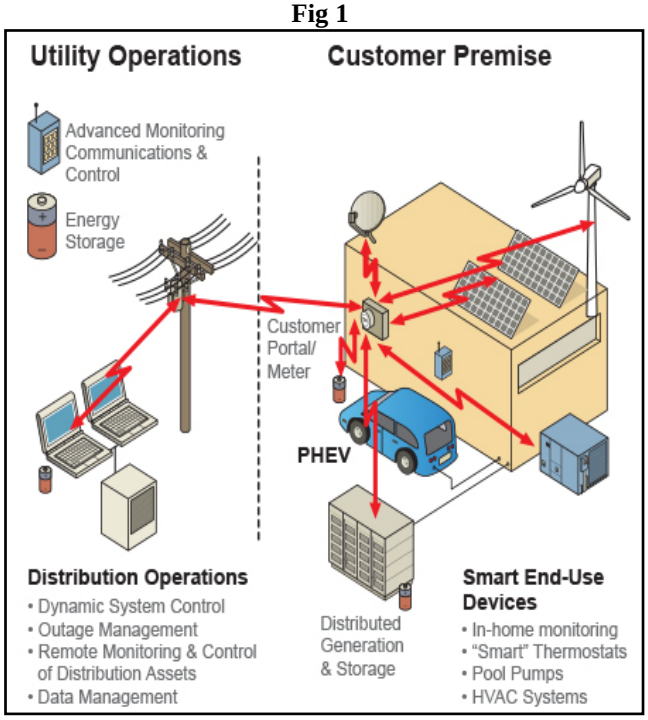


Fig 2 : Advanced Metering and Metering Communications and Plug-In Hybrid Electric Vehicles and Electric Vehicles.

IV HUSK POWER SYSTEM AND ITS APPLICATION

Husk Power Systems designs, installs and operates biomass-based power plants. Each plant uses proprietary gasification technology to convert abundant agricultural residue (procured from local farmers) into electricity, which is then distributed to rural households and micro-enterprises through a micro-grid system – providing a better quality, cheaper way to meet their need for energy.HPS creates an ecosystem around each plant by providing income generation opportunities to local farmers and entrepreneurs. Additionally, it creates employment through its livelihood programmes such as the incense stick manufacturing program which largely employs women.

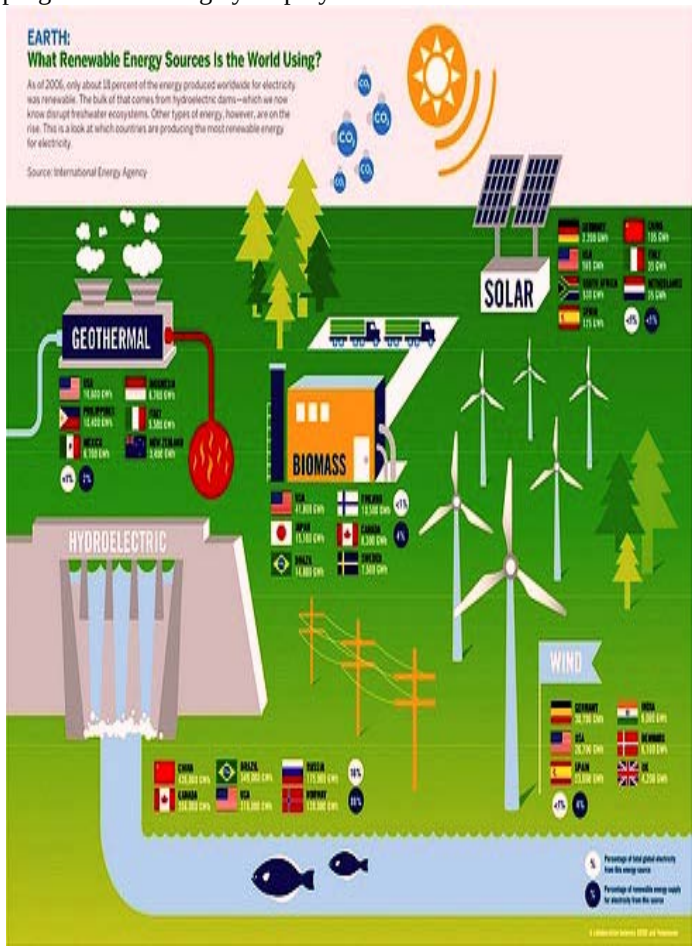


Fig 3 : Renewable energy resources (solar, wind, geothermal, biomass).

This enables sustainable development within the communities HPS serves. Since 2008, HPS has successfully installed more than 80 plants in Bihar, providing electricity to over 200,000 people across 300 villages and hamlets.HPS provides end-to-end renewable energy solutions by installing 25-kW to 100-kW 'mini power plants' and then wiring villages and hamlets of up to 4000 inhabitants to deliver electricity on a pay-for-use basis. It uses a biomass gasification based proprietary electricity generation process, that generates electricity using 100% producer gas based system ("single fuel mode") and distributes electricity directly to households and small businesses while keeping costs low by running insulated wires along bamboo poles to subscribing households, businesses and farms. Its Total Landed Cost of Installation < $1,300 per kW and Operational Cost is < $0.15/kWh

In just four years HPS has installed 84 mini-power plants, providing electricity to over 200,000 people spread across 300 villages, and employing 350 people operating across the state of Bihar.

Each plant serves around 400 households, saving approximately 42,000 litres of kerosene and 18,000 litres of diesel per year, significantly reducing indoor air pollution and improving health conditions in rural areas. By extending village life beyond day light hours, HPS promotes economic development by enabling businesses to stay open after dark and allowing children to study at night. HPS creates an ecosystem around each plant by providing income

generation opportunities to local farmers and entrepreneurs. Additionally, it creates employment through its livelihood programmes such as the incense stick manufacturing program which largely employs women. This enables sustainable development within the communities HPS serves.

V CONCLUSION

As seen in various references for this paper, there are several Smart Grid and other power systems projects funded by the Indian Government. The largest implication is that in a few years there will be an infrastructure that provides measurements, data, and communication paths. The next step would be to find applications that use these infrastructures to achieve the stated goals for Smart Grid. The future developments that are of interest to the authors include PHEV/EV integration, renewable energy integration, the impact of Smart Grid on power systems education, and the development of new schemes to utilize HPS.The applications of recent innovations have already begun to bear fruit in terms of existing projects meeting their stated goals. Each area in the Indian power system is incrementally improving reliability and customer experience thanks to the additions of new technologies. Some technologies are: a transmission corridor improves its voltage profile and increases its capacity. These innovations are tools that provide power system engineers with the ability to solve problems in different ways and increase the efficiency of the power system. It is the collective responsibility of engineers, educators, and policy makers to create an environment where future innovations can grow around the infrastructures that are being put in place.

VI FUTURE OUTLOOK

India's transmission grid is in urgent need of expansion and improvement. According to industry sources, utilities worldwide will spend US$ 378 Billion in Smart Grid technologies by 2030 and India, the third largest smart grid investment market, is set to install 130 million Smart Meters by 2021. At present, the market in India is nascent with only few smart meters roll outs so far. But this situation is expected to change and gather pace from 2012 onwards. Apart from smart meters, the investment will be geared towards grid automation, communication infrastructure, IT systems and hardware; home area network, and system integration. India Smart Grid spending is likely to touch about Rs. 9,500 crore by 2015 from the current level of Rs. 5,500 crore. However, investors in India are deterred by the sector's financial weakness, public ownership of utilities and bureaucratic delays [15]. The PHEV/EV integration holds promises and challenges to power systems operations. They represent potentially large and unpredictable loads to the power system if they're added to the system in an uncontrolled manner. [16] A utility that is equipped with advanced metering capabilities can reduce the impact of PHEV/EV and even turn it into a scheduling asset. This can be done by communicating charging availability between vehicles and the grid, thus ensuring that the charging is minimal during peak load conditions and the base load units have better utilization during low load periods. [17] In addition to peak load management, PHEV/EV can act as small-scale energy storage units with vehicle-to-grid (V2G)schemes [18].Renewable energy integration is of interest for the fact that renewable energy resources are not easily controllable. Wind and sunlight do not operate on a schedule. This presents challenges in addition to the dynamic and static performances of generators using these resources. Several other factors are involved in the future of renewable energy as well. The Indian wind energy sector has an installed capacity of 17,365.03 MW (as on March 31, 2012). In terms of wind power installed capacity, India is ranked 5th in the World. Today India is a major player in the global wind energy market. The potential is far from exhausted. Indian Wind Energy Association has estimated that with the current level of technology, the 'on-shore' potential for utilization of wind energy for electricity generation is of the order of 102 GW. The unexploited resource availability has the potential to sustain the growth of wind energy sector in India in the years to come [19].The impact on power systems education is not immediately clear. It is obvious that the coursework has to keep pace with the new technological advances and prepare the students for a changing industry. This may also mean a greater cooperation and integration with experts in other fields such as intelligent controls, automotive engineering, transportation engineering and mechanical engineering. In the India, there is a projected shortage in the power systems workforce due to upcoming retirements and low enrollment in previous years. This problem has been momentarily delayed due to the economic downturn keeping many engineers and researchers from retiring early, as well as forcing companies and universities to freeze hiring. This has a potential to become a large problem because each person who currently works in power systems has to learn new job functions and work on integrating new technologies, making training and replacement more difficult. At this time, there are ongoing projects at a few utilities that are attempting to use HPS, Renewable energy resource like solar, wind and hydro. Other special protection schemes and remedial action schemes are also being investigated. The regional independent system operators –companies that manage transactions and transmissions in areas with many utilities – are requiring more HPS to be installed by the local utilities, which reinforces the point about the growth of an infrastructure waiting for applications to catch up.

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Bio - Technology patents – Protection available under International Agreements

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I INTRODUCTION

Bio-technology plays an important role in the fields of medicine, food, fertilizer, energy and protection of environment. Bio-technology concerns living organisms, such as plants, animals and micro-organisms, as well as non-living biological material, such as seed, cells, enzymes, plasmids and the like. Bio- technology is one of the most research intensive industries in the world. In the U.S alone, the bio-tech industry reportedly spent $9 billion in research and development in 1997. This industry is also very sensitive to copying and piracy, since many inventions involve the description and function of genetic material where barriers to illegal exploitation are low. Bio-technological inventions fall into three categories. They are the processes for the creation or modification of living organisms and biological materials; the results of such processes; and the use of such results. The level of protection afforded to bio-technology inventions varies widely in throughout the world. For instance, not all countries offer protection comparable to U.S utility patents. On the other hand, many countries that issue utility patents for bio-technology inventions do so only for single – celled organisms. Complex living organisms such as plants, seeds or animals are not always patentable under their national laws.

Fortunately in several countries, the trend is towards more protection for plants and seed and other bio-technology inventions. For example, in 1998 china enacted a comprehensive series of regulations that provide significant protection to plant and seed varieties. The convention on Biological diversity (CBD) defines bio-technology as "any technological application that uses Bio-logical systems, living organisms or derivatives thereof , to make or modify products or processes for specific use.''

II APPLICATION OF BIO-TECHNOLOGY TO FOOD AND AGRICULTURE

Bio-technology in food and agriculture is one of the most promising new technologies of modem age. For example, somehow genetic engineering is essential to addressing food security and malnutrition in developing countries. In United States, the growing use of agricultural Bio- technology is resulting in reduced use of pesticides and increased adoption of environmental friendly farming practices such as "no-till" farming which reduces soil erosion and fertilizer run off. New crops derived from Bio-technology are being used in developing countries such as Argentina, South Africa, china, Philippines and India.

The United Nations Food and Agriculture organization (FAO) has supported bio-technology as a technology that would be beneficial to developing countries if more investment is directed towards it. According to him, new genetic technology for the so-called "orphan crops" such as cowpea, millet and sorghum are critical for food Supply and livelihoods of the world's poor people.

However, there are a number of barriers preventing the poor from accessing fully the benefits of modern technology including inadequate regulatory procedures, poorly functioning markets and seed delivery systems, weak domestic plant breeding capacity, inadequate research capabilities and complex intellectual property issues.

Western technological, pharmaceutical, and human health care industries have increased their interest in natural products as sources of new bio-chemical compounds for drugs, chemical and agro- products development. Although the interest in traditional knowledge and medicines from developing counties has increased in the past few decades, few if any, benefits have accrued to the source countries and traditional communities- their contribution to plant breeding, genetic enhancement. Bio-diversity conservation and global drug development are not recognized, compensated or even protected.

III BIO- TECHNOLOGY PATENTS

Beginning in the mid-1900's, nations began to offer plant variety protection (PVP) also known as Plant Breeder's Right (PBP) to breeders. Under PBP, a breeder could obtain protection for a new variety provided it is novel, uniform and stable. The protection gave the breeder the exclusive right to market the variety, although farmers were able to reuse their seed and breeders had the right to use the protected material in producing new varieties. However in 1991, Treaty provisions permitted nations to prohibit farmers form reusing harvested seeds and gave breeders certain rights over material bred from protected materials and stronger rights over products grown with protected seed.

The International Convention for the protection of New Varieties of plants was introduced in 1978, and the developing countries have been urged to adopt it as a sui generis plant variety protection system. ***The system of protection is governed by an International agreement and organization: UPOV (International Union for the Protection of New Varieties of plants).*** However, a few developing countries have become members of UPOV. The 1978

version of the convention allows the farmers to re-use propagating material from the previous seasons harvest and to freely exchange seeds of protected varieties with farmers. The 1991 version of the convention is more stringent and a farmer who produces a protected variety from the farm seeds is guilty of infringement unless the national law provides otherwise.

It has also been argued that UPOV is inadequate in protecting traditional knowledge of indigenous and local peoples. The Convention does not contain any provisions for recognizing the knowledge and other contributions the indigenous and local people make to plan breeding programs.

The U.S will grant a regular protection to a variety with the probable implication that the maternal cannot be reused by farmers or used by third party for further breeding. The U.S and probably Europe also grants patents on all plants of a particular species into which a specific new gene has been inserted by bio-technological means, in this sense it is possible to patent a gene which typically involves legal claims over the is isolated gene and DNA sequences, over the genetic engineering tools that use those sequences and over plants that have been transformed with such tools. The rights of the plant holder do not extend to plants in which the genes occur naturally.

The U. S and Europe have also granted patents on wide categories of transgenic plants, for example, all transgenic Colton or soybean. Many other nations grant patents on processes for genetic transformation of plants. Although many developing countries have been hesitant about adopting such forms of intellectual property protection, the trade related intellectual property right (TRIPs) agreement requires all members of the WTO to make patent available in all fields of technology. However, members may exclude from patentability, the plants and animals, other than microorganisms and the processes used for the production of plants and animals that are essentially biological. All members must provide an effective sui generis system for the protection of plant varieties.

Because the private sector will hold many of the advanced technologies, the publicly funded agricultural research community must also develop an effective approach in cooperation with the private sector in research and product development. International pressure is likely to ensure that national governments make an effort to comply with TRIP's. But such efforts should mean more than simply passing TRIPs complaint legislation.

The intellectual property legislation must be supplemented with appropriate training in the Courts, law firms and law schools so that law can be used effectively. Effective legislation for managing intellectual property rights for products of governmental research also must be passed.

IV INTELLECTUAL PROPERTY RIGHTS IN PLANTS

Plants have long been object of Private Property; Germplasm has not. But most-jurisdictions now recognize IP rights in plant genetic information. Law creates IP by separating an abstract idea like for molecularly engineered gene, for its physical vessel such as the gene itself contained in a plant or seed. Property Right in the abstract object may come as patents, Plant Breeder's rights or both. Innovation like bio-technology has magnified the philosophical instability of property rights in ideational resources. Thus IP is typically measured against public interest or occasionally society's rights are crystallized as common property.

There is a overlap between IP and classic property rights. Monsanto to markets agricultural systems; the farmer provides land and labour, and it provide seeds, chemicals or other tools for crop growing. Monsanto's system involves "Round Trip" glyphosate herbicide which kills plants. Monsanto has also engineered a gene that causes plant and the progeny to be glyphosate resistant. Farmers can therefore, spray "Round up" on a growing crop, killing weeds but leaving the genetically modified (GM) plants unharmed. Monsanto has a Canadian patent for glyphosate resistant plants including "Roundup Ready" Canola.

Monsanto has accused Percy schomeiser, a saskatchewam farmer of marking using and selling its patented inventions without license. Monsanto's private investigators discovered glyphosate resistant Canola in schmeiser's 1998 crop, which he had planted with seed saved from the previous year, as was his customary practice. Sehmeiser never purchased seeds from Monsanto that would have required contracting not to save new seeds generated from his crop. He argued that he was not responsible for, nor did he want, "Round up Ready" Canola on his land. He proposed various explanations for its presence including adventitious spread by wind or insets.

The Trial Division did not accept schmeiser's explanation. However, he declined to decide how and why Monsanto's gene did appear in schmeiser's crop. He held that growing and selling the GM seed under these circumstances made Sehmeiser liable for infringement of Monsanto's patent. The Court of Appeal and on may 21, 2004, five of the nine Judges of the Supreme Court of Canada, upheld this ruling.

Sehmeiser made many arguments to the Supreme Court. **First,** he argued that Monsanto's plant is invalid as it concerns a higher life form, which is not patentable in Canada. **Second**, because he did not spray has crop with "Round up" herbicide, he claimed that he did not "use" or exploit the patents' only moved utility. Sehmeiser also argued that the correct damage, if any, represent only has encroachment from exploiting the patent, not his entire profit.

The majority of the Supreme Court held that the patent was valid as it did not concerns a higher life form, but merely a gene and cell contained within a higher life form. In a compelling dissent, four Judges held that this is a distinction without a distinction. . This dissent is especially persuasive give the majority's finding that possession of a plant containing patented gene constitutes "use" and therefore, infringement. Schmeiser's failure to spray his crop with herbicide was immaterial because of the patent's stand- by utility as a consolation. However, the majority did accept schmeiser's argument regarding damages.

But Sehmeiser made another argument that is most interesting. He had argued that Monsonto for forfeited its IP rights by virtue of the unconfined release of its product; that innocent by-stander should not suffer from the adventurous spread of Monsanto's gene, and that solution to this dilemma is through the doctrines of waiver or implied license. The upshot is that schmeiser's classic property rights in the plants and seeds should not be subordinated to Monsanto's IP rights.

Sehmeiser tried to show how the law traditionally reconciles competing property claims. Indeed this is not is not a novel exercise. By the early 19th century, the law of the admixture recognized that "if a man" puts corn in my bag in which before there is some corn, the whole is mine because it's impossible to distinguish what was mine from what was his.

There are some noteworthy passages in response to Schmeiser's classic property argument. Justice McKay said in the trial division "for the defendants' it is argued that Monsonto has no properly interest in its gene, only intellectual property rights. While I acknowledge that the seed or plant containing the plaintiffs patented gene and cell may be owned in a legal sense by the farmer who has acquired the seed or plant, that owner's interest in seed or plant is subject to the plaintiff's patent rights including the exclusive right to use or sell its gene or cell and they alone may license others to use the invention.

Thus a farmer whose field contains seed or plants originating from seed may own the seed or plants or his land even if he did not set about to plant them. He does not, however, own the right to the use of the patented gene or of the seed or the plant containing the patented gene or cell.

In the court of appeal Justine sharlow remarked; "I am prepared to assume, without deciding, the owner of the real property has legal title to any volunteer plant on has land and generally has a right to save the seed from such a plant and to plant and harvest the seed for profit in subsequent years. However, there is no authority for the proposition that ownership of a plant must necessarily superseded the right of the holder of patent for a gene found in the plant. On the contrary, the jurisprudence presents a number of examples in which the right of ownership of property are composed of extent required to protect the patent holder's statutory monopoly.

But most disapprovingly, the majority of the Supreme Court missed the point entirely "the issue is not property rights, but patent protection. Ownership is no defense to a breach of the Patent Act". Actually reconciling intellectual and classical property right is exactly the issue.

Also, unfortunately, the majority also failed to mention any countervailing interest including Society's interest. They cited no purpose for patents except "to prevent others from depriving the inventor, even in part and even indirectly, of the monopoly that the law intends to be theirs"

Sehmeiser may not have been responsible for the initial presence of Monsanto's invention in his crop, yet Sehmeiser was distinguished from an "Innocent by-stander" Nevertheless, Sehmeiser was forced to give up or destroy all of his plants and seeds. He was also injected from saving or replanting any seed that he knows or should contain Monsanto's gene. So a farmer who knows of a patented gene in his crop cannot replant particular seeds known to contain the gene. That is perhaps a regrettable constraint on an owner's classical property rights.

But a worse, if a patented gene has infiltrated an entire crop, or even if it is sparsely distributed throughout the crop, all seed saving rights are in effect extinguished. Farmers who suspect GM plants on their land are in a very difficult position. For one, every farmer knows that Monsanto's gene spreads adventurously so they may not test spray the entire crop, killing if they were mistaken. If, however, they were correct, they could not save any of their seeds without being branded as an infringer. Not testing, but nevertheless saving seeds might make them willfully blind. The only viable option is to discontinue the practice of saving seeds. Not surprisingly, it has been said that Sehmeiser sets a "troubling general precedent"

V IMPLICATIONS OF IPR IN PLANTS FOR DEVELOPING COUNTRIES

Over a long period of time, farming communities in developing countries have bred and developed their own crop varieties improved on the varieties through selective breeding and sold them locally under names which have found widespread local acceptance.

Over the last few decades, some of these local varieties have also been exported. Intellectual property protection in developing countries however is poor and in many cases, the government is opposed to granting monopoly rights in agricultural crops.

In such a situation, an agricultural biotechnology company from a developed country can acquire samples of the crop. As these varieties are not produced using bio-technology, the company can make use of the exemption for plants and animals allowed under the World Trade Organization (WTO)

VI AGREEMENT ON TRADE RELATED ASPECTS OF INTELLECTUAL PROPERTY RIGHTS (TRIPS) ON BIOTECHNOLOGY

Beginning in 1999, the TRIPS Council commenced its review of Article 27.3 of TRIPS that related to bio-technological inventions. Article 27.3 permits countries to exclude plants, animals and biological processes from patent protection (although microorganisms and non-biological and microbiological processes are eligible for patents). Article 27.3(b), however, requires member countries to provide for the protection of plant varieties either by patents or through a system created specifically for that purpose (sui generis), or a combination of both.
In November 2001, the Doha Declaration linked the issues of biotechnology, biodiversity and tradional knowledge and declared that further work by the TRIPS Council on these review should be guided by the TRIPS objectives and principles and must take development into account.

Since the Doha Ministerial Conference, a number of proposals have been submitted on bio-diversity. On October 17, 2002, the EU submitted a proposal to examine the requirement that patent applicants disclose the origin of genetic material. Switzerland submitted a proposal on May 28, 2003 suggesting an amendment to WIPO'S Patent Cooperation Treaty, which would require domestic law to ask the patent applicants to disclose the origins of genetic resources and traditional knowledge.

A paper submitted by Brazil, Cuba, Ecuador, India, Peru, and Venezuela in June 2003 develops earlier o disclosure of the origins of biological resources and traditional knowledge, "Prior Informed Concept" for exploitation, and equitable benefit sharing. Under this proposal, the TRIPS section on biodiversity will be amended to make disclosures of the origins of genetic resources obligatory.

In June 2003, the African Group submitted a paper that proposes to prohibit the patenting of all life forms (plants, animals and microorganisms) and prefers Sui Generis protection for plant varieties to preserve farmers and breeders rights to use and share harvested seeds.

By claiming that these are natural varieties where no inventor can be identified – this is correct because most developing countries do not provide Intellectual property protection for their plant varieties. The agricultural bio- technology company can then genetically engineer a close substitute for the natural variety which maintains its desirable consumer characteristics. This genetically modified variety can be patented and its name copy righted, which makes it eligible for intellectual property protection under TRIPS. This means that bio-technology firm can license the production of the crop in any climatically friendly country, export the product in competition with natural varieties and prevent the natural varieties from being sold in importers markets using their national names. Examples are jasmine rice from Thailand and basmati rice from India; varieties of these two crops have been patented and copyrighted by U.S.A firms.

Some view this system as bio-piracy arguing that if a patent system which is supposed to reward inventiveness and creativity systematically rewards piracy as this to honestly apply criteria of novelty and non-obviousness in the granting of patents related to indigenous knowledge, then this system is flawed and needs to be changed . It cannot be the basis for granting patents or establishing the exclusive marketing rights. The difficulty with protecting patents or crops under patent law is that they confer property rights which are private in nature. This means that under the law, once a patent is granted, the owner enjoys exclusive right to his invention.

VII THE 2001, FAO INTERNATIONAL TREATY FOR PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE (PGRIA)

It seeks to facilitate and regulate access to genetic resources for food and agriculture. Contracting parties agree to take the necessary legal or other appropriate measures to provide access to other contracting parties or to legal and natural persons under the jurisdiction of any contracting party in accordance with a set of conditions. These include that a "recipients shall not claim any intellectual property or other right that limit the facilitated access to plant genetic resources for food and agriculture or their genetic parts or components, in the form received from multilateral system" and that "access to plants genetic resources for food and agriculture protected by intellectual and other property rights shall be consistent with relevant international agreements and with relevant national laws".

VIII CONCLUSION

Many developing countries argue that traditional knowledge held by indigenous and local communities now forms part of the product discovery process of the industrialized world, but that this knowledge is not recognized and adequately protected by the conventional IPR system. Therefore, sui generis legislation systems needs to be developed that would name the sources of genetic material and traditional knowledge used in new products and allow for the sharing of benefits arising from the use of such genetic material and knowledge. This would be in accordance with the requirements of the Convention on Biological Diversity and the FAO International Treaty on Plant Genetic Resources for Food and Agriculture.

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Development of Luminescent Nanoparticles for Various Applications

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I INTRODUCTION

Nanoparticles of luminescent materials (nanophosphors) emit light when excited with suitable energy. Such luminescent nanoparticles offer great potential for superior light emitting devices, displays, energy harvesting applications, security ink, fluorescence tracking and targeted drug delivery in biological systems and many others. The development of nanophosphor for a particular application including lighting and display require different window of excitation energy and specific emission energy. For example, solid state lighting with LED requires suitable nanophosphor excitable by blue/UV LED to produce white light; for Plasma Display Panel (PDP) they should be excitable by vacuum ultraviolet (VUV) light and emit in three primary colours Red/Green/Blue, for efficient solar spectrum conversion nanophosphor must absorb solar UV and IR radiation and convert into visible light for efficient photovoltaics. Moreover, fluorescence emission from nanoparticles can be enhanced through plasmonic coupling for better device efficiency.

Synthesis of luminescent nanoparticles of various inorganic host materials and doping with appropriate light emitting atoms to devise nanophosphor for various applications has been done using chemical methods such as co precipitation, sol gel, auto combustion and controlled solid state diffusion. Phase characterization has been done by x-ray diffraction, morphology and particle size examined by transmission electron microscopy. Photoluminescence properties have been studied with Edinburgh Instruments combined steady state and time resolved luminescence spectrometer (FLSP920) and confocal fluorescence microscope (WITec Instruments). Phosphors/ nanophosphors developed for particular applications and their properties are described below.

II NANOPHOSPHOURS APPLICATIONS

(a) Phosphors for Plasma Display Panel (PDP)- Phosphors for PDP applications have to be excitable by vacuum ultraviolet (VUV) light and emit in three primary colours red, green and blue (RGB) so that all the hues can be reproduced in PDP TV pictures. We have developed three phosphors for PDP application which are Y4Al2O9: Eu3+ (YAM:Eu3+), for red, YBO3: Tb3+ for green and BaMgAl10O17: Eu2+ (BAM) for blue. The phosphors were synthesized by high temperature solid state reaction method in an ambient atmosphere suitable for the valence state of the rare earth activator ion. Emission spectra and photographs of developed RGB phosphors under VUV excitation is shown in Fig.1(a). Degradation of phosphors due to thermal treatment during panel baking process and operation under VUV irradiation is major challenge in PDP industry. We successfully arrested degradation of PDP phosphors by coating individual phosphor grains with nanometer thick silica layer as shown in the inset TEM imag23e.

(b) Phosphors for Solid state lighting-Production of white light from monochrome LED light is mostly realized by coating a blue LED chip with blue to yellow down conversion phosphor so that part of blue LED light is absorbed by phosphor that emits yellow light and part of blue light is transmitted so that white light is generated by intermixing of blue and yellow - two complimentary colours (Fig.1b). Nanophosphor can reduce light scattering and improve the light output by 50%. Commercial white LEDs presently available in market uses coating of yellow emitting YAG: Ce (Ce3+ doped Y3Al5O12) phosphor on blue LED chips (450 –480 nm) and produce heavily blue tinged white, deficient of red part of the visible spectrum. Example of a rare earth ion doped alkaline earth aluminates SrAl2O4: Pr3+ with broad excitation band ranging from 430 – 490 nm covering the emission wavelength of all commercial blue LEDs and PL emission spectra showing broad emission in yellow orange spectral region is shown in Fig.1.

(c) Phosphors for solar spectrum conversion for efficient energy harvesting by solar cells-A very important emerging application of nanophosphor is solar spectrum conversion for enhancing solar cell efficiency. Effective absorption of silicon solar cells is limited in the range of 550- 1100 nm (hν ~ Eg - 2Eg) and Dye sensitized solar cells (DSSC) absorb mostly in the visible region. Thus most of the terrestrial solar energy (~ 300 - 2400nm) in the UV and IR remains unutilized by solar cells. Suitable nanophosphor layer, when integrated with solar cells, can convert solar UV and IR radiation in the visible range which can be utilized by solar cells for photo carrier generation. Mostly individual down conversion (UV to visible) and/or upconversion (IR to visible) nanophosphors that can be used on the front or rear surface of solar cell respectively are discussed that require a bifacial solar cell. A novel solution is to employ a dual excitation phosphor that can be simultaneously excited by both UV and IR solar radiation and emit in the visible region with high luminescence yield. Towards this goal, we have developed a dual excitation, dual emission phosphor YVO4:Eu3+,Er3+,Yb3+ and the emission spectra and photograph under UV and IR light is shown in Fig.1.

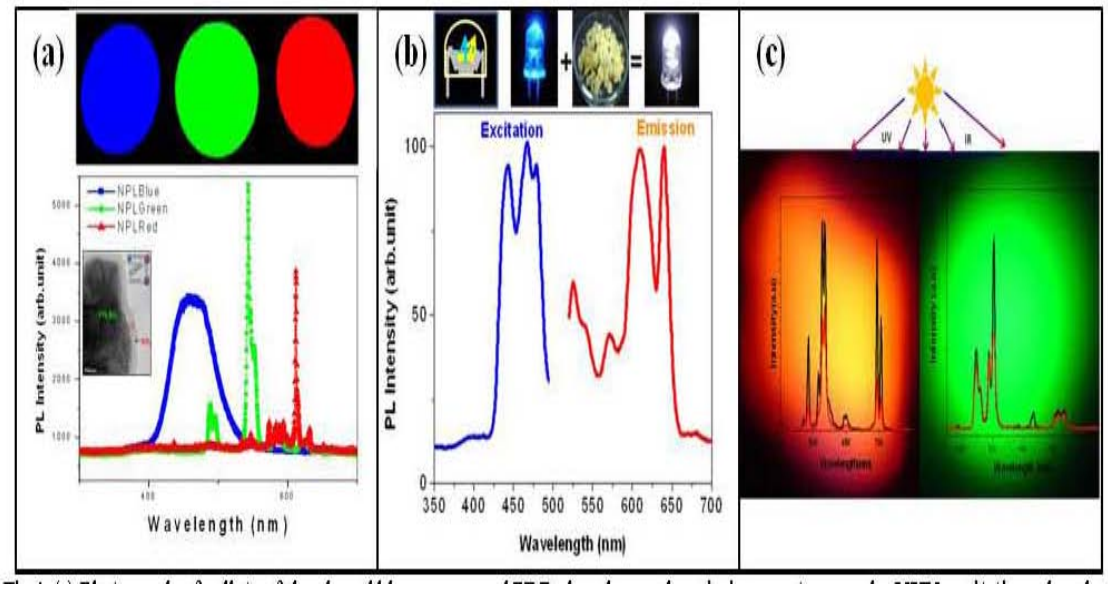

Fig1 Photograph of pellets of developed blue, green, red PDP phosphor and, emission spectrum under VUV excitation, also shown the TEM image of silica coated phosphor grain; (b) schematic of generating white light from a blue LED using a yellow emitting phosphor and excitation, emission spectra of developed SrAl2O4:Pr3+ phosphor; (c) photograph of dual excitation, dual emission phosphor YVO4:Eu3+,Er3+,Yb3+ under UV & IR excitation and emission spectra.

(d) Plasmonic enhancement of fluorescence- Metal nanoparticles (MNP) can confine and enhance the incident electromagnetic field (EM) around them due to surface Plasmon resonance (SPR) and lightening rod effect. Such plasmonic near field has the ability to enhance fluorescence from nanoparticles conjugated optimally with MNPs. We have shown that Silver nanoprisms (Ag NP) of different sizes influence fluorescence enhancement in YVO4:Eu3+ nanoparticles to various degrees. The Plasmon enhanced fluorescence process is shown schematically in Fig.2 and the TEM images of fluorescent YVO4:Eu3+ NPs (~ 5nm) and the scatter free colloidal solution; TEM images of Ag NPs and their colloidal solution showing different colours due to their respective SPR band is shown in Fig.2. The confocal images of only nanophosphor film and that of nanophosphor conjugated with Ag NPs clearly show the enhancement of fluorescence due to plasmonic near field.

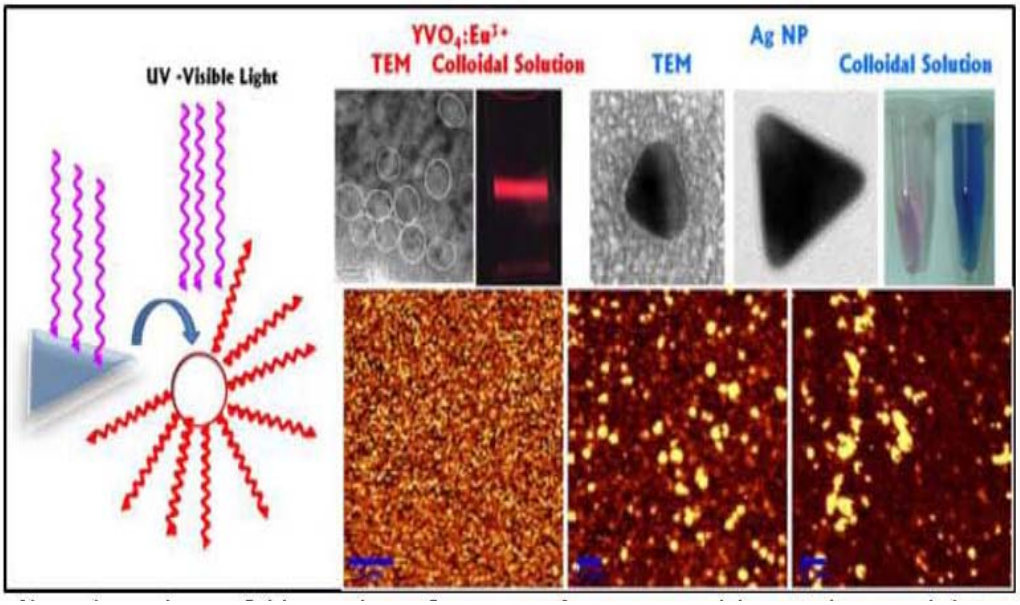

Fig.2 Schematic of how plasmonic near field can enhance fluorescence from a nanoparticle, TEM image and photograph of colloidal solution of nanophosphor YVO4:Eu3+, Silver nanoprisms of two different edge lengths and confocal fluorescence maps of (bottom: from left to right) thin film of only YVO4:Eu3+ NPs, YVO4:Eu3+ NP conjugated with smaller and larger Ag nanoprism respectively.

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Nanotechnology and Nature

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ABSTRACT
Two criteria are proposed for characterizing the diverse and not yet perspicuous relations between nanotechnology and nature. They assume a concept of nature as that which is not made by human action. One of the criteria endorses a distinction between natural and artificial objects in nanotechnology; the other allows for a discussion of the potential nanotechnological modification of nature. In so far as current trends may be taken as indicative of future development, nanotechnology might increasingly use the model of nature as a point of orientation, while many of its products will continue to be clearly distinguished from nature.

Keywords: Nanotechnology, Nature, Technology, Environment Impact.

I INTRODUCTION

Nanotechnology is the engineering **of** functional systems at the molecular scale. *Nature Nanotechnology* is focused on all topics regarding nanoscience and nanotechnology. Technologies are related to materials that are high performance or organic, inorganic, and hybrid.

Over the past decade, there has been growing concern over the potentially adverse environmental and health impacts of nanomaterials. At the same time, nanotechnology has provided improved environmental solutions, especially in the field of water quality. Environmental problems are a complicated mosaic of multiple phenomena that require multidimensional analysis and solutions.

We try to understand the fundamental physical interactions between nanomaterials and the ecosystem, and have developed several facile schemes for doing so using the principles and techniques Nanomaterials for Water Treatment

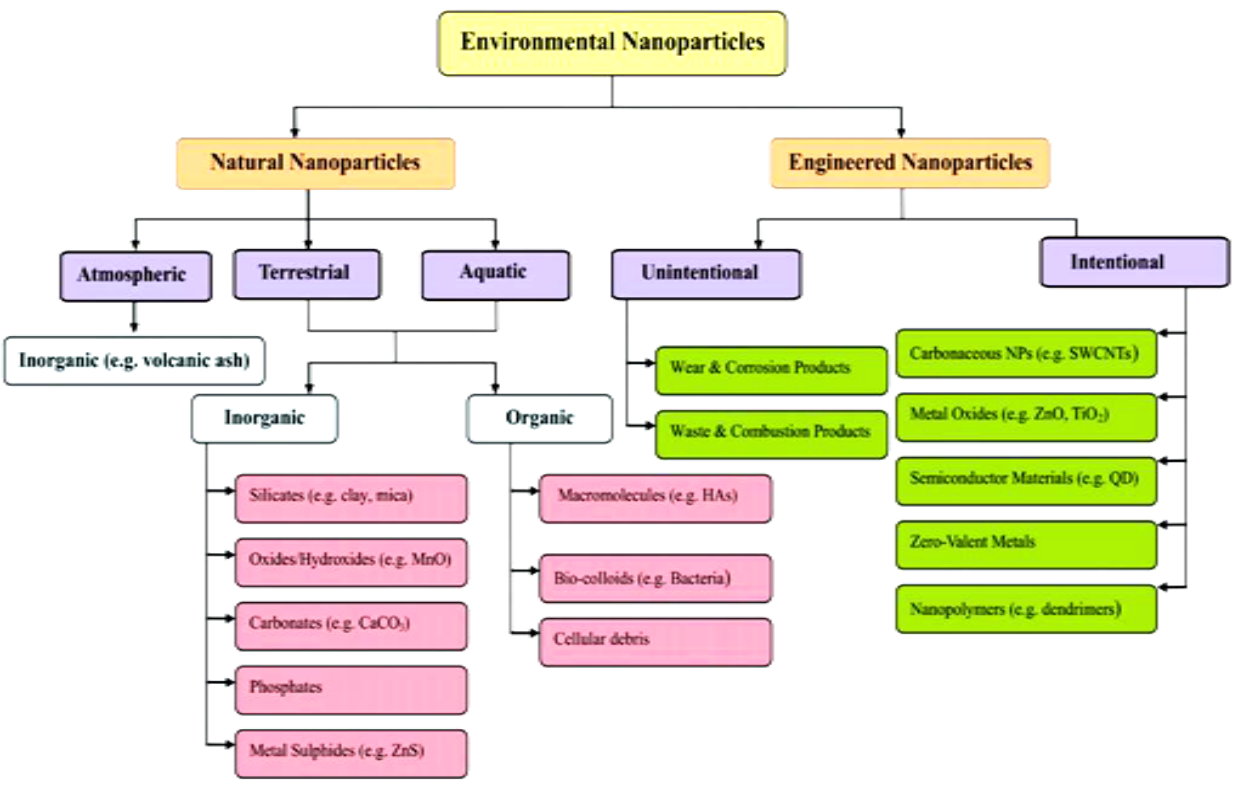

Fig 1: A detailed sorting of nanoparticles existing in the environments

II ENVIRONMENTAL ANALYSIS

Several nanoscale inclusions have been used for various applications. Among these nanoscale inclusions, graphene has the higher priority for various reasons. Graphene is one of the most advanced materials for structural improvement, substitution of silicon for electronic devices, as well as thermal transferring, and fire retardant. Three papers have been published describing the benefits of altering graphene to be more environmentally friendly. One study by Marcano, D.C., et al., improved the process of making graphene oxide (GO) by increasing amount of KMnO4 and eliminate NaNO3 that improves the process efficiency, and produces less toxic emission21. Salas, E.C., *et al.*, 22 and Kotchey, G.P., *et al.*,23 have also shown that shewanella bacteria and some other bacteria can decompose graphene and make graphene less toxic to the environment. 6

III POSITIVE EFFECTS ON ENVIRONMENT

(a) Positive Effects

Nanotechnology offers potential economic, societal and environment benefits. Nanotechnology also has the potential to help reduce the human footprint on the environment by providing solutions for energy consumption, pollution, and green gas emissions. Nanotechnology offers the potential for significant environmental benefits, including:

(i) Cleaner, more efficient industrial processes
(ii) Improved ability to detect and eliminate pollution by improving air, water, and soil quality
(iii) High precision manufacturing by reducing amount of waste
(iv) Clean abundant power via more efficient solar cells
(v) Removal of greenhouse gases and other pollutants from the atmosphere
(vi) Decreased need for large industrial plants
(vii) Remediating environmental damages.
(viii) The nanoscale products that utilize graphene in an industrial use or research can benefit the environment in several ways:
(ix) Graphene based nanocomposites reduce the weight of airplanes by substituting traditional metals and composites, and the consequence of the weight saving results in a reduction of a thousand tons of gasoline
(x) Graphene thin films or graphene buckypapers can be substituted in place of metal meshes around the fuselage of airplane used to prevent the direct and indirect effects of lightning strikes
(xi) The eminent properties of graphene increases the efficiency of advanced renewable energy processes, such as reducing the weight of a wind turbine blades and increasing the energy converse efficiency.

(b) Negative Effects

Understanding of the environmental effects and risks associated with nanotechnology is very limited and inconsistent. The potential environmental harm through nanotechnology can be summarized as follows:

(i) High energy requirements for synthesizing nanoparticles causing high energy demand
(ii) Dissemination of toxic, persistent nanosubstances originating environmental harm
(iii) Lower recovery and recycling rates
(iv) Environmental implications of other life cycle stages also not clear
(v) Lack of trained engineers and workers causing further concerns.

Worldwide, 1.1 billion people lack access to sufficient amounts of safe water. Adequate supplies of decontaminated water with high throughput at a low cost are a growing challenge around the world.

Current water purification methods in wide use employ chemically intensive treatment that is relatively expensive, harmful to the environment, and is not adaptable to the non-industrialized world.

Nanomaterial-based technologies, adsorbents and catalysts could create novel,

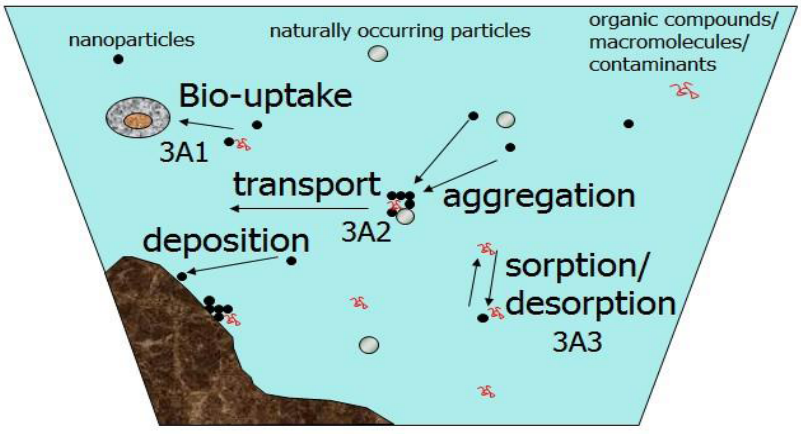

Fig 2 : Nanoparticles in a liquid environment

environmentally benign solutions for water treatment. There are three main applications where nanomaterials show promise – sensing and detection of pollutants, treatment and remediation of contaminants, and finally, prevention of pollution. Nanomaterials are also being used to enhance membrane separation processes, leading to greater selectivity and lower costs. However, successful applications of these technologies require high degree of control of nanoparticle (NP) mobility, reactivity, and ideally, specificity for the contaminant of interest.

The unknown ecological effects, environmental stability, fouling properties, low detection limits, high costs, and concerns over their regeneration and environmental deposition limits the large scale applications of many commonly used nanomaterials for water treatment, such as nano zero valent iron, titanium dioxide nanoparticles, carbon nanotubes and zeolites. Advances in macromolecular chemistry such as the synthesis of dendritic polymers have provided great opportunities for improving and developing effective filtration processes for water purification to eliminate different organic solutes and inorganic anions. Dendritic polymers which include hyperbranched and dendrigraft polymers, dendrons and dendrimers are highly synthetic, nanoscale branched structures with a high degree of surface functionalities, monodispersity, controlled composition, and architecture which display interesting physicochemical behavior due to their shape, size and multiple functionalities.4 of physics, materials, and physical chemistry. The focus of this article is the key contributions our lab has made to the field of drinking water remediation using nanomaterials

IV CONCLUSION

Nanotechnology offers great potential for benefit to humankind, and also brings severe dangers. While it is appropriate to examine carefully the risks and possible toxicity of nanoparticles and other products of nanoscale technology, the greatest hazards are posed by malicious or unwise use of molecular manufacturing. CRN's focus is on designing and promoting mechanisms for safe development and effective administration of MM.

V FUTURE DIRECTIONS

We are developing strategies for extending the scope of dendritic polymers for environmental remediation. One of our recent studies explored the ability of these dendritic polymers to disperse spilled oil,16 a huge environmental hazard associated with the offshore operation of the petroleum industry. Energetically, the hydrophobic interior of these polymers at ambient water pH provide for ample space for hydrophobic oil molecules to partition in.

While over 70% of the earth's surface is covered by water, only about 3% of it is available for human consumption. Even worse, in developing countries, 80% of illnesses are water related. In addition to providing technical solutions to the staggering challenge of providing clean drinking water, regulatory and public acceptance to using nanotechnology for drinking water treatment must be established. In addition, life cycle assessments of the risks and benefits of these nanomaterials are crucially necessary.

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