

# ARTIFICIAL INTELLIGENCE IN MODERN TIME

**Ekta Nehra**

*Student of C R college of Education, Hisar, Haryana-125001, (India)*

## ABSTRACT

*As name implies artificial intelligence is making the machines like human that can think like human and can do the work like human. Now a days' in every step of our life we are using artificial intelligence like when we use Google and another shopping sites that sites using artificial intelligence understand that what user prefer. In many companies and industries human workers are replacing by the artificial machines that machines can do more work than human and never tired and there is one time cost of that machines. Now robots are going to develop which looks like human and scientist are trying to put emotions in them. As the artificial is good for us same like it can be dangers' for us. So in this paper I tried to find out how AI affects our modern life firstly I tried to explain what artificial intelligence is. Then from what artificial intelligence is got or branches of artificial intelligence. Here I also give the fields where AI is used like in transportation, in journalism, in playing game etc and how artificial intelligence work or we can say the searching techniques are used for finding the solution. And at last I tried to find that what inventions are done in this field and what will be future of Artificial intelligence.*

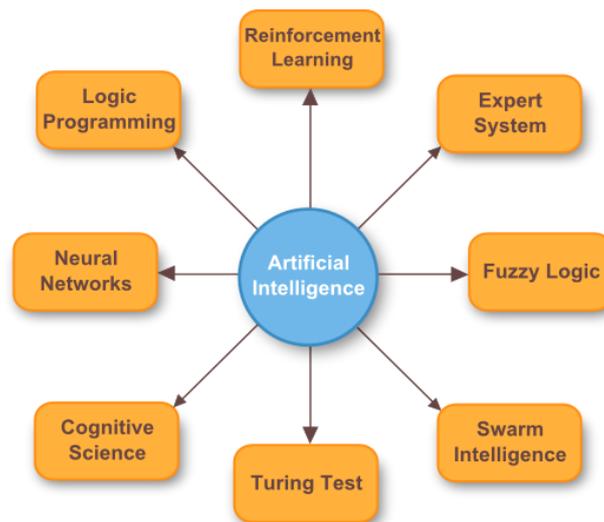
**Keywords:** *Artificial Intelligence, Heuristic, Transportation*

## I. INTRODUCTION

Artificial intelligence is the established name for the field, but the term "artificial intelligence" is a case of much confusion because artificial intelligence can be defined as the opposite of real intelligence. Artificial intelligence is defined as the concept of solving the problem in such a manner where the complex problem deals with the help of machines in more specific human like fashion or in simple words .It is combination of two terms machine + human being . Intelligence can solve the hard problems easily [8]. It means human intelligence in a machine that can be in robots, computer or any other electronic equipment. In artificial intelligence problems are solved regarding the real world in it human being give commands and problem is solved by the machines. With the invention of digital computers, time consuming and error-prone numerical computations are done with relative ease and accuracy. It then struck to humans "why not seek the help of the computers in the reasoning process". As all know human brain is more complex, complicated and advanced with respect to intelligence .And than human tried to simulate that intelligence on computers. The basic idea for intelligence in machines came from Turing test .An article was published in mind magazine by Turing in the year of 1950 ,which give birth of a controversial topic "can machine think". In modern time artificial is used in many fields' like- medical diagnosis, stock trading, robot control, law, remote sensing, scientific discovery, finance, online and telephone customer service, heavy industry, transportation etc. there can be as many definition of intelligence as many there are expert each define intelligence in his own way[5].

## II. MEANING OF ARTIFICIAL INTELLIGENCE

Artificial intelligence is combination of two words artificial+ intelligence. Where artificial means not real or natural and by intelligence means the ability to reason, to trigger new thoughts, to perceive and learn intelligence is. Artificial intelligence can be defined that area of computer science that mainly focus on the making on such kind of intelligent machines that work and give reaction same like human beings. It is combination of many activities which includes for designing the artificial in computers that are like- recognizing the speech, Learning, Planning, solving the problem. When any system adapts itself according to situation in any environment is called Intelligent [2]. In other words it can be defined as programming such machines which can think and act with some level of human intelligence is known as artificial intelligence. In 1956, John McCarthy used the term artificial intelligence. Artificial intelligence can be defined as efficiently use of limited resources [4]. So artificial intelligence can be defined as making computer programs to solve complex problems same like as human solve the problems. So it is also divided into two parts one is to solving the complex problem by the machine and second is same like human beings. The term artificial intelligence is also used to describe a property of machines or programs: the intelligence that the system demonstrates. Artificial Intelligence is combination of science and engineering for making the machines which behaves in intelligent manner. In it many fields are combined like philosophy, psychology, and computer science [3].



**Fig. 1. Factors included in AI**

## III. BRANCHES OF AI

AI is combination of many fields. It is made by combining the many parts like-

1. Artificial neural network is used in AI
2. AI also use Computer vision
3. Evolutionary algorithms are used in AI
4. Swarm intelligence is also a necessary part of AI
5. For recognizing the pattern, Pattern recognition is used
6. It also offer facilities of Learning from experiences
7. Genetic programming is an important part of AI
8. For processing the image, Image processing and analysis is used

9. For recognizing human language Natural language processing feature is used
10. For finding the optimal solution Global optimization technique is used
11. in AI machine can learn itself and it is called as Machine learning
12. Knowledge representation for representing the knowledge
13. it understands the society very well so called Social intelligence
14. For controlling to the AI Control theory is used
15. Data is inadequate in real world so Uncertain reasoning is done
16. Mathematical tools used in AI

## IV. APPLICATIONS OF AI

### 4.1 In the Journalism

It is very surprising that Artificial intelligence is used for writing articles and news which used to be written by the professionals and experts. Machines have taken the place of that professional and write articles and news itself without intervention of human being with their own intelligence. It is also used for handling business documents and handling annual reports.

### 4.2 For Playing Games

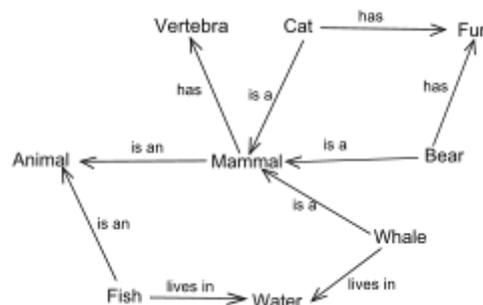
For playing games like chess a master level intelligence is required. So with the help of Artificial intelligence any kind of decision can be taken easily like which move is to taken in chess on what time. For taking moves it uses the brute force computation—which looks at hundreds of thousands of positions.

### 4.3 In the Transportation

In the coming future our car and other vehicle will be derived by the computers and there will be no need of actual driver. All the cars will be driverless we all know about it but it can be deeper then it. It will do driverless not only to cars but also to airplanes, trains etc. airplanes will be pilot less. It have both advantages and disadvantages as human work will be reduced and then they will have no job or in other hand it will prevent from accidents as it's concentration will be good and same at all time. It will also save fuel and from traffic gridlock.

### 4.4 In Heuristic Classification

The main characteristics expert system is to collect information from many sources and collect at one place. In heuristic classification many search techniques are used like hill-climbing, best first search etc. it tries to find out the optimal solution of complex problem at low cost and in minimum time. For an example it take decision whether to accept a proposed credit card purchase.



**Fig. 2. Use of Semantic Net by Expert System**

#### 4.5 For Emergency Services

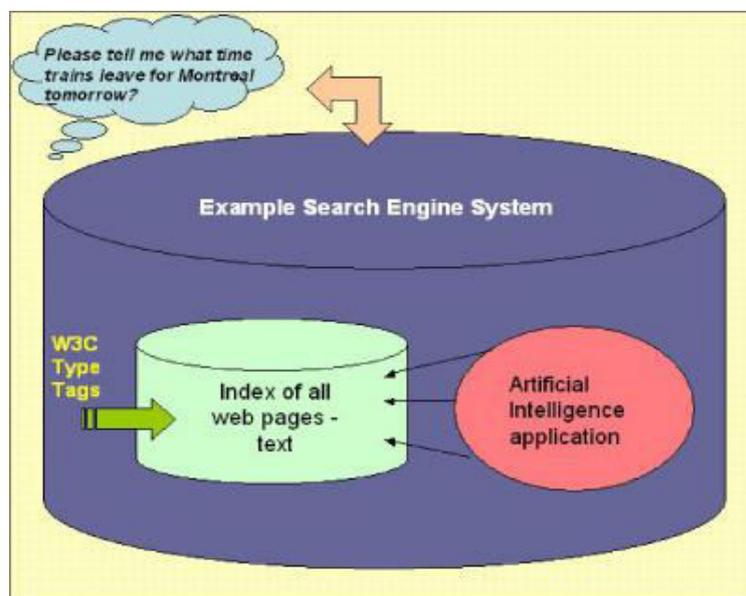
When we allow handling emergency to A.I then it is more beneficial for us. Because when some emergency come like fire, flood then we can send metal or silicon firefighters to save people because they have no danger to loss life , machines can also defy higher temperatures and can tolerate smoke easily and can search easily in close-quarters by using lasers and radar where as people may not be able to see. Firefighting was first field where artificial intelligent machines were used but now this concept is used in many fields like driving ambulances, handling dangerous law enforcement situations, and even cleaning up hazardous leaks or spills are prime examples. Now Navy is using this technology on the water, and some are developing it for use in cities.

#### 4.6 For Entertainment

We can apply artificial intelligence to the world of music, can make artificial director which see the real world and can generate the stories .we can make the robots which compose music and pitch and robots can create your favorite songs. New technology is also able to restore to life of that stars which are dead like Tupac Shakur and Michael Jackson etc.

#### 4.7 For providing Services to Customer

Now a day's, for providing services to the customer artificial intelligence is using in place of human being. When any person do calculation like preparing bill, handling account information he can do calculation error but machine do calculation properly and no mistake is done by the machine. Artificial intelligence also has a component that is natural language processing with the help of which human being can directly communicate with machine in their natural language and can get services directly.



**Fig. 3. Example of Services Provided to Customer**

## V. SEARCHING TECHNIQUES IN AI

In AI for finding the solution of problem searching has to be done because solution is not known in advance. For it AI programs are developed which do the searching process for solution because solution steps are not known beforehand and have to be found out.

For doing searching following steps are required

1. Initial state
2. A set of legal operators
3. Goal state or final state

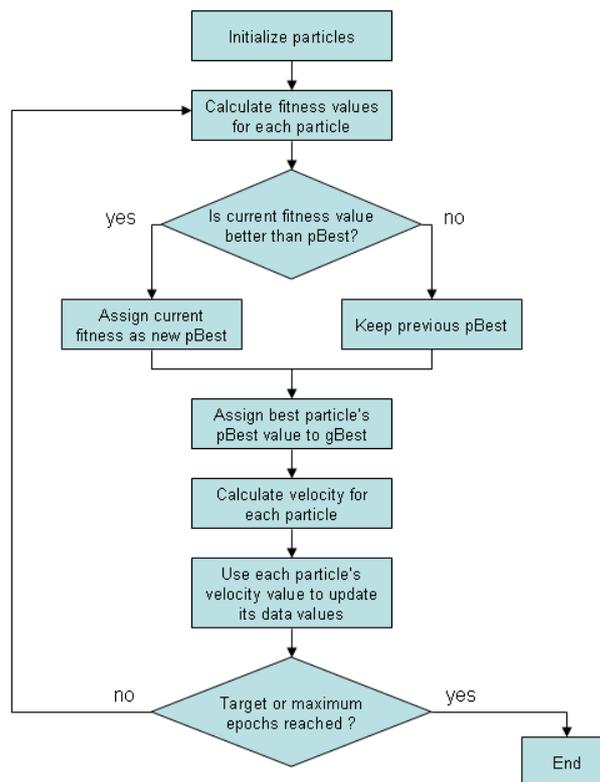


Fig. 4. Example of Searching in AI

So we can say that searching is a process which transform initial state to goal state. Searching in AI is broadly classified into two parts-

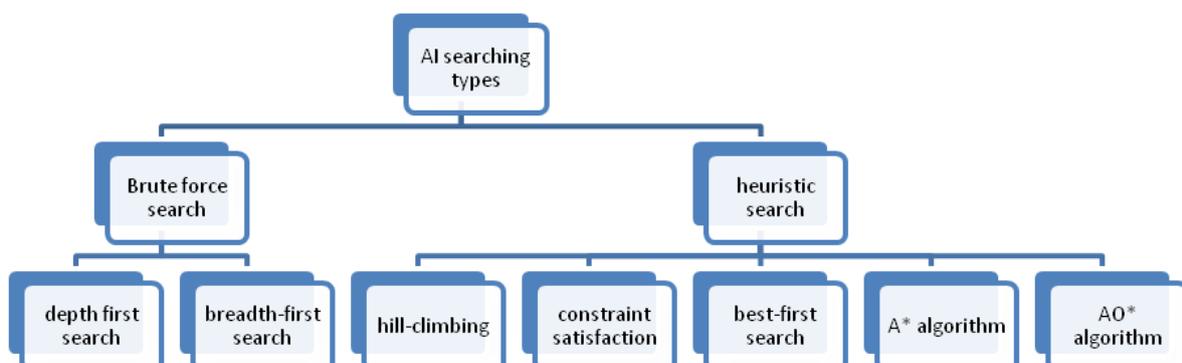


Fig. 5. Different Searching Techniques in AI

## VI. INVENTION IN THE FIELD OF AI

An American scientist John McCarthy invented the term Artificial Intelligence and he has credit of founder of Artificial Intelligence. He was a computer and cognitive scientist and was very popular early development of AI [7]. In the 1940s and 50s, many scientists from diversity fields like mathematics, psychology, engineering, economics and political science started to try to make a artificial mind which work like human in the year of 1940 and 50 and started academic in the year of 1956[6]. For using the semantic net first program of AI was written by Ross Quillian. We can define semantic net as like graph in which nodes represent the concept and arrow is used for providing link between the nodes [1]. A quiz was done in Feb 2011, named with *Jeopardy!* Quiz show it was an exhibition match. And the competition was in between the IBM's question answering system named as Watson and two champions named as Brad Rutter and Ken Jennings and that system beaten them by a great margin.

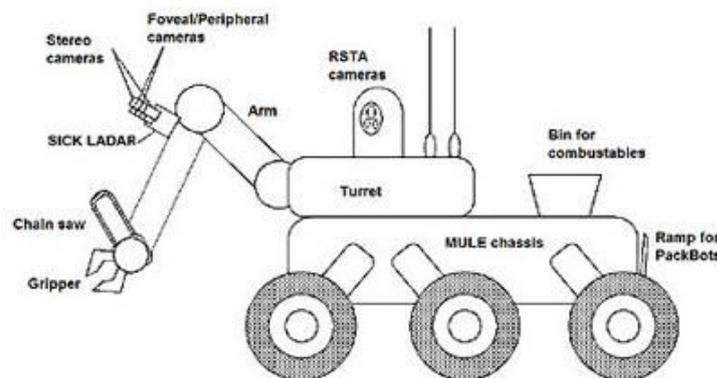


Fig.6 Example of Robot

## VII. THE FUTURE OF AI

It is true that many experts are doing research in the field of Artificial intelligence and in future machines will become more and more powerful. But anything which has advantages there exist disadvantages also so there can be ethical issues related to machines. For example, if any machine is made for very sensitive work and did any mistake than who will be responsible. If an AI program is made for diagnosis purpose and it gives the wrong answer then we cannot claim the doctor for it. So for it policy will have to make. And in future such kind of machines will be developed which will communicate with us same like the human and will be able to guess what should be done in which situation.

## VIII. CONCLUSION

As all know artificial intelligence is intelligence behavior of machines which is given by the professional. As you all know artificial intelligence have simplified our life in every aspect it can be article writing or game playing or taking any important decision. In any machine many experts mind can be combined which is more powerful than a single expert mind. Many labors work can be done by a single machine and good thing of it is that it never tired. Now such types of robots are going to make which have emotions it will finish the loneliness of the person. But it has another aspect that is can be dangers for us. If we become completely dependent on that

machines than it can ruin our life as we do not do any work ourselves and got lazy. And another is that it cannot give the feeling like human. So machines should be used only where there those are actually required.

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# APPRAISING THE EFFECTIVENESS OF STATE ELECTRICITY REGULATORY INSTITUTIONS

**Amit K Mishra**

*Assistant Professor, Management Studies, National Power Training Institute  
Faridabad, Haryana, (India)*

## ABSTRACT

*Indian Power Sector has undergone a tremendous growth and is also marked with numerous challenges ahead. The Electricity Act, 2003 ushered in many new Milestones and led the foundation of effective Regulatory mechanism in Power sector. The Regulatory Institutions were established to distance the Government from Tariff setting process and introduce economic principles in determination of Tariff & Power market development. After 12 years of introduction of Economic Regulation in the sector, it is important to appreciate the Regulatory reforms that the sector has gone through and the challenges that galore ahead. The Paper appraises the effectiveness of State Electricity Regulatory Institutions on various governance criterion and examines various facets & determinants for measuring effectiveness of Regulatory Institutions. The Research Paper focuses on five governance criteria namely - Functional independence, Financial autonomy, Transparency in operations, Stakeholder Participation in decision making and Investment facilitation in the sector to establish the effectiveness of State Electricity Regulatory Commissions. The principles for effective governance have further been rated as High, Average & Low to bring a greater clarity. The Paper concludes that strong and independent Regulatory Institution for the Power sector would develop favorable sentiment for investors, increase confidence among consumers and would have an overall positive impact on Power sector performance.*

***Keywords: Power Sector, Regulatory Institution, Effectiveness, Independent, Transparent.***

## I. INTRODUCTION

The Indian Power Sector today is reverberating with action, hope and optimism. Over the past few decades, significant changes have been introduced with respect to the Institutional framework in Power Sector. In 1948, the Government of India introduced Electricity Supply Act which led the way for formation of the State Electricity Boards. However, the absence of Competition led to operational inefficiencies, mismanagement & poor quality of services.

With the intent to introduce transparency and accountability in the Sector, the State Electricity Boards were unbundled. Private sector was roped in to boost investment in the sector. It thus turned out to be imperative on the part of Government to balance the interest of Consumers and provide a fair return to investors. Thus, an independent Regulator was sought for to discharge the responsibility in a holistic manner and remain equidistant from Stakeholders & Service providers. The Regulatory Policies in Power Sector got a major boost with the advent of Electricity Act 2003. The Act mandated the creation of Regulatory commissions in each state. The Regulatory commissions have played a significant role in passing different regulations and monitoring

performances of the state utilities. The role of Tariff fixation for Intra-state transaction of Power was entrusted with the respective State Electricity Regulatory Commissions. The Regulatory Commission were entrusted with dual, rather conflicting requirements of allowing investors to recover their cost of supply and on the other hand providing consumers reliable power at affordable cost. Balancing the requirement of attracting adequate investments to the sector and that of ensuring reasonability of user charges for the consumers is the critical challenge for the Regulatory process [1].

While the Indian Power sector has created a lot of enthusiasm amongst the investors and attracted investment during the last few years, the Sector is undergoing through a tough phase and the Investors are worried of the challenges that lie ahead. The Per Unit Average Cost of Supply (ACS) is more than the Average Revenue Realized (ARR) and the Government is incurring a loss of 86 Paise on each Unit being injected in the system [2]. The accumulated loss of Power Distribution Utilities has already surpassed the Rs 1.16 trillion figure as of March 2011 [3]. The Tariff orders of Utilities indicate a build-up of significant deferred Revenues. Utilities in 10 States have Regulatory assets worth Rs. 626 Billion. Tamil Nadu leads in this respect with assets worth about Rs. 256 Billion for FY 2013-14, followed by Rajasthan at about Rs. 160 Billion. Other major States with deferred Revenues include Delhi at Rs. 72 Billion, Kerala at Rs. 60 Billion, Haryana at Rs. 23 Billion and West Bengal at Rs. 21 Billion [4].

The Power Sector is increasingly turning financially unviable and lenders are reluctant of further investment in the sector. Questions are being raised on the transparency and independence of regulation in the Power sector. Thus, after 12 Years of introduction of Electricity Act 2003, it is high time to review the ground realities of Power Sector reforms in various States. The Research paper is primarily aimed to appraise the effectiveness of State Electricity Regulatory Commissions. It also concludes that strong and independent Regulatory Institution in a State enhances the investor & consumer sentiment and has a favorable impact on Power sector development.

## **II. REFORMS IN INDIAN POWER SECTOR**

Post the liberalization and reform in FY1991-92, reform efforts in Power sector were initiated which brought in private investments and paved the path for independent regulation in the sector. During that period Regulation was carried out by Government and the focus was primarily on electricity pricing and investment approval. Since, both the functions of business execution and Price determination were entrusted to the state, the relationship between the two wasn't always at arms length.

This led to the introduction of Electricity Regulatory Commission Act of 1998 to create independent regulators in the Power sector. The Act mandated the Regulatory Commission to regulate the tariff and issue of license. The Electricity Regulatory Commissions Act 1998 paved the way for setting up of the Central Electricity Regulatory Commission (CERC) and State Electricity Regulatory Commissions (SERCs). The functions of the CERC and the SERCs were clearly charted out. While CERC was responsible for all Central sector and Inter-State issues, the SERCs were responsible for Intra-State issues. The primary intention for setting up of Regulatory commissions was to ensure that tariffs were determined according to economic principles and that the entire process be free from any political interference. The Government's role was to act as facilitator and catalyst to lay down broad principles of policy.

Further, the Electricity Act 2003 came into effect from June 10, 2003 to replace the earlier laws, acts governing the Indian Power sector, namely, the Electricity (Supply) Act 1948 and the Electricity Regulatory Commissions Act 1998.

**Table 1: Milestone Legislations in Indian Power Sector**

<b>Laws/Policies</b>	<b>Objective</b>	<b>Impact</b>
The Electricity Act, 1948	Mandated creation of State Electricity Boards	Centralized entity for all business streams
The Regulatory Commission Act, 1998	Provision of setting-up of Central/State Electricity Regulatory Commission	Independent Regulatory mechanism
Electricity Act, 2003	Balance the interests of Consumers & Investors	Investments in Capacity addition at competitive tariff

The Act created a liberal framework for development of the power industry, promoting competition, protecting interests of consumers and supply of electricity to all areas, rationalisation of electricity tariff and ensuring transparent policies and promotion of efficiency, among others. The Act came out with the National Electricity Policy, mandatory creation of SERCs, emphasis on rural electrification, open access in transmission and distribution and some other provisions. It mandated the Regulatory commissions to regulate the tariff and issues of license.

### **III. REGULATORY INSTITUTIONS IN INDIAN POWER SECTOR**

The Electricity Act 2003 facilitated the creation of Central Electricity Regulatory Commission at Central level & State Electricity Regulatory Commissions in respective States. These regulatory bodies were set up primarily to look into all aspects of tariff fixation and matters incidental thereto. The Central Government also established an Appellate Tribunal for Electricity to hear appeals against the orders of the Appropriate Commission.

#### **3.1 Objectives of CERC**

The Commission intends to promote competition, efficiency, improve the quality & reliability of supply, promote investments and protect the interests of Consumers.

In pursuit of these objectives the Commission aims to:

- ❖ Improve the operations and management of Transmission Grid through Indian Electricity Grid Code (IEGC), Availability Based Tariff (ABT), etc.
- ❖ Formulate an efficient tariff setting mechanism, to balance the interests of both Investor & Consumer
- ❖ Facilitate open access
- ❖ Facilitate inter-state trading of Power
- ❖ Promote Power market development
- ❖ Ensure wider information dissemination to all stakeholders.
- ❖ Adjudicate upon Inter-state & Central sector issues/disputes

### 3.2 Objectives of SERC

The main objective of SERC is to determine the tariff for electricity, to regulate power purchase of distribution

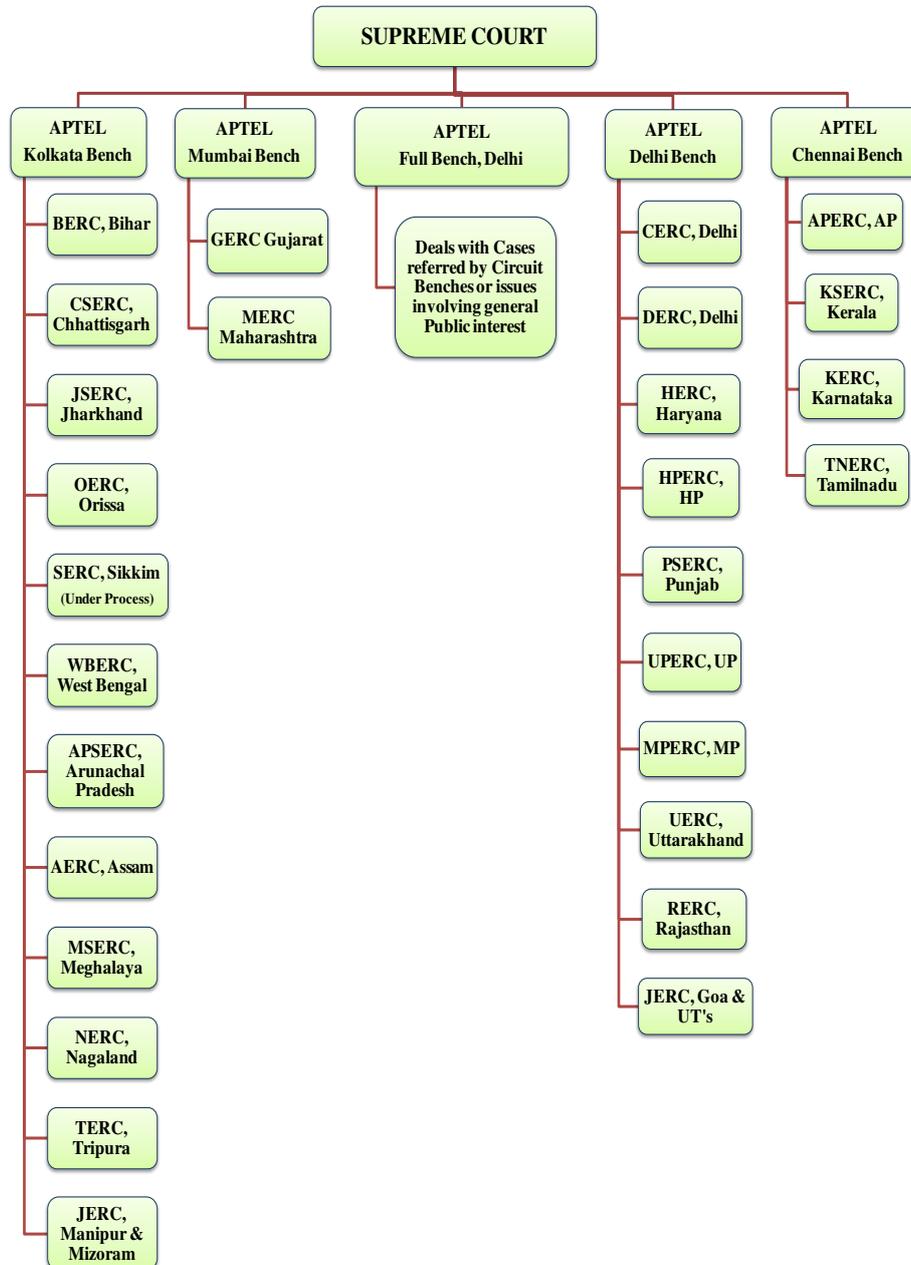


Figure 1 Organogram of Electricity Regulatory Institutions in Country [5]

Utilities, to promote competition and to protect the interests of consumers in the activities of the electricity industries.

- ❖ Determine tariff for generation, transmission and distribution entities within the State.
- ❖ Regulate electricity purchase and procurement process of distribution licensees within the State.
- ❖ Adjudicate upon disputes between licensees and generating companies for above.
- ❖ Specify and enforce standards for quality, continuity and reliability of services by licensees.
- ❖ Protect the interests of consumers.

#### IV. GOVERNANCE CRITERIA FOR MEASURING REGULATORY EFFECTIVENESS

A worldwide reforms & restructuring of Power Sector - in both developed and developing countries began in 1980s. Keeping with the trend worldwide, the Power sector in India has undergone fundamental transformation of its institutional structure particularly after the enactment of Electricity Act, 2003. Regulatory Institutions were envisaged to induce greater transparency in the sector. The primary aim of creating Regulatory institutions was to create a more commercially oriented Power sector that is more efficient and less politicized. Several studies across the world were conducted in the latter part of 1990 to study the regulatory process and institutional arrangements.

In 1997, the UK Better Regulation Task Force (BRTF) published its Principles for Good Regulation [6]. Their five Principles for better Regulation were based on Transparency, Accountability, Proportionality, Consistency and Targeting.

Further, Stern & Holder in 1999 use three aspects that relate to institutional design. These are: Clarity of roles & objectives, autonomy and accountability. They have also included three aspects that relate to regulatory processes and practices: Participation, Transparency and Predictability [7].

Subhes C. Bhattacharyya (2007) asserts that the reforms in Indian Power Sector to date have not produced desirable political, economic, financial, social or environmental outcomes. The Paper suggests that the reform can be considered as sustainable if it is politically acceptable, financially viable, economically & environmentally efficient, socially desirable and implementable as a project [8].

Navroz K. Dubash (2005) highlights that in India Regulators and their staffs are largely drawn from government or from public utilities, an inescapable consequence of the state monopoly over the sector for five decades [9].

In context to establishing the effectiveness of State Electricity Regulatory Institutions of Indian Power Sector, the Research Paper focuses on:

- (i) Functional independence
- (ii) Financial autonomy
- (iii) Transparency in operations
- (iv) Stakeholder Participation in decision making
- (v) Investment facilitation in the sector

The Governance criteria for measuring effectiveness of State Electricity Regulatory Institutions have been further rated between High, Average & Low to arrive at a meaningful conclusion.

##### 4.1 Functional Independence

The Electricity Act, 2003 under Section 85 (Constitution of Selection Committee to select Members of State Commission) empowers the State Government to constitute a selection committee to select Members of the State Electricity Regulatory Commission. Though the Committee for selection of Members of Commission is clearly defined, the selection committee does comprise of Member which is part of the State Government. Thus, there are chances of appointment being influenced by the Government. Selection committee for State Electricity Regulatory Commission should constitute more independent members so as to make the selection process more transparent and fair.

Navroz K. Dubash and D. Narasimha Rao (2007) studied three state level electricity regulators - Andhra Pradesh, Delhi and Karnataka and infer that even with fairly thorough selection and screening guidelines, an opaque selection process can allow government influence, which undermines the regulatory institution [10].

S. L. Rao (2013) expresses concern that an independent regulation as a mechanism of governance in India has been captured by the bureaucracy. Today almost all regulatory bodies are headed by retired Indian Administrative Service officers. Most of them are subservient to the opinions of ministers and bureaucrats in service. Few function truly independently [11].

The Regulators should act independently in discharging their responsibilities. An individual who in the past has been in service of State government should be barred for applying to the post of Member/Chairman of Regulatory Commission and the concept of cooling period be introduced.

The Electricity Act, 2003 under Section 108 also gives superior powers to the State Government and mentions that State Commission will be guided by the directions of State Government in matters of policy involving public interest. The decision of the State Government would be deemed as final on what could come under the purview of matters of policy involving public interest.

The Author views these as threat to the Functional independence of the State Electricity Regulatory Commission and thus rates the functional independence of Regulators as Average.

#### **4.2 Financial Autonomy**

A major impediment to the financial autonomy of the State Electricity Regulatory Institutions is the dependence for budgetary support from respective State Government towards meeting salary, allowances and other remuneration of Chairperson, Members, Secretary, officers and other employees of the State Commission. Under this situation, State Regulators might be facing a tough time managing their resources for meeting day-to-day expenses and having an arms length from the State Government in their adjudication.

Dependence on budgetary support to Regulatory institutions needs to be minimized/eliminated for their independent functioning. The State Electricity Regulatory Commission have poor financial autonomy and thus the Author rates it as Low.

#### **4.3 Transparency in Operations**

The operations of State Electricity Regulatory Commission are prima facie transparent and governed by the provisions of Electricity Act, 2003. All the judicial proceedings in the Commission give due opportunity to both the parties of being heard. Any revision in tariff is done after a thorough process of inviting public comments on the revision sought by utilizes in their petition.

The operations of State Electricity Regulatory Commission appears to be transparent, however the yearly tariff revision awarded by State Electricity Regulatory Commissions remains questionable. Many of the States witness a relatively small or absolutely no tariff revision during an election year. Also, the tariff revision being allowed year-on-year is not requisite leading to an accumulated Regulatory asset, which is well recognized by the Regulatory Commission but is deferred for recovery in future years.

The concept of Regulatory asset came into existence with the noble thought of protecting Consumer from tariff shocks so that a part of Revenue gap could be recovered in future years. However, it appears that Regulatory Commission for extraneous reasons don't allow recovery of yearly revenue gap which keeps on getting accumulated. Since, the cost of tariff is increasing, Regulatory Commissions are now finding it difficult to allow

Regulatory Assets created earlier to form part of current Aggregate Revenue Requirement (ARR) and as a result instead of reductions, Regulatory Assets are increasing even after increase in tariff every year. Considering the above condition which is leading to increase in Regulatory Assets of various Distribution Companies instead of reduction or stabilizing at a reasonable level, the viability of Power Sector in the Country is coming under cloud. Mounting Regulatory assets and inadequate tariff revisions have brought the Power sector to a stand-still. The basic premise of independent regulation of power sector seems to be at lost. The Author rates transparency in operation of State Electricity Regulatory Commission at Average.

#### 4.4 Stakeholder participation in decision making

Though all the State Electricity Regulatory Commission involve stakeholder in their decision making process, but there is ample scope for widening the participation. Regulatory commission does invite various Civil society groups and individuals for discussion, but many of them don't turn-up because of the travel expense that they have to bear. Regulatory Commission may create a fund through which the legitimate expense of Civil society groups & individuals who come to share their views during the hearing process can be refunded. It is imperative that the State Regulators should provide financing and support for representation of Consumer voices.

Regulatory Commission should also educate Public on various issues confronting the Sector. This would in-turn help in increasing acceptance of the relatively strong decisions that Regulators have to undertake to move the Sector forward. It would also help in pacifying Public outcry that usually results with any indication of a rise in tariff for Electricity.

There is a need for a stronger stakeholder participation in the decision making of State Electricity Regulators and hence the Author rates it as Average.

#### 4.5 Investment facilitation in the Sector

The Policies of Regulator should be transparent, stable & predictable to attract investment flow in the sector. The Regulatory Commission has to ensure both the aspects of ensuring adequate investments flow in the Power sector by providing adequate return on investment to investors and of providing electricity at affordable costs to consumers.

Over last many years, it is being seen that investors perceive Distribution sector as a risky investment proposition. There are very few private players in the Distribution segment of Power sector. Distribution sector remains the weakest link in the Power sector value chain.

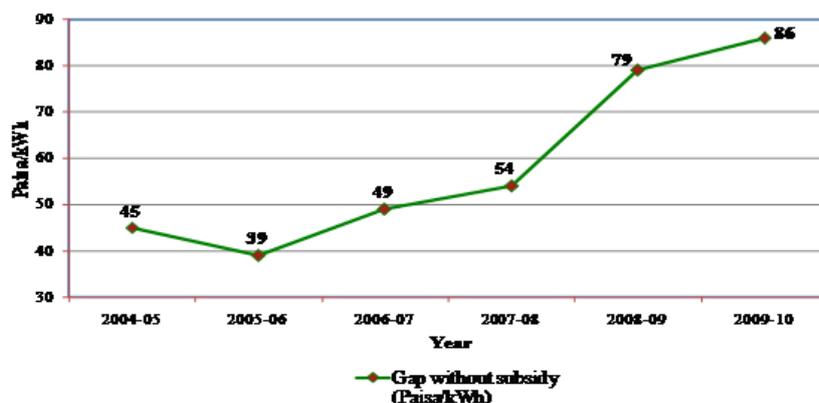


Chart1. Mounting Gap between ACS & ARR (Paisa/Unit) [12]

This state of affairs gets further aggravated by the reluctance of SERCs to award requisite Tariff hikes to the Utilities. The Gap between Average Cost of Supply (ACS) and Average Revenue Realization (ARR) of the Distribution Utilities is continuously widening making the Utilities in deep cash crunch.

In such a scenario, when the Distribution Utilities are not able to recover their cost of supply, the investment in the sector is dampening. It is high time that State Electricity Regulatory Commission run the sector on economic principles so that the investment and consequently the competition in the sector develop. With State Distribution sector worsening and requisite investment and private participation not happening in the Sector, the Author rates it as Low.

## **V. CONCLUSIONS**

The Research paper has presented various governance criterion for appraising the effectiveness of State Electricity Regulatory Institutions. The Paper would also facilitate in understanding the Regulatory elements that have led the Power Sector in Gujarat & Maharashtra on a strong path vis-à-vis the Sector performance in Tamil Nadu, Uttar Pradesh & Rajasthan.

The Indian Power Sector is undergoing through a serious crisis of huge accumulated loss and there is an urgent need to curtail the mounting losses of Distribution companies. The State Electricity Regulatory Commissions have an uphill task to balance the interests of both investors & consumers. The Tariff should be set to bridge the gap between Average Cost of Supply and Average Revenue Realised. There are only few States which have been able to take relatively tough decisions of keeping Tariffs commensurate with the Cost of Supply. Regulators should take cognizance & take urgent action on Tariff revision in various States with mounting Revenue gap. Appellate Tribunal of Electricity (APTEL) had also directed the State Regulators to initiate suo-motu proceedings for tariff declarations in case States don't file the Tariff Petitions in due duration. Inclusion of consumer voices in the Regulatory deliberations would appease the Public outcry that results post the issuance of Tariff orders. A robust and independent Regulatory framework is needed for the development of Power sector. Independent regulation is the only way to prevent theft and misuse of government resources. The level of Stakeholder participation in decision making should be raised. With the trust & confidence gain of Stakeholders, it would empower the Regulators to take tough decisions. In sum, the Paper has identified the performance indicators of effectiveness of different State Electricity Regulators and rated them with the objective of making Power a commercially viable sector for the Indian economy to sustain growth.

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# HOW TO REDUCE EXECUTION TIME

Amit Bansal<sup>1</sup>, Vipin Babbar<sup>2</sup>

<sup>1,2</sup>Department of Computer Sc. Govt. College for Women, Hisar, Haryana, (India)

## ABSTRACT

Complexity of the software increases as the dependence on the computer is increasing. The importance and use of computer can be enhanced by reducing execution time of software. Writing a program is a good skill to be a programmer. But writing a bug free program makes a programmer better. Programmer can be the best if he can write programs which can produce results in no time. Testing can be used to check the time taken by program by applying different types of methods to solve a particular problem. We can also test our program by applying different technique in a block which are taking most of the processing time so that technique which are using less time without changing the goal of program can be incorporated in our program. This paper explains some of the techniques to reduce execution time in basic programming.

## I. INTRODUCTION

Testing is a process

- To find out errors in a program.
- Try to fail the program by testing on some inputs which can generate errors in a program.
- Spend some time on executing the program by giving different inputs in the whole domain.
- To understand the working of a program.
- To understand different inputs and their corresponding outputs.
- It is a way to makes program work in adverse conditions.
- It is a way to trust on a program to work in a critical situation.

Testing may also be used to check the time taken by program to produce required output. If the time taken by program to produce required output is in valid range than time parameter can be accepted. If the time is not in the valid range, it can be put in that range by doing some of the very basic changes in the program as given below.

## II. DIFFERENT METHODS TO REDUCE EXECUTION TIME

**2.1** To find some repetitive process and think whether it can be converted in recursive process. Because recursive process takes less time to execute than looping and easy to understand for a programmer.

**2.2** You can use formulas instead executing the whole process of the formula for ex.

Use  $(N*(N+1))/2$  to calculate sum of natural numbers instead of using for loop like

```
Sum=0;
For(i=1;i<N;i++)
    Sum=sum+I;
Printf(“%d”,sum);
```

Using the formula instead of detailed calculation may takes less time to execute.

**2.3** Use faster algorithm for data structure operations in the application you are working. This can be achieved by comparing complexity. For example in searching in an array, binary search is less time consuming than linear search. So using binary search instead of linear search might takes less time to execute in most of the cases. But selection of technique may depend upon the behavior of problem.

DS operation	Worst case complexity	Best case complexity	Avg. case complexity
Linear searching	$O(n)$	$O(1)$	$O(n)$
Binary searching	$\log_2 n$	$O(1)$	$\log_2 n$
Bubble Sort	$O(n^2)$	$O(n)$	$O(n^2)$
Insertion Sort	$O(n^2)$	$O(n)$	$O(n^2)$
Selection sort	$O(n^2)$	$O(n^2)$	$O(n^2)$
Quick sort	$O(n^2)$	$O(n \log_2 n)$	$O(n \log_2 n)$
Merge sort	$O(n \log_2 n)$	$O(n \log_2 n)$	$O(n \log_2 n)$
Heap sort	$O(n \log_2 n)$	$O(n \log_2 n)$	$O(n \log_2 n)$
Radix sort	$O(n^2)$	$O(n \log_2 n)$	$O(n \log_2 n)$

**2.4** Avoid unnecessary declaration of a variable.

**2.5** If we have functions in our programs, then we have to call them by reference instead of call by value. But the danger of changing the original value can be avoided by declaring the parameter as a const.

**2.6** Use of macros for smaller functions may reduce the time to execute.

**2.7** Try to maximize the step value in for loop. So that no of iteration should be minimum for a particular problem.

For Ex consider the for loop to calculate sum of odd numbers from 1 to 10.

```
Sum=0;
For (i=1;i<10;i++)
{
    If(i%2!=0)
        Sum=sum+i;
}
```

Instead of using this for loop we can do this as follows:

```
Sum=0;
For (i=1;i<10;i+=2)
```

```
{  
    Sum-sum+i;  
}
```

In the first method there are 10 iterations as well as extra condition checking makes this method more time consuming than the second method.

2.8 Include only those files in your program which are necessary for your program. Inclusion of header Files which are not used in C/C++ Programs may increase compilation time<sup>[2]</sup>.

### III. CONCLUSION

The methods explained above looks to be promising to reduce the total execution time of a program in any programming language. All these methods are explained on the basis of theoretical knowledge and some programming techniques . But still I need experimental proof to prove these facts. The main difficulty for taking experimental data is that the time taken by the smaller programs in basic programming is not measurable as these statements takes approximately no time to execute. We have to find the smallest time unit to measure the time.

# BIOSORPTION OF TEXTILE EFFLUENT USING SARGASSAM LONGIFOLIUM

**M.Aswin**

*Undergraduate Student, Department of Chemical Engineering, Alagappa College of Technology,  
Anna University, Chennai,(India)*

## **ABSTRACT**

*Biosorption capacity of saragassam longifolium for textile effluent was studied in this paper. The impact of sorbent measurements, agitation, temperature, contact time and initial dye concentration, were contemplated in cluster examination. The measure of dye adsorbed at equilibrium was found to change from 67.32 mg/g to 581.61mg/g with expanding introductory dye amassing of 20-100 mg/L for a biomass of 0.1 g. It was found that the biomass demonstrated greatest adsorption limit at 100 mg/L colour answer for a sorbent dose of 0.1g at 20 °C with a agitation speed of 100 rpm. The exploratory information was dissected by Langmuir and Freundlich adsorption isotherm. The equilibrium information was found to fit well with Freundlich when compared with Langmuir adsorption isotherm. The chemical kinetics of the adsorption procedure was likewise concentrated on and the response was found to take after the pseudo second order kinetics. The surface morphology of the biomass was analyzed by utilizing SEM.*

**Keywords:** *Biosorption, Sargassam Longifolium, Dye Adsorption, Isotherm, Chemical Kinetics*

## **I. INTRODUCTION**

Textile industry is one of the biggest and most established commercial industry which exhibit all around, expending 80-200 m<sup>3</sup> of water for every ton of product and discharges 1,650 m<sup>3</sup> of wastewater every day [1,2,3]The kind of colours and chemicals utilized as a part of the textile industry are found to vary contingent upon the fabrics produced. A few sorts of material colours which are used vary with different sorts of fabrics. [4] More than 7x10<sup>5</sup> tons and around 10,000 unique sorts of colours are created on the planet. Shockingly, around 10 to 15% of the aggregate delivered colours is discharged into the sea-going biological communities without being expelled from the effluents and huge volumes of exceedingly contaminated wastewater are created.[5,6,7,8] The synthesis of the effluent are substantial metals (chromium, copper, lead, and arsenic), colours (azo, receptive), surfactants, and so forth. It also contains high values of COD,BOD, suspended and dissolved solids.[9,10] Improper textile dye effluent disposal in biological systems prompts the decrease in daylight entrance which thusly diminishes the photosynthetic movement, broke down oxygen fixation, water quality and delineates intense harmful impacts on sea-going widely varied vegetation, creating serious ecological issues around the world.[11] These effluents are rich in colours and chemicals, some of which are non-biodegradable and cancer-causing and represent a noteworthy risk to wellbeing and nature if not legitimately treated.[12] Also, colours in the water bodies experience synthetic and natural changes that expend disintegrated oxygen bringing about fish executes and the obliteration of other amphibian organic entities.[13] Textile effluents are additionally found to contain other natural and microbial polluting influences [14]

Current advancements to treat effluents incorporate reverse osmosis, organic oxidation, coagulation and actuated carbon. Tragically these techniques experience the ill effects of confinements like high-vitality request, high cost, moderate colour evacuation prepare, a lot of compound prerequisites, and dangerous results .[15,16,17] Reverse osmosis powers water under weight through a film that is impermeable to contaminants, yet the procedure is extremely extravagant and vitality escalated .[18].Biological oxidation procedure includes gushing water treatment utilizing oxygen consuming and anaerobic micro organisms, is costly, and produces by-product as a side effect .[18] It can't be recovered in a financially savvy way and is not feasible everywhere scales.[17]

## II. MATERIALS AND METHODS

### 2.1 Effluent

The effluent is collected from NACSOLS industry which is located at Thirupur in Tamil Nadu. The effluent waste from this industry is combined with *sargassum longifolium* which was then subjected to many processes.

### 2.2 Preparation of Biomass

The brown algae *Sargassum longifolium* was collected from Pamban coast( Lat 9° 16' N; Long 79° 13' E) (Fig I) Gulf of Mannar region, southeast coast of Tamil Nadu during July 2014. The Fresh plant was completely washed with seawater to uproot the disciple sand and the epiphytes and got to the research facility in plastic sacks. The kelp sample was again washed altogether with refined water to evacuate the earth and other follower materials and dried in free air at room temperature took after by 40°C in the hot air oven for two days. At that point it was processed in a mechanical grinder for 5 min, to acquire a fine homogeneous powder and kept in impermeable plastic sacks at room temperature for examination of their natural organization.

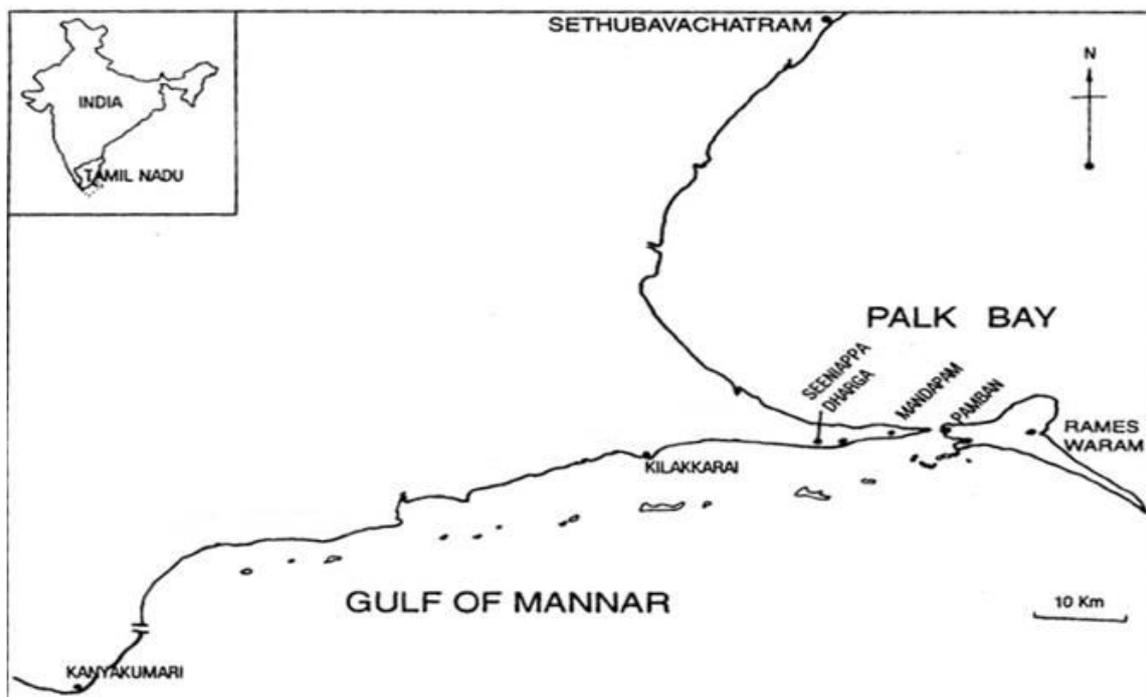


Fig 1, Geographical Location of Biomass

### III. METHODS

#### 3.1 Dye Analysis

The change in dye concentration because of adsorption was controlled by UV-vis spectrometer. Absorbance was measured at wavelength 450 nm. The rate of dye removal because of bio sorption was ascertained as % dye removal =  $[(C_0 - C_i)/C_0] \times 100$  %, where  $C_i$  and  $C_0$  are the beginning and last convergence of colour arrangement (mg/L) individually.

#### 3.2 Study of Sorbent Dosage

20ppm of the colour arrangement was arranged and the impact of starting sorbent measurement on the evacuation of colour arrangement was concentrated on by fluctuating the sorbent dose from 0.1 to 0.5g every 100mL of colour arrangement. The set up was kept up in a thermostatic shaker at a temperature of 20°C and a tumult of 100rpm. The adjustment in amassing of the colour was watched for the given arrangement at 24hours time interim for 5days utilizing colorimeter at the wavelength 450nm.

$$q_e = \frac{C_0 - C_e}{w} \times V$$

Where  $C_0$  is initial dye concentration (mg/L),  $C_e$  is the final dye concentration (mg/L),  $V$  the volume of the sample (L), and  $W$  is the weight of the biomass (g).

#### 3.3 Study of Initial Dye Concentration

Textile effluent of different concentration changing from 20ppm to 100ppm was dissolved in distilled water to study initial dye concentration. To these changing amounts of colours arrangement a balance amassing of sorbent dose was included. The tapered carafes were then put in a thermostatic shaker and disturbed at 20°C at 100rpm. The specimens were occasionally tried at 24 hours time interim for 5days utilizing UV-Spectrophotometer at greatest absorbance of 450nm.

$$\text{Percentage color removal} = \frac{C_0 - C_e}{C_0} \times V$$

Where  $C_0$  and  $C_e$  are equilibrium concentrations of dye in the solution (mg/L),  $V$  the volume of the sample (L).

#### 3.4 Study of Temperature Change

The impact of temperature on the uptake limit of dye by the biomass was contemplated. The conical flasks were then set in a thermostatic shaker kept up at 100rpm and different temperature goes (20, 24, 28, and 32°C). The arrangement in changing temperature was analyzed for each 24hrs at once interims for 5days utilizing UV spectrophotometer at greatest absorbance of 450nm.

#### 3.5 Study of Adsorption Isotherms and Kinetics

Adsorption isotherm and kinetic experiments were conveyed utilizing the batch method. In five conical flasks 100ml of arrangement containing 20ppm, 40ppm, 60ppm, 80ppm and 100ppm of textile effluent were prepared with a sorbent dose of 0.1 grams in each. The conical flasks were then put in a thermostatic shaker which agitated the arrangement at 100rpm at 20c. The measure of colour adsorbed at balance was computed from mathematical statement,

$$q_e = \frac{C_0 - C_e}{w} \times V$$

Where  $c$  and  $c_e$  are the amassing of the colour in the arrangement in the first place and at balance separately (mg/l),  $V$  is the volume of solution (L),  $w$  is the mass of dry algae powder(g). With a specific end goal to comprehend the impact of temperature, introductory colour fixation and sorbent measurement on the absorbance of colour preparatory analyses were done utilizing shifted fomentation paces and the best disturbance rate was found to happen at 100rpm.

### 3.6 Langmuir Isotherm

The Langmuir isotherm is derived from the assumption that the adsorbed layer is monolayer and is given by equation,

$$\frac{C_e}{q_e} = \frac{1}{Q_0 b} + \frac{1}{Q_0} C_e$$

Where  $c$  the equilibrium concentration of dye (mg/l) is,  $q_s$  the amount of dye sorbent per unit mass of sorbent at equilibrium (mg/g),  $Q$  (mg/g) and  $b$  (l/mg) are the Langmuir constants related to the sorption capacity and energy of separation respectively.

### 3.7 Freundlich Isotherm

The Freundlich isotherm describing heterogeneous reversible multilayer adsorption on catalytic surface is give empirically be the formula,

$$q_e = K C_e^{\frac{1}{n}}$$

This is most generally utilized as a part of portraying colour adsorption onto a strong surface. in the above recipe is the sorbate focus at equilibrium(mg/L), is the measure of colour adsorbed every unit mass of sorbent(mg/g),  $K$  and  $n$  speaks to the Freundlich adsorption isotherm constants which shifts as indicated by the heterogeneity of the material. The values of the adsorption constants can be estimated by plotting a graph between  $\log$  vs  $\log$ . The slope of the linear graph and intercept gives  $\log K$ .

## IV. RESULTS AND DISCUSSIONS

### 4.1 Effect of Sorbent Dosage

The impact of sorbent dose of SARGASSAM LONGIFOLIUM concerning the dye uptake limit is assessed and the greatest balance uptake limit is found to happen for sorbent measurements of 0.1grams of dry weight. The equilibrium uptake limit was found to decrease with expanding sorbent measurement. This could be clarified by the way that the measure of dye to be adsorbed is part among the expanded dye adsorption sites with increasing sorbent dosage prompting lower particular dye uptake limit. The accompanying analyses were consequently directed with adsorbent measurements of 0.1 grams.

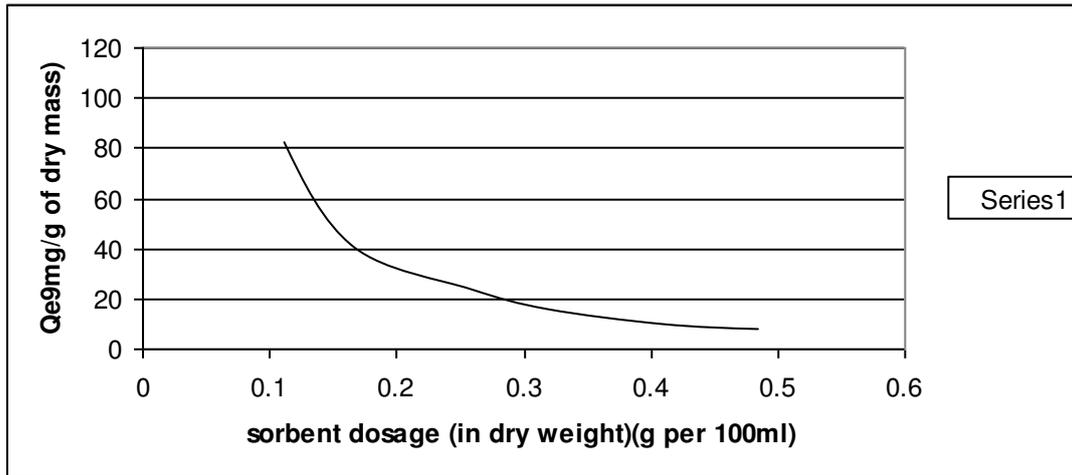


Fig 2, Effect of Sorbent Dosage

#### 4.2 Effects of Temperature

The impact of temperature on the balance uptake limit of textile effluent on *Sargassum longifolium* was mulled over with starting dye concentration of 20 mg/L. The temperatures of study taken were 20°C, 24°C, 28°C and 32°C. The best equilibrium uptake limit was found to happen for 20°C. There was a discernible pattern of lessening in adsorption limit of *Sargassum longifolium* with increment in temperature. These outcomes demonstrate that the adsorption of *Sargassum longifolium* is an exothermic procedure and the quality of the physical securities between the colour particles and the dynamic locales of the *Sargassum longifolium* diminishes with expanding temperature. Comparable results were seen by (Hu et al. 2010) who explored the impact of temperature on the evacuation of the colour Congo red from watery arrangement by cattail root and demonstrated adsorption diminishing with increasing temperature.

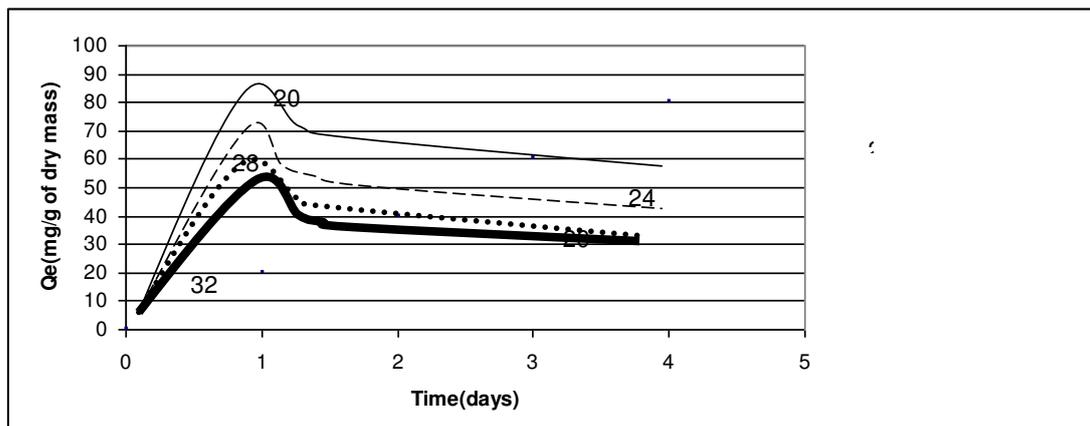


Fig 3. Effect of Temperature

#### 4.3 Effect of Initial Dye Concentration

Dye concentration ranging from 24ppm to 100ppm were contemplated and the balance uptake limit for 100ppm colour focus was discovered to be the biggest. The ascertained estimation of equilibrium uptake limit for 100ppm was 458.367 (mg/g dry biomass). The equilibrium uptake can be clarified by the vicinity of an expanding focus slope which gives an expanding main impetus to conquer all mass exchange resistances of the colour atoms between the watery and strong stage prompting an expanding balance adsorption until saturation is

reached. A comparative pattern was accounted for with methyl violet onto sunflower seed frames ( Hameed 2008 ) certainly a lot of colour particles are accessible for adsorption on the sorbent surface are thus expanding the uptake limit of the material alongside the arrangement of multilayer adsorption framework.

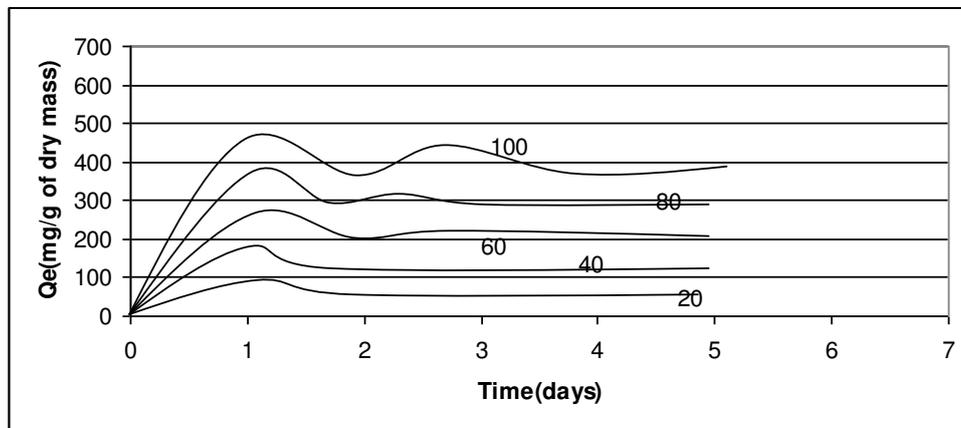


Fig 4, Effect of Initial Dye Concentration

#### 4.4 Equilibrium Modelling

Equilibrium modelling was done for the adsorption of Sargassum longifolium onto the surface of the sorbent by the preparation of 20ppm colour arrangement and after that dissolving the sorbent into the arrangement. The arrangement containing the sorbent is kept up at a steady temperature of 20 °c and shaker is kept at 100rpm. The dye concentration is tried at 24 hours interims. It is seen from the watched qualities that the greatest adsorbance up to 90% happens inside of the initial 24 hours after which equilibrium is reached because of the absence of accessibility of adsorption locales.

#### 4.5 Equilibrium Isotherms

Figure 5 and Figure 6 Shows the fitting of Langmuir and Freundlich isotherms individually for material colour on Sargassum longifolium. Analysis of qualities demonstrates that the Freundlich isotherms are a more proper fit for the given information. This is additionally an evidence of surface heterogeneity of Sargassum longifolium in charge of multilayer adsorption because of the vicinity of enthusiastically heterogeneous adsorption locales.

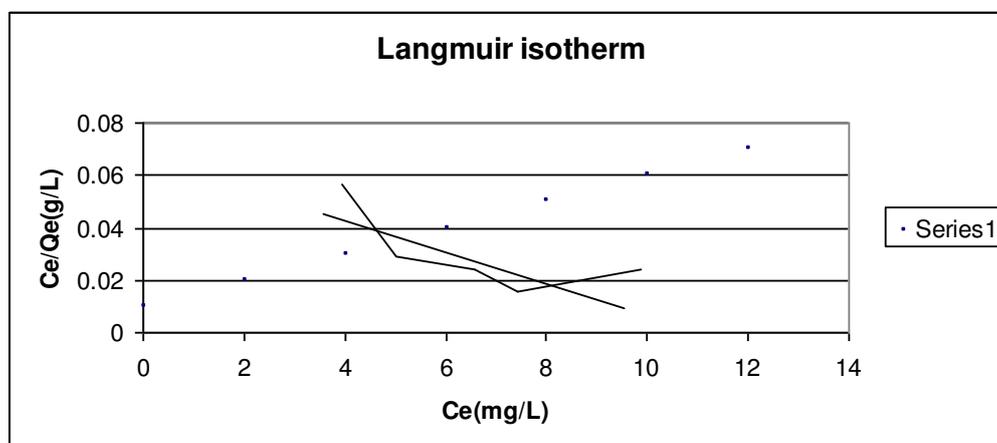
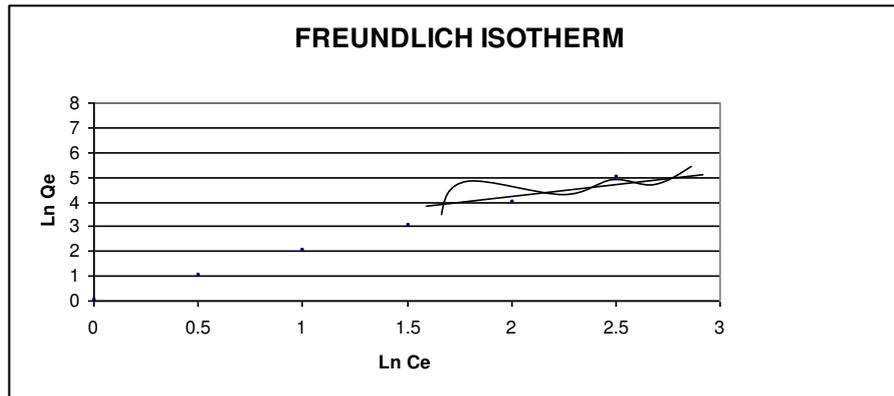


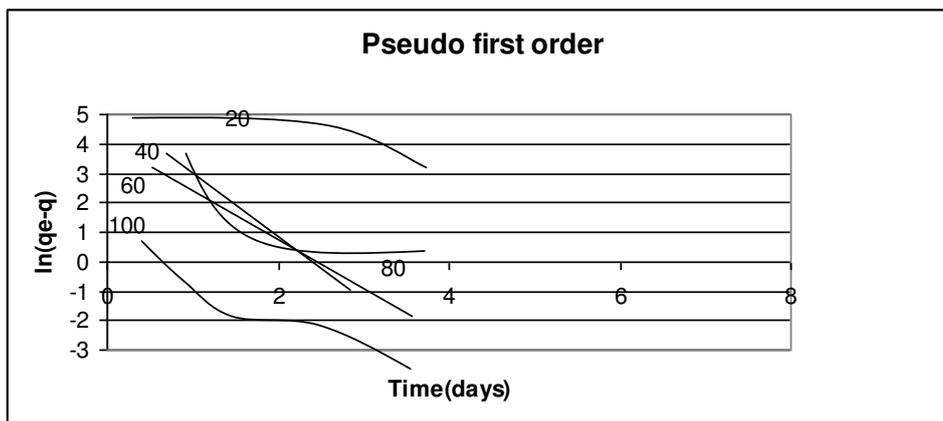
Fig 5, Langmuir Isotherm



**Fig .6 Freundlich Isotherm**

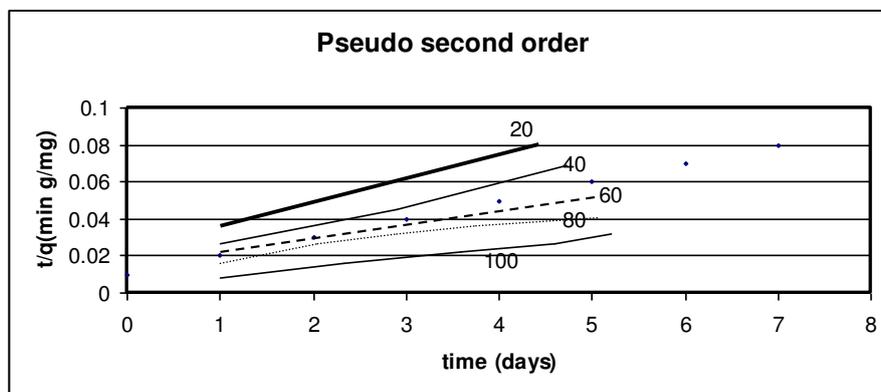
**4.6 Kinetic studies**

The active studies give valuable data to demonstrating and planning adsorption forms. The energy of material colour sorption on Sargassam longifolium was considered under pseudo first order and second order energy models.



**Fig 7 Pseudo First Order**

From the slope and intercept of the diagram plotted between  $\ln(q_e - q)$  versus  $\ln q$  vs  $t$ , for the starting dye convergences of 20ppm ,40ppm, 60ppm, and 100ppm for a sorbent dose of 0.1 at temperature of 20 °C, the first order rate constant and equilibrium adsorption capacity were resolved. Contrasting computed estimation of and watched estimation of it turns out to be clear that the framework does not take after pseudo first order kinetics.



**Fig 8, Pseudo Second Order**

The slope and intercept of the graph plotted between  $t/q$  vs.  $t$  gave the pseudo second order coefficients and. Comparing calculated values of with observed values of shows the adsorption of textile dye on *Sargassum longifolium* is relatively well explained by pseudo second order kinetics.

## **V. SCANNING ELECTRON MICROSCOPY**

SEM has been utilized to study the physical auxiliary of the plant species *Sargassum longifolium*. The biomass was investigated before the amassing of material colour utilizing SEM. SEM is extremely normal strategy used to study the surface morphology and physical properties of the adsorbent. It is observed that *Sargassum longifolium* is exceptionally sporadic and uneven consequently prompting higher adsorption range. This expanded surface zone gives bigger region to adsorbance and thus expands the uptake limit of the dye.

## **VI. CONCLUSION**

In this examination of the harmony uptake limit of the dye by *Sargassum longifolium* were considered. The pulverized *Sargassum longifolium* particles were subjected to five introductory color focuses (20ppm, 40ppm, 60ppm, 80ppm and 100ppm). The equilibrium uptake limit of dye was discovered to be most elevated at a centralization of 100ppm and demonstrated expanding uptake limit pattern with starting dye concentration. The uptake limit was additionally tried against the impact of distinctive temperature (20°, 24°, 28°C and 32°C) and sorbent doses (0.1g, 0.2g, 0.3, 0.4 and 0.5g) and the uptake limit of the dye by *Sargassum longifolium* was found to increment with diminishing temperatures and sorbent measurement. The most noteworthy uptake limit was found to happen for sorbent measurements of 0.1g and at a temperature. The harmony information fitted well with Freundlich adsorption isotherm, affirming multilayer adsorption of textile effluent on *Sargassum longifolium*. The response energy was found to take after pseudo second order kinetic with great relationships. SEM investigation of the biomass was led indicating sporadic surface having high surface territory every volume. Contemplating these data it can be outlined that *Sargassum longifolium* can be utilized as a viable and savvy system for the expulsion of dye from material wastewater.

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# AUTO-IMMUNE DISEASES:THE CAUSES OF THEIR PREVALENCE AND INCIDENCE IN HUMAN POPULATION

**Dr.K.Y.Chitra**

*Assistant Professor, Dept of Zoology, University College for Women, Osmania University,  
Hyderabad (India)*

## **ABSTRACT**

*Auto-immune diseases are caused by the body's immune response to its own tissues/tissue components either by producing auto-antibodies or by increased production of the immune system cells. There are many autoimmune diseases affecting the human population all over the world. These diseases may be systemic (systemic lupus erythematosus )or tissue specific (thyroiditis).The causes could be hereditary, aging, epigenetic changes, hormonal, nutritional deficiencies, stress, environmental agents, infections etc. The causes may be specific or a combination of factors that may contribute to their development. The female population is the most affected. Some of these diseases are a common occurrence like diabetes typeI, thyroiditis, multiple sclerosis, etc. The incidence of these diseases is increased during the present century when compared to the past as the living standards today is totally compromised due to various reasons like sedentary life style, consuming adulterated foods, drugs, pollution etc. Therefore, there is a dire need to understand the possible mechanisms that triggers off the immune system's response against self, taking into consideration all the factors. Many questions pertaining to auto-immunity like recognition of self from non-self, immune tolerance etc needs to be investigated.*

**Keywords:** *Auto-Immunity, Auto-Antibodies, Systemic, Thyroiditis, Pollution*

## **I. INTRODUCTION**

The immune system protects our body against many disease causing agents by both the specific and non-specific immune responses producing the antibodies, lymphocytes(T and B cells),complement, natural killer cells and phagocytes[1].Auto-immunity is the body's natural ability to distinguish between the self from the non-self by a phenomenon known as immune tolerance, with which it can identify the self tissue components. If the tolerance or any other components of the immune system is affected then the immune response also is affected and results in the development of auto-immune disorders. There are more than 80 types of auto-immune diseases[2].Auto-immune diseases are the major cause of all the ailments like heart disease, cancer etc[3].The diseases can be of systemic like systemic lupus erythematosus or may be tissue specific like thyroiditis. If systemic they can affect all the organs of the body due to the circulating auto-antibodies or lymphocytes[4].

The auto immune diseases were not that prevalent in the olden days and were usually seen in the older people that too the incidence of such disorders were very low. But, in the present scenario there seems to be increased incidence of these diseases as well as their prevalence due to many reasons like the consumption of the diet deficient in nutrients, adulterated food, sedentary life style, stress, pollution etc[5].The auto –immune diseases

seem to run in the families i.e., there is genetic predisposition [6].The women are the worst affected by these diseases because of their complicated reproductive cycle and the children due to their low immunity, as they are born with the natural(Passive) immunity obtained from the mother through the immunoglobulin-G as it can pass through the placenta and confer resistance to the growing foetus.

Because of the rise in the development of the auto –immune diseases all over the globe various organisations like American auto-immune related diseases association, Indian immunology society etc are actively involved in the study and research and creating awareness among people to prevent these diseases .Therefore, the present study was aimed to furnish information about their prevalence and incidence and to further assist and have a thorough understanding of these diseases there is a need to gather information about all these diseases and how they are caused, the genetic basis etc all over the world.

For the present study the population selected was random from the people of only Hyderabad city without considering a particular caste/religion/ or community. The data collected from the people was divided into two groups with children being the first group and the adults the second group. Among the adults there are males and the females of the age group 40 plus and another group of age 50 and above. A questionnaire was prepared to get the feed back related to certain general medical history like diabetes, blood pressure, and any other recent infections or diseases they are suffering from including auto-immune related ones like thyroid ,multiple sclerosis, hormonal disturbances etc, The data was obtained from nearly 500 people from across the city either personally or through distribution of the questionnaire feed back forms.

## **II. RESULTS**

From the data collected it was clear that the common ailments people are suffering from are diabetes type I,blood pressure, thyroid diseases. Multiple sclerosis is a very common occurrence among females. Rarely among children the systemic disease was noticed. The data alone cannot be used to say that the diseases are purely the auto-immune origin but there should be a careful evaluation of the diseases by proper diagnosis, like for example in case of the thyroid it is mandatory to know if the antibody titres are done in addition to the screening of the thyroid hormone levels. As much information as possible is to be obtained to know the disease prevalence and incidence. Based on the data the study and research can be done to know the exact causes and also to come to a conclusion about what mechanisms are involved in causing them. Such studies not only provide information but also gives an insight into the mechanisms of the development of these diseases. More and more data need to be collected and analysed. There are reports and published data/statistics of auto-immune diseases in the US.

The present study is only a beginning to know about how the trend is among the few Indian population of Asia and based on the data, how we can initiate research of their occurrence, treatment options and prevention. Also to contribute to the research all over the world so that the diseases’ management becomes easier and this may also give some information to treat/prevent other ailments as well.

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# EFFECT OF MARKETING MIX ON CUSTOMER SATISFACTION

**Niharika**

*Assistant Professor, Department of Commerce, Govt. College, Hisar, Haryana, (India)*

## ABSTRACT

*The one of the essential factor for the success of any business organization is customer satisfaction. All the activities are customer oriented. And it gets possible only through rising role of marketing in business organizations day-by-day. And now in today's scenario marketing is known as the foremost target of every organization as due to customer satisfaction long run and successful survival of their organization is possible. And it gets possible when the organization knows about their customer's various needs like:-*

- ❖ What they want? (Product)
- ❖ At which Price they want? (Price)
- ❖ When & where they want? (Time & Place)
- ❖ How the potential customers convert into user? (Promotion)
- ❖ How to influence? (Promotion) and so on...

All the facts are revolving around the main centric part i.e. customer satisfaction and all the information we get with the help of marketing-mix that is major component of marketing management. Conventionally, there are 4P's comprised in the marketing-mix. Then, there is addition of one more most important component i.e. People/personnel (By whom) And become 5 components of Marketing-mix But after that some people considered seven P's i.e. in addition to top 5 two more are:



And another important concept in addition of it is Benchmarking which is a continuous process and helpful in meeting various marketing challenges. So with the help of this study my aim is to show how marketing mix and benchmarking affects customer satisfaction.

**Keywords: Marketing Mix, Benchmarking and Customer Satisfaction**

## I. INTRODUCTION

### 1.1 Marketing Mix

For the creation and better implementation of marketing strategies, marketing mix is known as a suitable model. For the attainment of the organizational and consumer objectives, marketing mix model lays stress on the various factors. The elements of it are known as marketing tactics comprise of 4P's namely product, price, place, promotion.



And in modern marketing concept, its amount extends up to seven namely, product, price, place promotion, people (personnel), process and physical evidence. Marketers should targets there market for blending the mix elements. Firstly, marketers must know about their target consumers, their wants and preferences and then construct the mix elements in the appropriate way to formulate better marketing strategies and plans to satisfy the target consumers. For achieving goal, the marketer should control over these marketing mix elements to work in the changing environment i.e., internal and external. 4P's are arranged in such a manner which create perceived value and generate a positive response<sup>[1]</sup>.

### 1.2 Customer Satisfaction

Customer satisfaction is a psychological law based on perception and degree of satisfaction. For meeting customer's requirement, high quality of products and services should be provided. A business term is there to measure how product and services supplied by a company meet or surpass customers' expectations is known as customer satisfaction. Customer satisfaction is known as one of the perspective of balanced scorecard and seems as a key performance indicator<sup>[2]</sup>. For surviving in this competitive marketing place and marking differentiation between satisfaction is seems to an important key element to make the business strategy. For successful marketing, five key steps are there:

- Target To Your Customers
- Understanding Your Customers
- Making Values For Target Customers
- Communication Of Values
- Making Easy For Customers To Buy That Value

### 1.3 Benchmarking

Benchmarking is a process which is used in management and it is particularly used in strategic management and in which usually within own sector, business organizations evaluate various aspects which is helpful in developing relations with best practice<sup>[3]</sup>. Another name used for benchmarking are:

- 1) Best practice Benchmarking
- 2) Process Benchmarking

Benchmarking is treated as one time event but in reality it is a continuous process and it is the practice done by organization to face various marketing challenges.

## **II. OBJECTIVES OF THE STUDY**

The main objective of this study is to truly define the solution of the problem of the research. This research has two main objectives:

1. To build an analytical connection between the customers satisfaction with the marketing mix model, the four Ps and benchmarking.
  - ✓ Determination of products and services that helps to meet the needs of customers.
  - ✓ Determination of the distribution channels according to the potential customer desire
  - ✓ To observe the value of price that intended customers willing to pay.
  - ✓ To analyze the impact of the promotion of the business on customers.
  - ✓ Setting of benchmark base on the four P's of marketing mix.
2. Creation of perceived value and generate a positive response.

## **III. LITERATURE REVIEW**

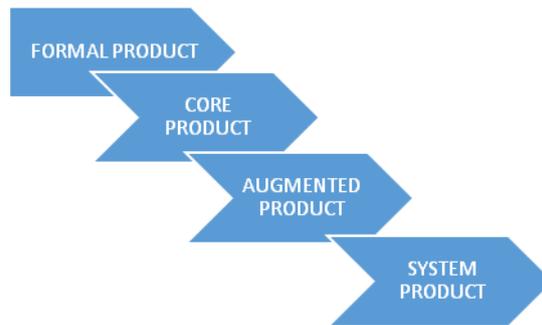
Knowledge is cumulative in nature. It means every part of a research links with another part of the research and that's why I we do some research about anything, firstly we have to start with review of related research or literature and then determine the fact that is there any data source available already that can be create problem in research<sup>[1]</sup>. This research is referred as secondary research. Like it is based on same earlier work and will provide base for other researches in future. This study includes a literature review on the status study of marketing mix, benchmarking and customer satisfaction<sup>[3]</sup>.

## **IV. MARKETING MIX**

For creating and implementing marketing strategies, marketing mix model is used organizational and consumer objectives are achieved by laying down the stress on the blending of various factors. And elements of marketing mix are known as marketing tactics also namely product, price, place, promotion. In 1964, this model is introduced by Neil Borden who started using this phrase in 1949. Marketers should consider their target market while blending the mix elements<sup>[4]</sup>. For formulating and implementing better market strategies and plan marketers firstly must know about the wants and preferences of their target customers and then make use of appropriate marketing mix to satisfy those wants and preferences.

### **4.1 Product Decision**

A Product is something tangible like cars and intangible like services of banking, which offers to the market for the satisfaction of need or wants. There are four types of products:



- a. **Formal Product:** The physical product which is bought by customers for their own benefits like computers, mobiles etc.
- b. **Core product:** what is the core benefit associated with the physical product which is bought by customer from company like status and knowledge.
- c. **Augmented Product:** The sum total of the benefit which is received by the customer by using formal formal product like time saving and quick assessing of information.
- d. **System Product:** This product is the expansion of augmented product like training support and manuals.[Kotler et.al.,2009]

#### 4.1.1 Relationship between Product and Customer Satisfaction

There are **five principles** which can influence customer satisfaction:

- Purity
- Lawfulness
- Deliverability
- Price Determination
  - Cleanliness [Kotler and Armstrong,2004]

If we talking about the broad sense then: a product which is purchased by a consumer also includes the post-sales relationship with the company. And this relationship includes:-

- Certain features
- Certain scents
- Certain colors
- Warranty
- And other customer services

#### 4.2 Price Decision

It is known as the important decision for the business firm for generating the revenue and profitability. The amount paid for the product is known as its price in its general sense. According to Adam Smith, “Value for Exchange” is known as price<sup>[5]</sup>. While in marketing perspective “The amount of money charged for a product or services, or the sum of the values that consumer can exchange for the benefits of having or using the product or services” [Kotler and Armstrong, 2004]. In business to business (B2B) marketing, total cost of ownership includes in the price. Totalprice of ownership comprised of installation and other products which are required to deliver a complete functional solution. According to the stage of product life cycle price should be firstly decide for the target customers after that develop the features which suits that price<sup>[4]</sup>. This technique is known as target costing.

#### 4.2.1 Relationship Between Price and Customer Satisfaction

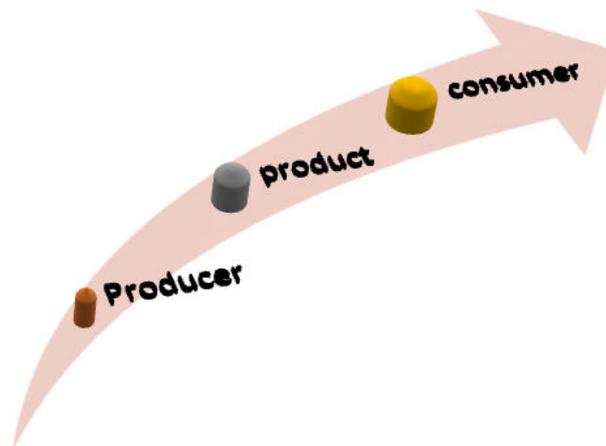
Prices of the firm are not only based on the cost incurred by the but also give due consideration to the consumer perception of the value of the product or services. There are so many activities done by human being which includes the aspects such as:

- Society
- Economy
- Politics
- Spirituality
- Education etc.

And each aspect has its value which is based on customer perception. Every firms cash flow will get managed through their loyal customers and if firm will give due consideration to the it's loyal customers while taking price decision it will helpful in creating customer satisfaction<sup>[6]</sup>.

#### 4.3 PLACE DECISION

The location from where we can purchase a product is called place of distribution. And it is known as distribution channel in which product moves from producer part to the consumer part, i.e.



The channel used for this movement is known as Distribution Channel. It includes both physical as well as virtual stores which are available on internet.

#### 4.1.3 Relationship between Place and Customer Satisfaction

Inconvenience to the customer leads to dissatisfaction among the customers which further influence the organization in negative way. So, to keep the customers in their comfort zone and provide them goods on the more relevant place suits to them and create satisfaction among them<sup>[5]</sup>. And helpful in increase the sales of the firm as well. In short, provide goods at the consumer place for providing various benefits like easy approach, less transportation cost and less time consumption.

#### 4.4 Promotion Decision

Various aspects of marketing communication are represented by the promotion under the context of marketing mix like for attaining the goal of generating a positive customer response, it communicate the information about the product to the customers. Promotion is very wide term includes all the communications that a marketer may insert to the market place<sup>[7]</sup>. These communications include:

- Radio
- Television
- Print media
- Coupons
- Billboards
- Online advertisements
- Direct mail

Role of the human sales force in the promotion is one of the very less defined areas. And on the other hand, sales person, who support the consumers to make the purchase decision that whether they purchase the product or not. So, in this case, the services can be defined as the feature of the product whether perceived or real.

#### 4.1.4 Relationship between Promotion and Customer Satisfaction

While doing promotional activities the following points should be kept in mind of the marketers:

- There should be honesty in the advertisements
- All the promotional activities should be based on truthfulness
- Transparency in the act of the dealers
- And work should be done with full sincerity

All this help in increasing customer loyalty and as well as in customer satisfaction.

## V. LIMITATION OF THE MARKETING MIX FRAMEWORK

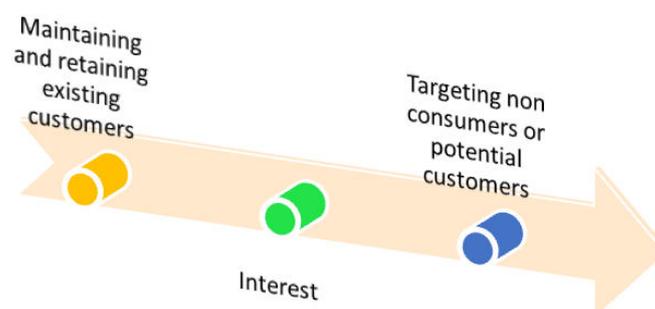
In the early days, physical product represented a large portion of the economy in the marketing concept. Marketing mix was treated as very useful framework. In today's marketing scenario, integrated concept is used for wide varieties of products and markets are attempted by extending the fifth element i.e., people/packaging/process etc. whenever needed<sup>[8]</sup>. But however, today's marketing mix considers only 4P's. Some of its limitations are:

- Conflicting objectives
- Organizational constraints
- Difficulty in understanding the stage of product life cycle

Despite of this limitation, marketing mix still treated as strong framework of the organized text books.

## VI. MEASUREMENT OF CUSTOMER SATISFACTION

As we have discussed earlier, customer satisfaction is a psychological law which is based upon degree and perception of an individual, even though it is necessary to measure it. Every business organization is alarmingly interested in the main things are as follows:



Through this we can able to convert potential customers into users. An indication that shows how successful the organization is at providing its product and services is measured by customer satisfaction. Customer satisfaction is an abstract and ambiguous concept. The actual manifestation regarding satisfaction varies from product to product and person to person as well<sup>[9]</sup>. It also includes variation regarding services to services.

The state of satisfaction is depends upon two variables namely:

- Psychological variable
- Physical variable

And it helps to correlate the information behavior with recommended rate and return. The level of customer satisfaction also depends upon the variation of the option of the customer about the product of the two organizations on the basis of comparison between them. As we know that, customer satisfaction is basically a psychological state, so care should be given to those efforts which help in the quantitative measurement of it.

In the recently study about quantitative measure, the common measure of customer satisfaction involves a survey which includes a set of statement using Likert's scale or technique or model. It is a scale based model like outstanding, excellent, very good, good, bad, worst etc. It helps to know the psychological behavior of individual in objective way which helps to take decision.

## VII. ROLE OF BENCHMARKING

As we have discussed earlier that Benchmarking is a process which is used in management and it is particularly used in strategic management and in which usually within own sector, business organizations evaluate various aspects which is helpful in developing relations with best practice. Another name used for benchmarking is:

- a. Best practice Benchmarking
- b. Process Benchmarking

Benchmarking is treated as one time event but in reality it is a continuous process and it is the practice done by organization to face various marketing challenges.



There is another form of benchmarking in addition to it is Competitive Benchmarking.

### 7.1 Competitive Benchmarking

For the analysis of competitors, this benchmarking is used. It helps while searching about your best competitors and also about the best company in the industry whether it serves in the same location or in different location<sup>[10]</sup>.

Advantages of benchmarking

- It provides better purpose planning and task /mission to achieve in the company as benchmarking is centered on what take place outside in the controlled and mastered manner.
- A better understanding about the expectation of the customer can be made because it is based on the real market estimation and must be in the objective way.
- Due to real problem understanding of the process like what and how they produce, a better increase in productivity is there.
- Provide better competitiveness as it helps to know about the competition level, how staff is efficient in getting new ideas on the different practices and tries different techniques also.
- Due to different search for decision practice, current practice is becoming better.

There are some of the consequences which are beyond the level of the benchmarking:-

- Helpful in reforms of all the level of the company
- Also helpful in reforming the hierarchical organization by making simple communication system.
- It reforms the product as well mind of employees of the organization.
- It also modifies the production of process.

## **VIII. CONCLUSION**

It is the strength of this research that it lays on its specific focus on the connection between the customer's satisfaction with the marketing mix model, the four Ps and benchmarking. This research also shows the impact of customer buying behavior base on the company quality policy regarding product, price, place, promotion. As all the policy formulation revolves around the customer's interest. Through the above research we come on the following crux as follows:

- ✓ A clear picture is there which shows the connection between customers' satisfaction and marketing mix model, the four Ps.
- ✓ The 4P's are the main parameters that the marketing manager can control, subject to the internal and external constraints of the marketing environment.
- ✓ Manifest a clear picture of the connection between customer's satisfaction and its company benchmarking strategy.
- ✓ Gain insight into future industry trends that will affect its business.
- ✓ Understanding the customers.
- ✓ Make values for customers.
- ✓ Communication of the retail value to target market.
- ✓ Helpful to managers to look outside of themselves for solutions.

This research enables the retail stores to gain insight into future industry trends that will affect its business, get data and analysis in the most cost-effective and flexible manner. There are some limitations of the marketing mix like internal dissensions, conflicting objectives, prediction of the stage of the PLC etc. Even though, it is used by marketers to formulate policies. Rough outlines of potential marketing activities are understood by the marketing manager that can be used to take advantage of capabilities and convert weaknesses and threats. However, at this stage, there will likely be many potential directions for the managers to pursue. The manager

must prioritize all marketing activities and develop specific goals and objectives for the marketing plan (Contemporary Marketing, 1992).

## **IX. DIRECTIONS FOR FURTHER RESEARCH**

The relationships between customer satisfaction and behavioral outcomes are probably much more complex than the things which are initially assumed. This study has looked only at a limited part of the puzzle that how customer's satisfaction translates into behavioral outcomes. In what way consumer's characteristics moderate the relationship between satisfactions and repurchase behavior. It is likely to be contingent for the products or services categories and the buying and usage process for those categories<sup>[12]</sup>. Further research on how there is effects of satisfaction on behavior is moderated by different consumer characteristics would advance customer satisfaction research as well as have great managerial significance. In today's scenario only four P's are used by marketers so it is suggested to them to utilize all the 7P's of marketing mix to get the better result.

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## EFFECT OF CURVATURE ON BLUNT BODIES

S Venkata Sai Sudheer<sup>1</sup>, Yadavelli Kavya<sup>2</sup>, Kothakapu Shivani Pravallika<sup>3</sup>

<sup>1</sup>Assistant Professor, <sup>2,3</sup>Student, Mechanical Engineering, CVR College of Engineering (India)

### ABSTRACT

*Effect of curvature on blunt body is presented in this paper. Blunt bodies of elliptical and circular curvature having same hydraulic mean dia. are taken to study. Comparison is done with rectangular geometry having same hydraulic mean dia. at different Reynolds numbers of 100,200,300,400&500. Elliptical blunt body show significant effect at Reynolds 500. Circular blunt show significant effect at Reynolds number 400.*

**Keywords:** *Elliptical blunt, Circular blunt, Reynolds number, Vortex size, Contours.*

### I. INTRODUCTION

Solution of the viscous flow over a bluff body has been a challenging problem for a number of years. Such flows are of great interest because they display fundamental fluid dynamic phenomena such as separation of a boundary layer, the evolution of the shear layer, its growth and eventually the formation of vortices that are shed in the wake. These are the key features that characterize the flow over a bluff body. Many structures such as tall buildings, bridges, off-shore pipelines and risers may be considered as bluff bodies and the complex flow over them is of great interest. Also, some streamlined structures may behave as a bluff body at some operating conditions, such as an airplane wing at high angles of attack. A circular cylinder and a sphere are the representative bluff bodies of two and three dimensions, respectively. For inviscid flow, there is no friction to cause boundary layer separation, vortices or a subsequent wake. However, inviscid flow over a cylinder will generate areas of different pressure gradients. There are two stagnation points in which one is on the middle of the cylinder in the fluid flow direction and one behind the cylinder. At these points,  $C_p$  will be one. Since the cylinder is a symmetric body, there will be symmetric pressure regions around the body. In the direction perpendicular to the fluid flow, a suction force exists. In this inviscid scenario, aerodynamic forces will not show any effect due symmetry. The non-uniformity of the approach flow was found numerically to have significant influences on the aerodynamic forces acting on the bluff bodies as well as vortex shedding behavior. A cylinder in a linearly varying flow was studied [1-3]. It was found in their numerical study that the time-averaged lift force varied proportional to a shear parameter. Experimental investigations were also conducted on circular cylinders in linear shear flow, such as the works [4, 5]. Based on the results of the researchers, the effects of shear flow on bluff bodies are considerably different from that of uniform flow.

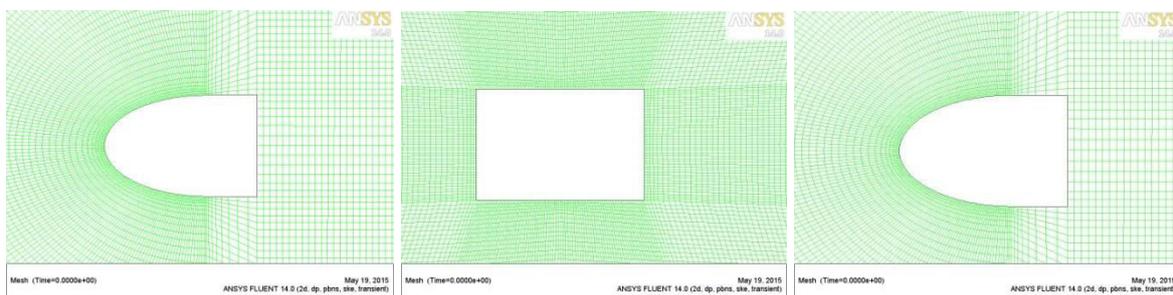
In the present work study the curvature effect on blunt bodies. Two dimensional computational model has taken to study having curvature of semi circle and elliptical. And it compared with rectangular blunt body. Flow analysis done at very low Reynolds number regions. Comparison made as the Reynolds number increase how models behaving, and at the same Reynolds number curvature influence on models.

### II.COMPUTATIONAL METHODOLOGIES

Computational analysis is carried out to solve a flow field in two-dimensional blunt bodies of different models to analyze flow characteristics, and the effect of curvature on the recirculation of the separated flow. Fig. 2.1

shows the different models of varying curvature. The modeling and analysis is done in Ansys 14.0 Workbench for creating the desired geometries. Pure quadrilateral meshing is used to get structured mesh.

Standard  $k-\epsilon$  model is used to predict the flow field Flow past the step involves recirculation (swirl) and the effect of swirl on turbulence is included in the Standard model, due to which accuracy of the model further increases. A UN steady state based implicit solver is used to achieve convergence. Second-order upwind scheme was used for the discretization of all the equations to achieve higher accuracy in results. Velocity-pressure coupling is established by pressure-velocity correlation using a PISO algorithm. Under-relaxation factors are used for all equation to satisfy Scarborough condition. Residuals are continuously monitored for continuity, x-velocity, y-velocity, z-velocity,  $k$ , and  $\epsilon$ . Convergence of the solution is assumed when the values of all residuals goes below  $10^{-6}$  Enhanced wall treatment is used to solve for the near wall treatment, as  $y^+$  is more than 30 in the whole domain.

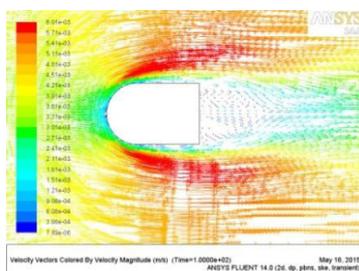


**Fig 2.1 Circular Blunt, Rectangles Blunt, Elliptical Blunt**

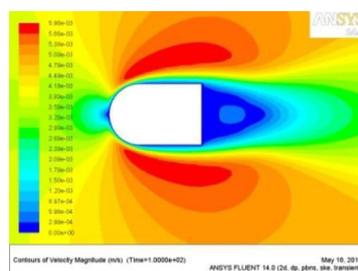
### III. RESULT AND DISCUSSION

#### 3.1 Flow Over Circular Blunt Body

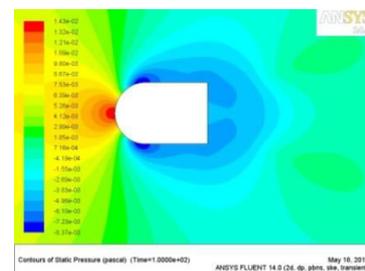
Figure 3.1.1 (a, b, &c) shows the velocity vectors, contours of velocity and pressure at Reynolds no. 100. Figure 3.1.2 (a, b, &c) shows the velocity vectors, contours of velocity and pressure at Reynolds no 200. Figure 3.1.3 (a, b, &c) shows the velocity vectors, contours of velocity and pressure at Reynolds no. 300. Figure 3.1.4 (a, b, &c) shows the velocity vectors, contours of velocity and pressure at Reynolds no 400. Figure 3.1.5 (a, b, &c) shows the velocity vectors, contours of velocity and pressure at Reynolds no 500.



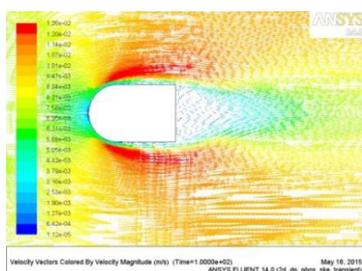
**Fig 3.1.1(a) Velocity vectors**



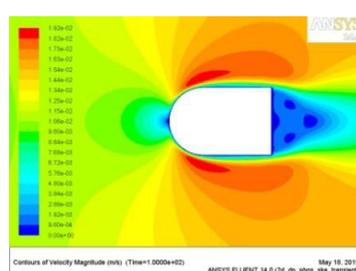
**Fig 3.1.1(b) Velocity contours**



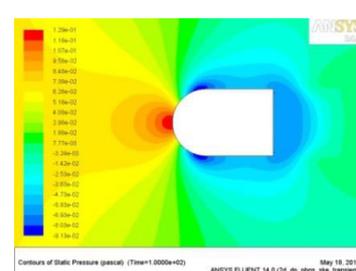
**Fig 3.1.1(c) Pressure contour**



**Fig 3.1.2(a) Velocity vectors**



**Fig 3.1.2(b) Velocity contours**



**Fig 3.1.2(c) Pressure contour**

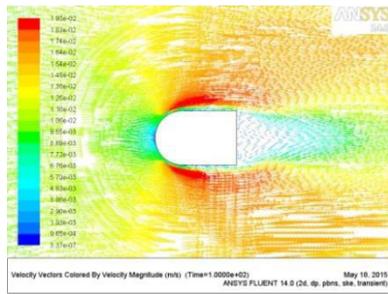


Fig 3.1.3(a) Velocity vectors

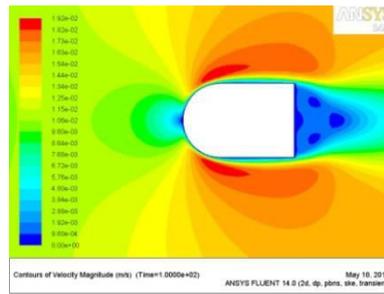


Fig 3.1.3(b) Velocity contours

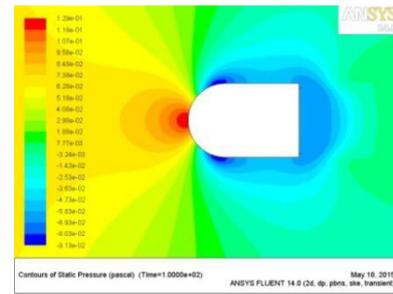


Fig 3.1.3(c) Pressure contour

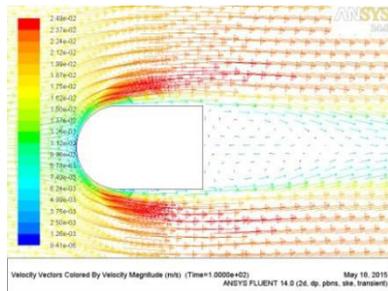


Fig 3.1.4(a) Velocity vectors

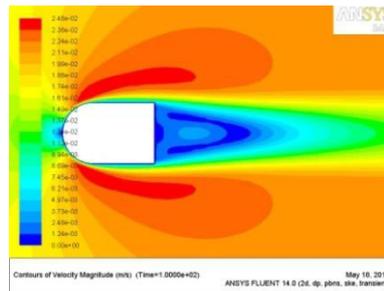


Fig 3.1.4(b) Velocity contours

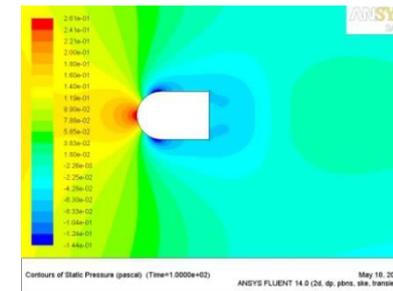


Fig 3.1.4(c) Pressure contour

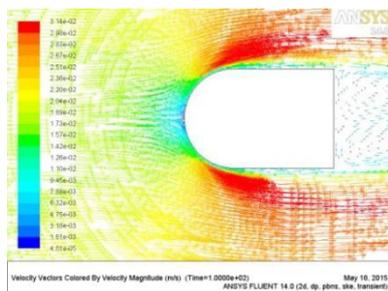


Fig 3.1.5(a) Velocity vectors

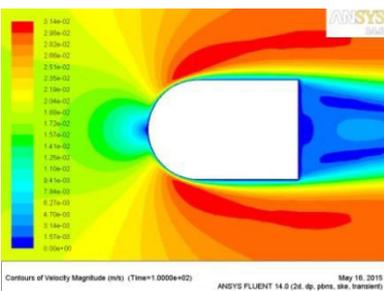


Fig 3.1.5(b) Velocity contours

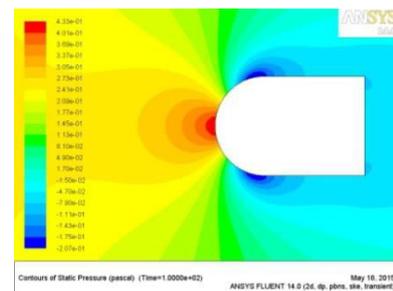


Fig 3.1.5(c) Pressure contour

As the Reynolds number increase from 100 to 500 the circular blunt shows significant variations in vortex size. Up to 300 Reynolds number vortex size decreases then after sudden incremental at Reynolds number 400 then after rapid decreases. At all Reynolds number except 400 right vortex size is more compared to left vortex size. And at Reynolds number 400 left and right vortexes are nearly equal. The region formed around the circular blunt show significant effect when Reynolds number increases. At Reynolds number 500 high velocity region surround to the circular blunt is more compared to all other Reynolds number.

### 3.2 Flow over Elliptical Blunt Body

Figure 3.2.1 (a, b, &c) shows the velocity vectors, contours of velocity and pressure at Reynolds no. 100. Figure 3.2.2 (a, b, &c) shows the velocity vectors, contours of velocity and pressure at Reynolds no 200. Figure 3.2.3 (a, b, &c) shows the velocity vectors, contours of velocity and pressure at Reynolds no. 300. Figure 3.2.4 (a, b, &c) shows the velocity vectors, contours of velocity and pressure at Reynolds no 400. Figure 3.2.5 (a, b, &c) shows the velocity vectors, contours of velocity and pressure at Reynolds no 500.

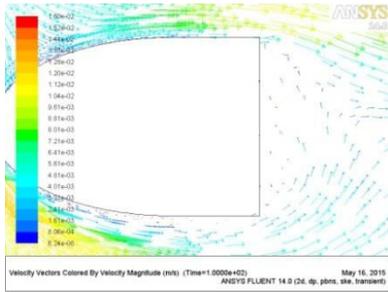


Fig 3.2.1(a) Velocity vectors

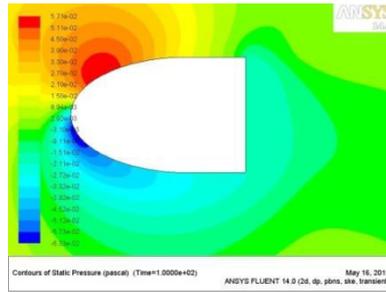


Fig 3.2.1(b) Velocity contours

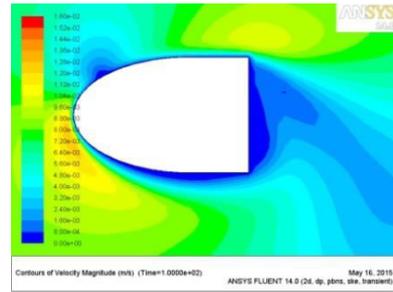


Fig 3.2.1(c) Pressure contour

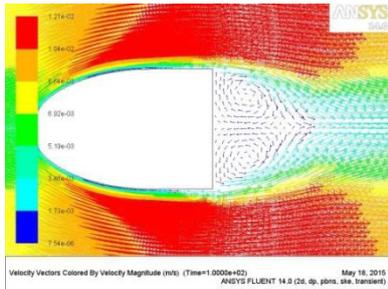


Fig 3.2.2(a) Velocity vectors

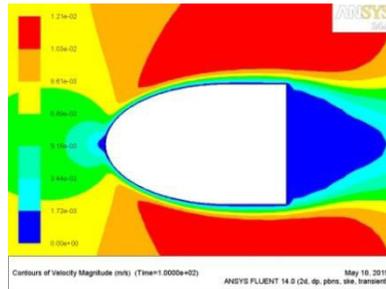


Fig 3.2.2(b) Velocity contours

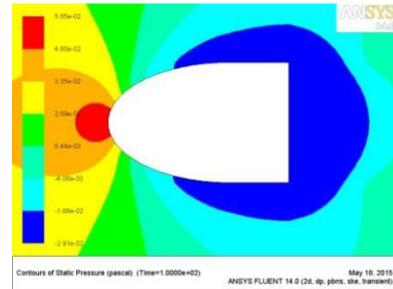


Fig 3.2.2(c) Pressure contour

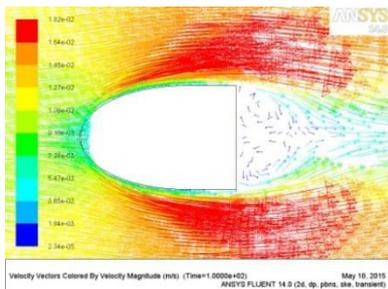


Fig 3.2.3(a) Velocity vectors

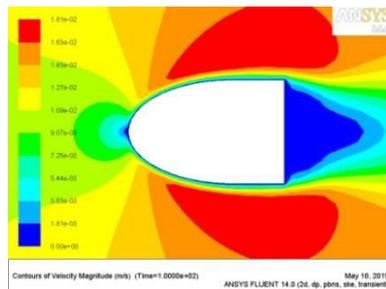


Fig 3.2.3(b) Velocity contours

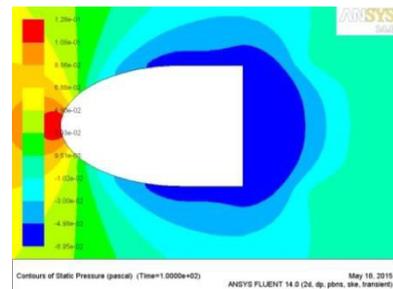


Fig 3.2.3(c) Pressure contour

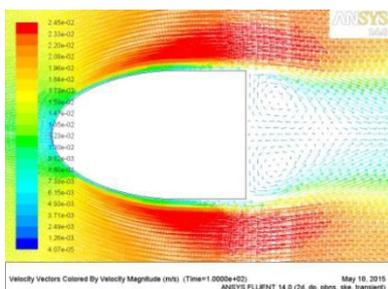


Fig 3.2.4(a) Velocity vectors

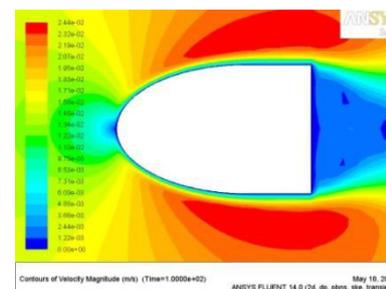


Fig 3.2.4(b) Velocity contours

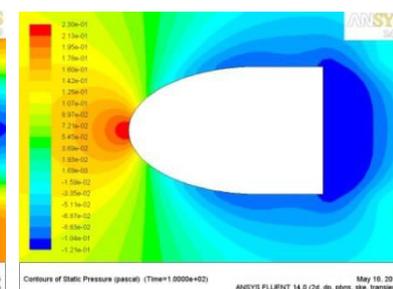


Fig 3.2.4(c) Pressure contour

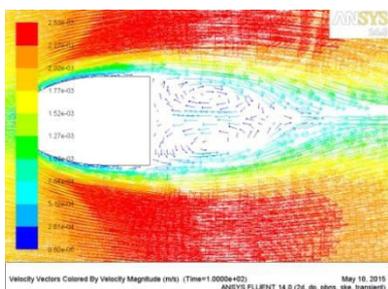


Fig 3.2.5(a) Velocity vectors

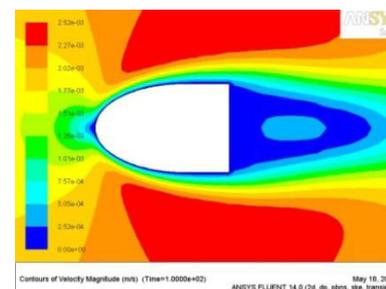


Fig 3.2.5(b) Velocity contours

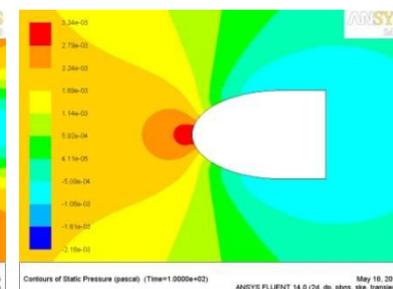


Fig 3.2.5(c) Pressure contour

As the Reynolds number increase from 100 to 500 the elliptical blunt shows significant variations in vortex size. As the Reynolds number increase vortex size decreases up to Reynolds number 400 then after sudden increment

in vortex size. At all Reynolds number except 500 left and right vortexes are equal in size. At Reynolds number 500 right vortex size is more compared to left vortex size. The region formed around the elliptical blunt show significant effect when Reynolds number increases. As the Reynolds number increases high velocity region surround to the elliptical blunt is increases.

### 3.3 Flow over Rectangular Blunt Body

Figure 3.3.1 (a, b, &c) shows the velocity vectors, contours of velocity and pressure at Reynolds no. 100. Figure 3.3.2 (a, b, &c) shows the velocity vectors, contours of velocity and pressure at Reynolds no 200. Figure 3.3.3 (a, b, &c) shows the velocity vectors, contours of velocity and pressure at Reynolds no. 300. Figure 3.3.4 (a, b, &c) shows the velocity vectors, contours of velocity and pressure at Reynolds no 400. Figure 3.3.5 (a, b, &c) shows the velocity vectors, contours of velocity and pressure at Reynolds no 500.

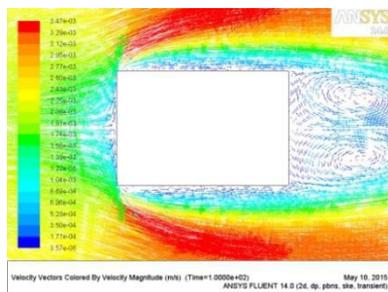


Fig 3.3.1(a) Velocity vectors

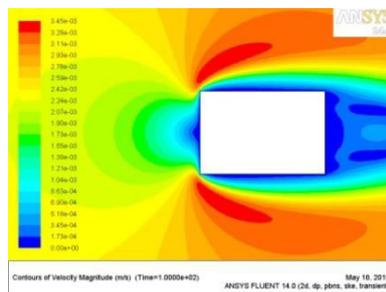


Fig 3.3.1(b) Velocity contours

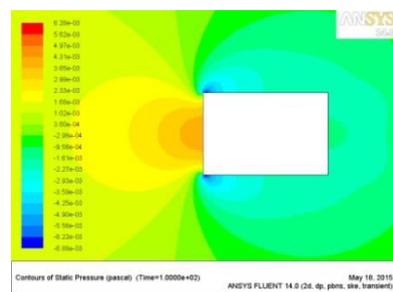


Fig 3.3.1(c) Pressure contour

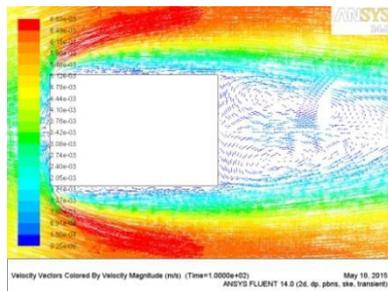


Fig 3.3.2(a) Velocity vectors

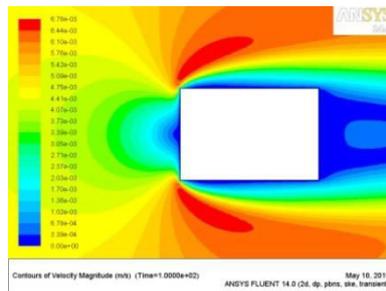


Fig 3.3.2(b) Velocity contours

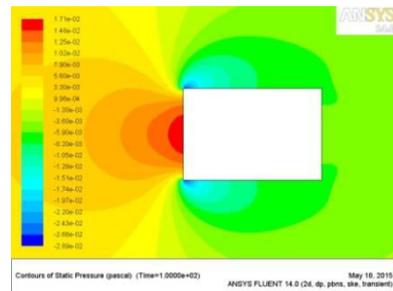


Fig 3.3.2(c) Pressure contour

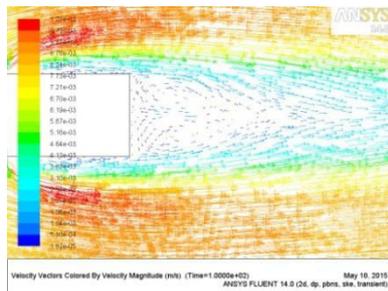


Fig 3.3.3(a) Velocity vectors

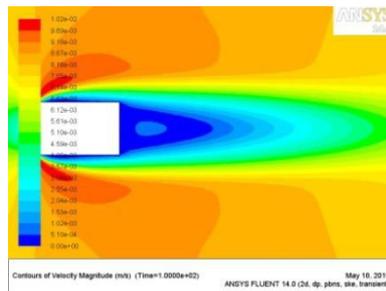


Fig 3.3.3(b) Velocity contours

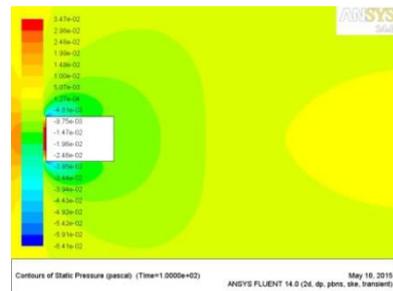


Fig 3.3.3 (c) Pressure contour

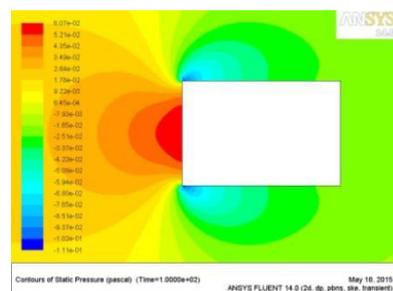
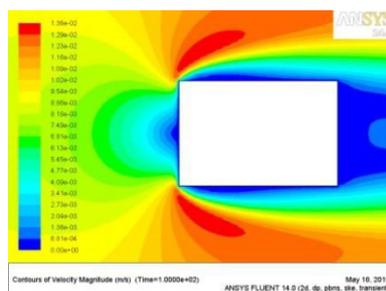
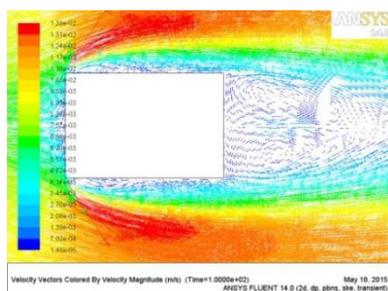


Fig 3.3.4(a) Velocity vectors

Fig 3.3.4(b) Velocity contours

Fig 3.3.4 (c) Pressure contour

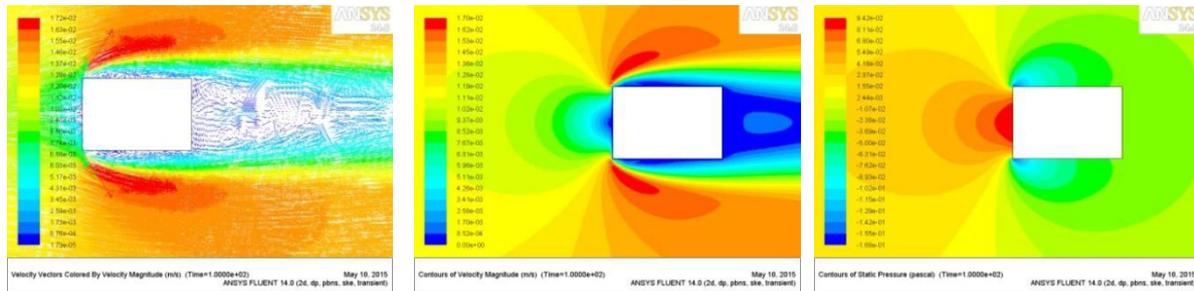


Fig 3.3.5 (a) Velocity vectors

Fig 3.3.5 (b) Velocity contours

Fig 3.3.5 (c) Pressure contour

As the Reynolds number increase from 100 to 500 the Rectangular blunt shows significant variations in vortex size. As the Reynolds number increase vortex size decreases up to Reynolds number 200 then after sudden increment in vortex size at Reynolds number 300. Then after vortex size decreases. At all Reynolds number except 100 left and right vortexes are equal in size. At Reynolds number 100 right vortex size is more compared to left vortex size. The region formed around the elliptical blunt show no significant effect when Reynolds number increases.

#### IV CONCLUSION

Comparison has to done on different models at same Reynolds number and Flow analysis on a specific model as increasing Reynolds number.

#### 4.1 Flow analysis at Different Reynolds Number

At Reynolds numbers 100, 200,400 and 500 circular blunt body and elliptical blunt body shows significant effect in vortex size. There is no significant effect of varying curvature at Reynolds number 300. Except Reynolds number 500 circular blunt has high vortex size compared to elliptical blunt. In all the cases rectangular blunt has more vortex size due to corner effect.

#### 4.2 Flow Analysis of Different Blunt Models

As the Reynolds number increases flow over different models shows different effects. For elliptical blunt body sudden increase and decrease vortex size is observed. And it has high vortex size at Reynolds number 500.

For circular blunt body decrease of vortex size observed up to Reynolds number 300, then sudden increment and decrement observed. It has high vortex size at Reynolds number 400.

For Rectangular body a decrease of vortex size at Reynolds number 200, then after incremental in vortex size and it has high vortex size compared to all other models.

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# SYNTHESIS AND STRUCTURAL BEHAVIOR OF NANOSIZED RARE EARTH SESQUIOXIDES IN SILICA MATRIX

Rachna Ahlawat

*Department of Physics, Ch. Devi Lal University, Sirsa-125055, Haryana (India)*

## ABSTRACT

*Nanocomposites of rare earth sesquioxides like  $Y_2O_3/Gd_2O_3$  in silica matrix were obtained using  $Y(NO_3)_3 \cdot 4H_2O/TEOS$  and  $Gd(NO_3)_3 \cdot 6H_2O/TEOS$  as the precursors by sol-gel method. The crystal structures and surface morphologies of the prepared nano powder were characterized by the powder XRD, FTIR, SEM and TEM techniques. Almost fully dense quasi-spherical cubic phase of nanopowder has been obtained at 900°C in both types of the samples. The average nanocrystallite size was calculated using well known Scherrer formula and found in the range of 25-30 nm. The formation of rare earth oxides (M-O bond) was verified with Fourier transform infrared (FTIR) spectroscopy. Effect of the annealing temperature on the nanocrystallite size, micro strain, dislocation density and densification of prepared samples has been discussed in detail.*

**Keywords:** *Rare Earth Sesquioxides, Spherical Nanocrystallites, XRD, FTIR, SEM, TEM.*

## I. INTRODUCTION

Binary system of rare earth (RE) and silica are important class of materials due to their many scientific and technological applications in many fields such as miniaturized optical devices, catalysts, advanced high temperature superconductors, ceramics and integrated optics [1-5]. Rare earth sesquioxides related nanocrystals, especially the nanosized yttrium/gadolinium oxide with controllable size and morphology, have also been widely studied because of their potential applications in transparent ceramics and luminescent devices such as glass lasers, a host for solid state lasers and optical fiber amplifiers and also hold promise for flat panel displays, FED, CRT etc [6-7].  $Y_2O_3$  has a wide energy band gap, high refractive index with thermal stability up to 2325°C and thus has been also used as an optical coating material. Gadolinium oxide ( $Gd_2O_3$ ), which is isostructural to  $Y_2O_3$ , is a promising candidate for laser ceramic applications because of its good qualities such as high refractive index ( $>1.9$ ), large band gap (5.4 eV), low phonon energy (phonon cutoff  $\sim 600\text{ cm}^{-1}$ ), low lattice mismatch with Si ( $a_{Gd_2O_3} = 1.082\text{ nm}$ ,  $a_{Si} \times 2 = 1.086\text{ nm}$ ) and its ability of being easily doped [8-9].

Yttrium/ gadolinium compounds are widely used in the preparation of phosphors for colour TV tubes. About 1% of these elements in iron, chromium and related alloys improve the workability and resistance to high temperatures and oxidation. The wide applications of these rare earth oxides have induced the search for suitable processes for their preparation. Chemical synthesis of the powders is probably the best way to control their characteristics and especially sol-gel type processing which is a powerful route to obtain ultra-fine particles with a controlled morphology. In these sol-gel processes good quality of the oxide products was expected primarily due to the purity of the used precursor materials and chemical homogeneity obtained by synthesis [10-11].

Very few studies are available in the literature [12-13] for the preparation of  $Y_2O_3:SiO_2$  and  $Gd_2O_3:SiO_2$  powder. We have first time synthesize a ceramic powder ( $Y_2O_3:SiO_2/Gd_2O_3:SiO_2$ ) by the sol-gel method using an acid-catalysed solution. The effects of increasing the sintering temperature on the phase evolution of the prepared samples were studied. We report the results of studies on the structure evolution of doped samples by X-ray diffraction (XRD) and Fourier-transform infrared (FTIR) spectroscopy; and the microstructure by scanning electron microscopy (SEM) and transmission electron microscopy (TEM) techniques.

## II. EXPERIMENTAL

### 2.1 Sample Preparation

Using sol-gel technique hydrous yttrium/gadolinium nitrate and hydrous silicon oxide were used at room temperature. For this purpose high purity reagent: tetraethoxysilane (Aldrich 99.99%), ethanol (Merck 99.9%) and double distilled water were mixed. The detailed description of the synthesis route has been described in the fig. 1 in which a specific molar ratio of the precursors was taken to prepare  $Y_2O_3:SiO_2$   $Gd_2O_3:SiO_2$  nano dimensional powder.

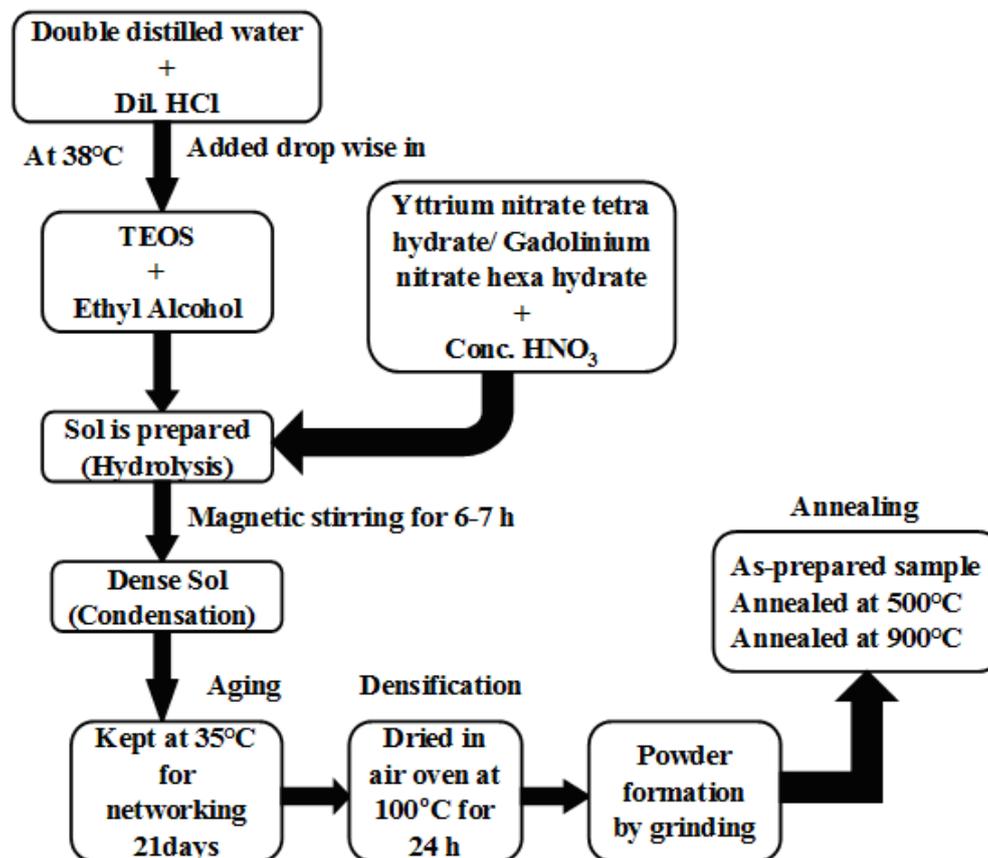


Figure 1. Block Diagram of Synthesis Procedure for  $Y_2O_3/Gd_2O_3:SiO_2$  Binary Oxides.

### 2.2 Characterizations

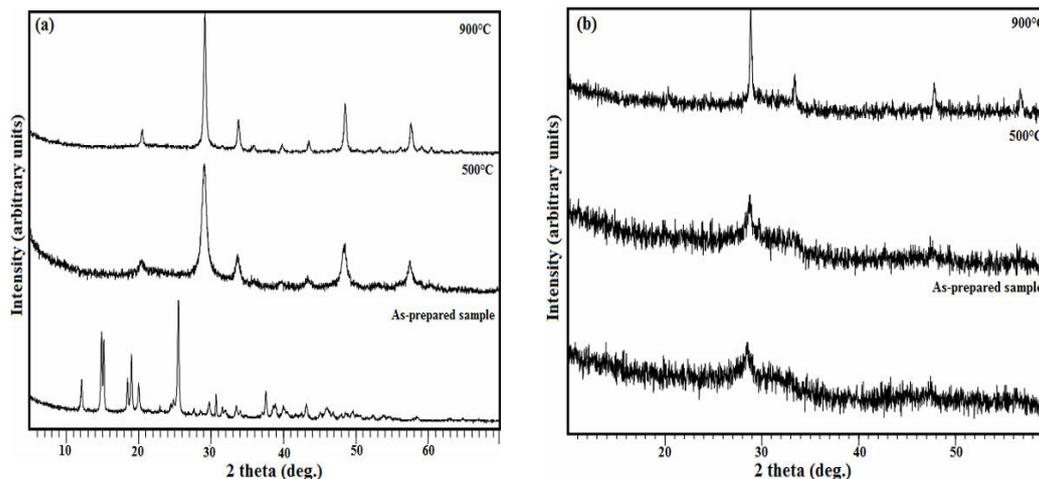
As-prepared and annealed samples were characterized by an X'pert Pro X-Ray Diffractometer with  $Cu-K_{\alpha 1}$  radiation in the range of  $5^\circ-80^\circ$  in steps of  $0.017^\circ$  (40 mA, 45 KV) for the determination of crystalline structure of binary oxides which were further conformed by HRTEM Hitachi 4500 micrograph operating at an accelerating voltage of 80 KV. Infrared spectra of as-prepared and annealed samples were collected by Perkin-

Elmer Spectrum 400 spectrophotometer in 4000- 450  $\text{cm}^{-1}$  ranges. For FTIR studies, the samples were mixed homogeneously with KBr and pellets of the desired dimensions made. Specimens for TEM were prepared by dispersing the powder sample in ethanol and placed a droplet of suspension on a grid coated with perforated carbon. The surface morphology has been studied by JEOL-JSM-6100 scanning electron microscope (SEM).

### III. RESULTS AND DISCUSSION

#### 3.1 Xrd Analysis

The XRD patterns of as-prepared  $\text{Y}_2\text{O}_3:\text{SiO}_2$  and annealed samples are shown in the fig 1 (a). The diffraction pattern of as-prepared sample depicts a very strong and sharp diffraction line centered at  $2\theta \sim 25.65^\circ$  and a series of weak peaks between  $10^\circ$  to  $45^\circ$ . These sharp lines of dried sample signify bulk behavior of hydrous precursor's nuclei and they are also suggesting that the precursors have not decomposed. In the diffraction pattern of sample annealed at  $500^\circ\text{C}$ , a strong but slightly broad new peak appeared at  $2\theta \sim 29.25^\circ$  with some weak new peaks at  $2\theta \sim 20.62^\circ$ ,  $33.85^\circ$ ,  $48.58^\circ$  and  $57.77^\circ$  in the diffraction pattern. The occurrence of these new peaks infers development of a new phase in the sample. In order to identify structure of the polycrystalline phase, "check cell" code was run and found that plane corresponding to diffraction peaks at  $2\theta \sim 20.62^\circ$ ,  $33.85^\circ$ ,  $48.58^\circ$ ,  $57.77^\circ$  which could be assigned to Miller indices (211), (222), (400), (440) and (622) respectively of the cubic phase of  $\text{Y}_2\text{O}_3$  with lattice parameter  $a = 10.56 \text{ \AA}$  and space group  $\text{Ia}\bar{3} (\text{T}_h^7)$  [14].



**Figure 2. XRD Pattern of (a)  $\text{Y}_2\text{O}_3:\text{SiO}_2$  and (b)  $\text{Gd}_2\text{O}_3:\text{SiO}_2$  Binary Oxides.**

Moreover, a code was also confirmed by comparing the obtained check cell data with the JCPDS card no. 41-1105 and the literature [15]. These results infer that intermediate crystalline phase of  $\text{Y}_2\text{O}_3$  in silica matrix can be obtained at low temperature ( $900^\circ\text{C}$ ). Furthermore, the temperature was raised up to  $900^\circ\text{C}$  to examine structural changes and crystallinity of cubic  $\text{Y}_2\text{O}_3:\text{SiO}_2$  polycrystalline powder. A significant increase in intensity and sharpness of the characteristic peaks of  $\text{Y}_2\text{O}_3$ , signifies increase in its crystallinity, densification and size. In contrast to this, literature survey reveals a conventional heat treatment of dried  $\text{Y}_2\text{O}_3:\text{SiO}_2$  sample at  $T \sim 900^\circ\text{C}$  &  $1300^\circ\text{C}$  for (0.5 h) yielded amorphous  $\text{Y}_2\text{O}_3:\text{SiO}_2$  composites [12].

The XRD patterns of as-prepared  $\text{Gd}_2\text{O}_3:\text{SiO}_2$  and annealed samples are shown in the fig 1 (b). The XRD pattern of as-prepared sample shows a single peak around  $2\theta \sim 28.50^\circ$ . This characteristic peak is assigned to reflection corresponding to miller indices (222) of the cubic phase of gadolinium oxide with unit cell parameters  $a = 10.80 \text{ \AA}$  and space group -  $\text{Ia}\bar{3} (206)$  [16]. As the sample was annealed at  $500^\circ\text{C}$ , the intensity of characteristic peak

around  $2\theta \sim 28.71^\circ$  is increased significantly and other peaks also starts to grow at  $2\theta \sim 47.27^\circ$  and  $56.28^\circ$ . At this annealing temperature, the sample shows initial development of complete cubic structure of gadolinium oxide. It is expected that the increased temperature reduces pores and connectivity of the composites leads to the development of dense and crystalline structure in the material. The sample annealed at  $900^\circ\text{C}$  (6h) illustrates increased intensity of the earlier diffraction peaks along with appearance of many new weak peaks developing in the cubic phase at  $2\theta \sim 20.04^\circ$ ,  $28.78^\circ$ ,  $33.29^\circ$ ,  $47.71^\circ$  and  $56.64^\circ$  which correspond to (211), (222), (400), (440) and (622) planes, respectively (JCPDS file no. 43-1014) owing to the evolution of the complete cubic phase of  $\text{Gd}_2\text{O}_3$ . It is noticed that the diffraction peak becomes sharper as the annealing temperature is increased from  $500^\circ\text{C}$  to  $900^\circ\text{C}$  which infers the growth of the crystallite size [17]. Thus, from XRD measurements, it is concluded that heat treatment changes the nature of the sample (from amorphous to crystalline) and results in the development of single cubic phase along with increased crystallite size and densification.

Nanocrystallite size, strain and dislocation density

The micro-strain and crystallite size produces peak broadening in the diffractogram. The crystallite size and strain effect have to be differentiated in the diffractogram. Both effects are independent and can be distinguished by W-H equation [18-19]:

$\beta_{\text{hkl}} \cos(\theta)_{\text{hkl}} = K\lambda/D + 2 \epsilon \sin(\theta)_{\text{hkl}}$  (3.6) where  $K$  is the shape factor which is 0.9 for uniform small size crystals,  $\lambda$  is the wavelength of X-ray,  $\theta_{\text{hkl}}$  is the Bragg angle for the (hkl) plane,  $\epsilon$  is the micro-strain,  $\beta_{\text{hkl}}$  is corrected full width half maximum in radians and  $D$  is an average crystallite size for the (hkl) plane measured in a direction perpendicular to the surface of the specimen. A graph is plotted between  $\sin(\theta)_{\text{hkl}}$  and  $\beta_{\text{hkl}} \cos(\theta)_{\text{hkl}}$  as shown in the Fig. 3. The value of micro-strain is estimated from slope of the line and the crystallite sizes were obtained from the intersection with the vertical axis and they are given in the table 1. In the table 1, the data are not available for  $\text{Gd}_2\text{O}_3:\text{SiO}_2$  sample annealed at  $500^\circ\text{C}$  because of weak intensity of the peaks in its XRD pattern.

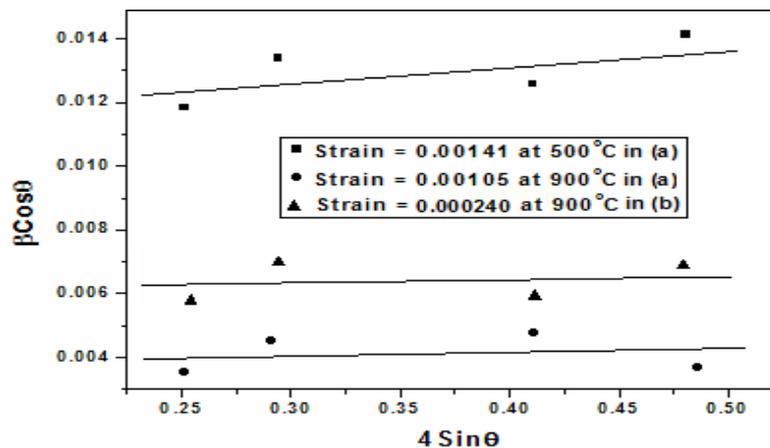


Figure 3. W-H Plots of (a)  $\text{Y}_2\text{O}_3:\text{SiO}_2$  and (b)  $\text{Gd}_2\text{O}_3:\text{SiO}_2$  Binary Oxides.

Table 3.1 Size, Micro Strain and Dislocation Density at Different Temperatures

Sample	( $D_{\text{W-H}}$ )	( $D_{\text{D-S}}$ )	( $\epsilon$ ) calculated	$\rho \approx 1/\langle D_{\text{W-H}} \rangle^2$
$\text{Y}_2\text{O}_3:\text{SiO}_2$ annealed at $500^\circ\text{C}$	13 nm	10 nm	$1.41 \times 10^{-3}$	$5.9 \times 10^{15} \text{ m}^{-2}$
$\text{Y}_2\text{O}_3:\text{SiO}_2$ annealed at $900^\circ\text{C}$	35 nm	33 nm	$1.05 \times 10^{-3}$	$8.2 \times 10^{14} \text{ m}^{-2}$
$\text{Gd}_2\text{O}_3:\text{SiO}_2$ annealed at $900^\circ\text{C}$	29 nm	27 nm	$2.40 \times 10^{-4}$	$1.2 \times 10^{15} \text{ m}^{-2}$

It is noticed that micro-strain reduces gradually with increasing annealing temperatures and its influence on broadening XRD peak is negligibly small. Under such considerations ( $\epsilon = 0$ ), Williamson-Hall relation reduces to Debye-Scherrer's formula ( $D = K\lambda/\beta\cos\theta$ ) [20]. The average crystalline size ( $D$ ) of  $Gd_2O_3$  was also calculated using this formula and the results are summarized in the table 1. In order to estimate the dislocation density, the well known formula given by Wilkens has been used [21]. (i.e dislocation density  $\rho = (\text{mean size effect})^{-2}$ ). Using this relationship, the dislocation density of the prepared powder has been obtained which is also given in the table1.

### 3.2 Ftir Analysis

The FTIR spectra of as prepared and annealed sample of  $Y_2O_3:SiO_2/Gd_2O_3:SiO_2$  binary oxides are shown in the fig. 2 within the spectral range  $4000-400\text{ cm}^{-1}$ . These spectra provide valuable information about the phase composition as well as bonding in the prepared binary oxides. Table 2 shows the sources and absorption bands of the FTIR spectra for all the samples. The FTIR spectra of as prepared and annealed samples in both the powders have three major absorption regions of  $H_2O$ ,  $SiO_2$  and  $M_2O_3$ . In the first region, the as-prepared sample exhibits a broad absorption band in the region  $3430-3450\text{ cm}^{-1}$  assigned to O-H stretching vibration and at  $1645\text{ cm}^{-1}$  due to the molecular H-O-H bending modes [22-23]. In second region, the band appeared in the range of  $465-490\text{ cm}^{-1}$  is due to the Si-O-Si and O-Si-O bending modes whereas bands at  $803-810\text{ cm}^{-1}$  and  $1091-1099\text{ cm}^{-1}$  correspond to the Si-O-Si symmetric and antisymmetric stretching vibrations, respectively [24-26]. The FTIR spectrum of all samples also depicts weak absorptions around  $2361\text{ cm}^{-1}$ ,  $1483\text{ cm}^{-1}$ ,  $1359\text{ cm}^{-1}$ , and  $1315\text{ cm}^{-1}$  which could be due to organic impurities like C=O, -CH<sub>2</sub>- and -NO<sub>2</sub> [29] respectively but noticeable feature of the spectrum is disappearance of N-O band which supports the XRD pattern of the corresponding sample. In the third region, in both the cases the peak at  $542$  and  $562\text{ cm}^{-1}$  is assigned for the stretching frequency of M-O (M= Y, Gd) bond respectively [27-28]. It is interesting to note that the intensity of the band at  $542$  and  $562\text{ cm}^{-1}$  is very weak/negligible for as prepared sample while it becomes sharper and intense as the annealing temperature increases up to  $900\text{ }^\circ\text{C}$ . This can be correlated with the change in the nature/phase of the phosphor sample on post annealing which is also apparent in the XRD analysis discussed in Sec. 3.1.

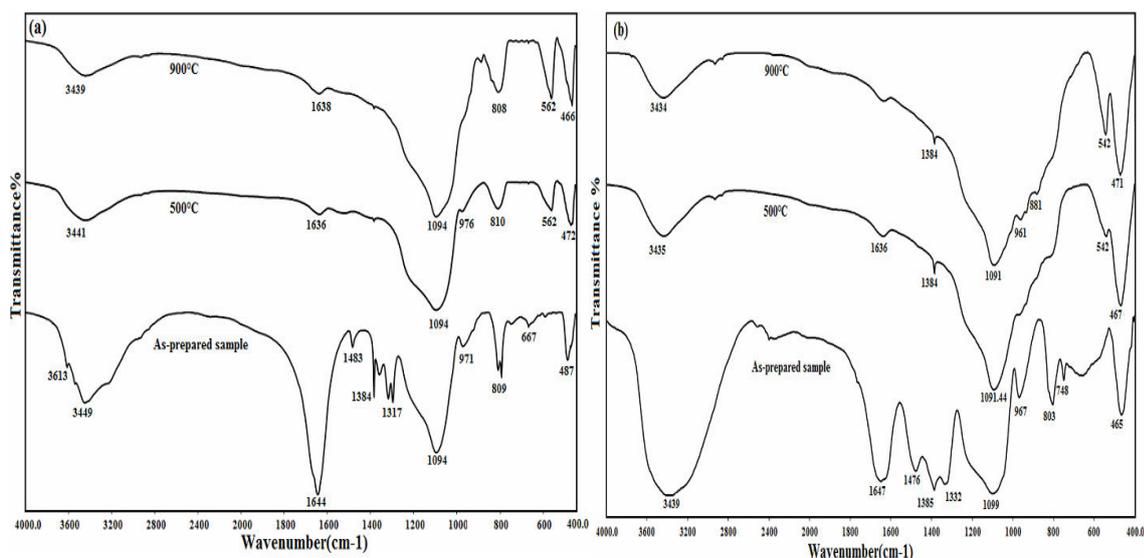


Figure 4 FTIR Spectra of (a)  $Y_2O_3:SiO_2$  and (b)  $Gd_2O_3:SiO_2$  Binary Oxides

**Table 2: FTIR Peak Positions and Corresponding Functional Groups**

Absorption frequency range (cm <sup>-1</sup> )	Assignments of functional groups
562 & 542 cm <sup>-1</sup>	Char. vibrational band of Y-O & Gd-O bond
803-810 cm <sup>-1</sup>	Si- O-Si symmetric stretching
961-976 cm <sup>-1</sup>	Silanol group Si-OH
1090-1099 cm <sup>-1</sup>	Si- O-Si symmetric stretching in cyclic structure (asymmetric stretching)
1476, 1385, 1332 cm <sup>-1</sup>	Organic residues specially C-O, N-H, NO <sub>3</sub> in ethyl group and nitro group
1625-1650 cm <sup>-1</sup>	Bending modes of H-O-H adsorbed at silica surface
3450 – 3430 cm <sup>-1</sup>	O-H vibrations of residual adsorbed water, Si-OH stretching vibrations

### 3.3. Sem Analysis

Figure 5 (a) shows the surface morphologies of Y<sub>2</sub>O<sub>3</sub>:SiO<sub>2</sub> binary oxides as viewed under scanning electron microscope. Micrograph of as-prepared sample (a) is structureless due to the amorphous nature of the product. Abundance of water is present in as-prepared sample can be seen clearly by reflection from surface of the powder. With increasing temperature at 500°C the content of water molecule, Si-OH and volatile materials decreases, which indicate the beginning of the crystalline phase in the sample. It is worth pointing out that the sol gel process and step wise annealing favors the formation of cubic phase of yttrium oxide with well defined grain boundaries in the micrograph annealed at 900°C. This micrograph provides much improved crystallinity and dispersion of yttrium in a fused silica matrix. One may notice in this micrograph that the structure of nanocrystals is similar to rod shaped and thick lamellar shape. The actual size of the nanoparticles cannot be determined from the SEM images as it is limited by the resolution of the used SEM instrument.

In order to study the morphology of as-prepared and heat treated samples of Gd<sub>2</sub>O<sub>3</sub>:SiO<sub>2</sub> binary oxides, SEM micrographs are shown in the Fig. 5 (b). The morphology of the as-prepared sample dried at 100°C for 24 h duration shows irregular structure of gadolinium due to amorphous nature of the prepared powder. At 500°C, the SEM image consists of small coarse grains with swallowed spheroids on some grains and these are found agglomerated somehow. But when the sample was further annealed at 900°C, mostly non-agglomerated nanocrystals are appeared in the micrograph with different shape and sizes. The SEM and XRD results of the binary oxides (molar ratio Y/Gd: Si = 6:1) revealed the most homogeneous densification and best crystallinity.

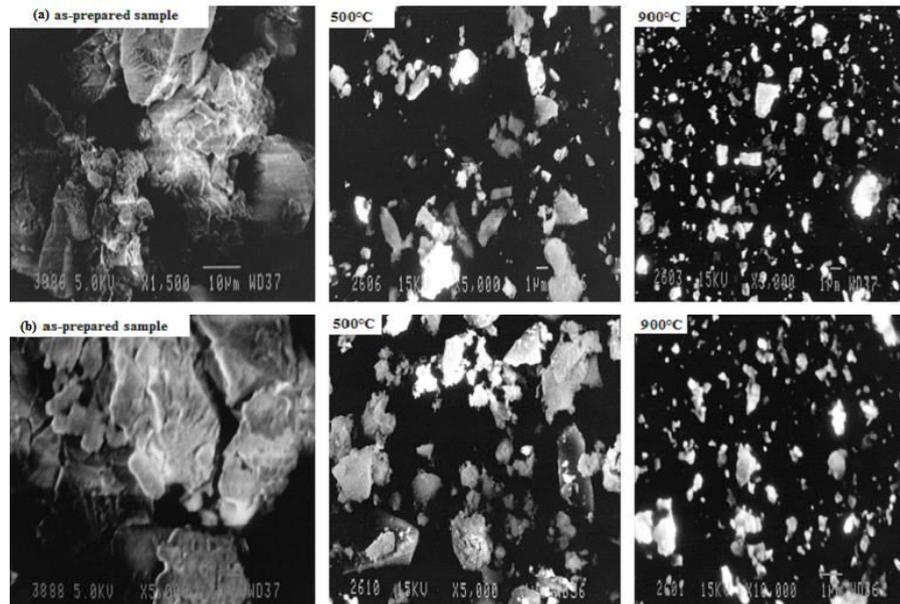


Figure 5. SEM Images of (a)  $Y_2O_3:SiO_2$  and (b)  $Gd_2O_3:SiO_2$  Binary Oxides

### 3.4. Tem Analysis

The TEM micrographs for  $Y_2O_3:SiO_2$  and (b)  $Gd_2O_3:SiO_2$  binary oxides are shown in the fig. 6 (a & b). The samples were prepared for TEM imaging by drying the aforesaid samples on a copper grid that was coated with a thin layer of carbon and then analyzed using a Hitachi 4500 type micrograph. Micrograph of as prepared sample in the Fig. 6 (a) shows a typical chain-like structure of acidic gel of precursors and this confirms the acid nature of the precursors in the sample. The TEM micrographs of the sample annealed at 500°C shows non-agglomerated yttria nanocrystallites of quasi-spherical shape having size ranges 10-15 nm.

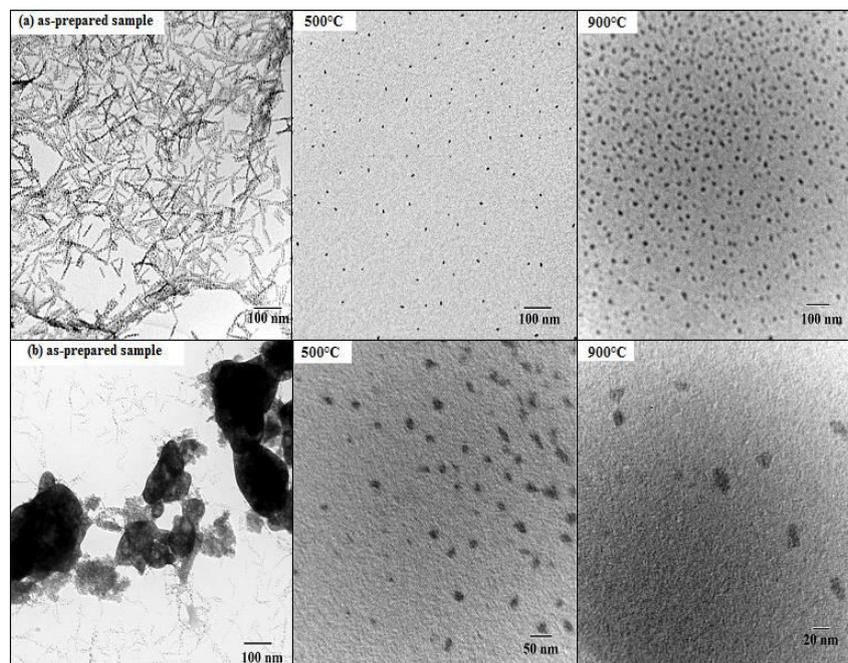


Figure 6. TEM Images of (a)  $Y_2O_3:SiO_2$  and (b)  $Gd_2O_3:SiO_2$  Binary Oxides

The nanocrystals have narrow grain size distribution in the silica matrix which is shown in the Fig. 7 (a). The TEM micrograph of the sample annealed at 900°C are also shown in the fig. 6 (a) which illustrates almost

spherical shape of the yttria nanocrystals. The particle size distribution for this micrograph results in the bigger size particles in the range of 25-40 nm, among them 80 % crystallites are having size 35-40 nm as shown in the Fig. 7 (a) annealed at 900°C. The TEM micrograph for Gd<sub>2</sub>O<sub>3</sub>:SiO<sub>2</sub> binary oxide are also shown in the fig. 6 (b) in which one can notice that the as-prepared sample is not having complete crystalline nature. The sample annealed at 500°C and 900°C are homogenously dispersed in silica matrix and having almost spherical shape of the nanocrystals. Their corresponding particle size distribution are also shown in the fig. 7 (b) having size ranges in 20-25 nm and 25-30 nm for the samples annealed at 500°C and 900°C, respectively.

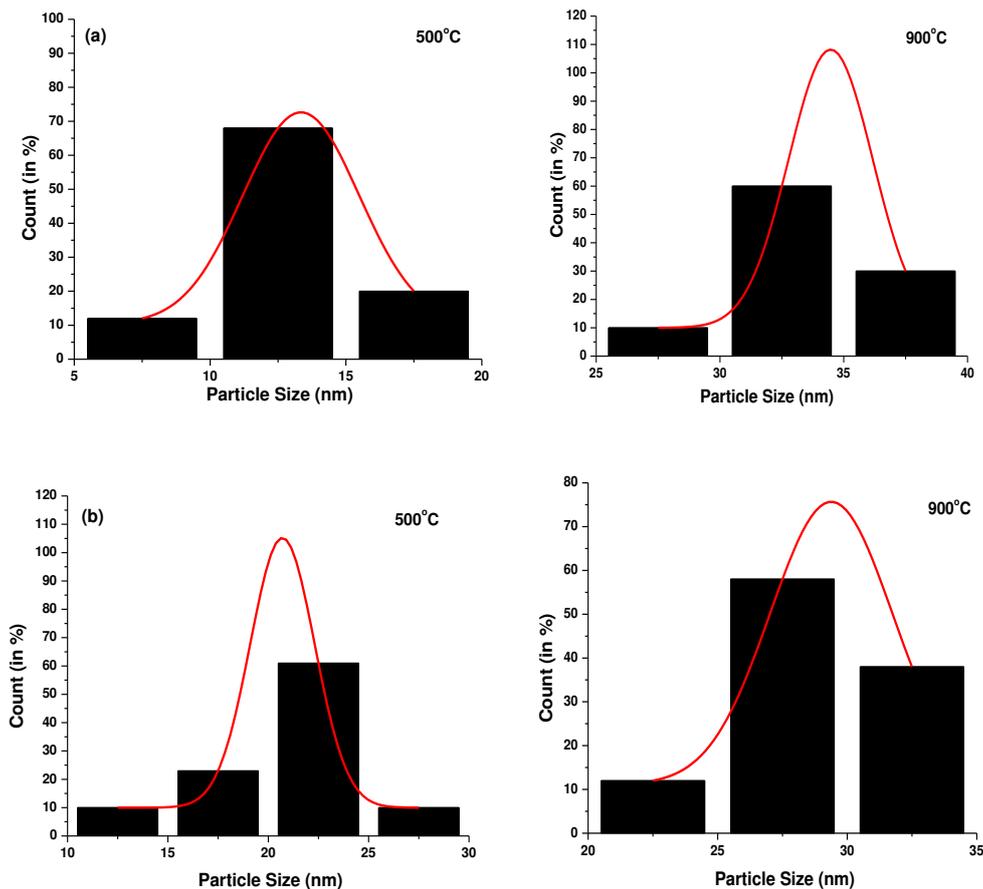


Figure 7. Particle Size Distributions of (a) Y<sub>2</sub>O<sub>3</sub>:SiO<sub>2</sub> and (b) Gd<sub>2</sub>O<sub>3</sub>:SiO<sub>2</sub> Binary Oxides

#### IV. CONCLUSIONS

From the present study it could be concluded that the formation of Y<sub>2</sub>O<sub>3</sub>:SiO<sub>2</sub> and Gd<sub>2</sub>O<sub>3</sub>:SiO<sub>2</sub> ceramics powder using the sol- gel synthesis depends on the nature of the starting materials and annealing process. The present study demonstrates the versatility of the sol gel method to yield a cubic phase of the sesquioxides in the binary oxide samples at a low annealing temperature (900°C) when compared to the temperature (>1400- 1600°C) required for the solid-state synthesis. The XRD analysis proved that cubic structure of Y<sub>2</sub>O<sub>3</sub> and Gd<sub>2</sub>O<sub>3</sub> was well grown with in the silica matrix. The average size of the nanocrystallites was calculated from the diffraction line width based on the Debye-Secherrer formula. Different functional groups have been investigated by FTIR spectra and it shows that the absorption bands broadened as the particle size decreases. In both the binary oxides, the absorption peak at 542 and 562 cm<sup>-1</sup> are assigned for the stretching frequency of M-O (M= Y, Gd)

bond, respectively. TEM micrographs confirmed the XRD observations regarding the crystallite/particle size of cubic phase developed in the nano-dimensional powder of rare earth sesquioxides in silica.

## V. ACKNOWLEDGEMENTS

The author gratefully acknowledges Sophisticated Analytical Instrumentation Facilities (SAIF), Panjab University, Chandigarh, for providing experimental facilities.

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# SQL INJECTION: A SURVEY PAPER

Amit Banchhor<sup>1</sup>, Tushar Vaidya<sup>2</sup>

<sup>1,2</sup> M.Tech.Scholar, Dept.of Computer Science & Engg. CSIT, Durg, (India)

## ABSTRACT

*SQL injection is a code injection technique, used to attack data driven applications, in which malicious SQL statements are inserted into an entry field for execution<sup>[1]</sup>. SQL injection must exploit a security vulnerability in an application's software. Applications are filtered for string literal escape characters embedded in SQL statements. When the user input is not strongly typed and unexpectedly executed these causes injection. SQL injection is mostly known as an attack vector for websites but can be used to attack any type of SQL database. There are various types of injection techniques that are used by the hackers to get access to the database. This paper discusses all those types of techniques those are widely used by the hackers to cause a SQL injection.*

**Keywords:** *SQL, Security, Strongly Typed, Attack Vector, Database*

## I. INTRODUCTION

SQL injections attacks(SQLIA) are caused when there is change in the SQL query by insertion of new SQL keywords into the existing query. SQL injection vulnerabilities are one of the most serious threats for web applications. These injections allow an attacker to gain complete access to the database. In some case the hacker may use an SQL injection to take control and corrupt the system that hosts the web application.

SQL injection refers to a class of code-injection attacks in which data provided by the user is included in an SQL query in such a way that part of the user's input is treated as SQL code. By taking advantage of these vulnerabilities, an attacker can submit SQL commands directly to the database. These attacks are serious to any type of web applications that receives information from the users as input and incorporate it into SQL queries to an underlying database.

The major cause of SQL injection is insufficient user validation, to address this problem developers have proposed a range of guidelines for coding, which promotes defensive coding practices, such as encoding user input and validation.<sup>[2]</sup> A rigorous and systematic application of these applications is an effective solution for preventing SQL injection vulnerabilities. However, in practice the application of such techniques is prone to human errors. Furthermore, fixing legacy code-bases that might contain SQL injection vulnerabilities can be extremely labor-intensive task.

## II. SQLIA TECHNIQUES

The SQLIA that is SQL injection attacks can be categorized into three major groups. These groups are:

### 2.1 Injection Through User Input

In this technique, hacker injects SQL keywords or statements by selectively selecting the user's input. A web application usually reads the user's input in several ways depending on the environment in which it is

developed. In most of the applications user's input is collected via online forms through HTTP GET or POST requests

## **2.2 Injection Through Cookies**

In this technique cookies are used to create a malicious code. Cookies are the special files that contain information of the state of the web page generated by the web applications. These are stored locally on the client system. Cookies are used to restore the client's state information when there is switching among the web pages. Since the cookies are located locally hence a malicious code could be embedded in it to cause unintended activity in the application.

## **2.3 Injection Through Server Variables**

Server variables are a collection of variables that contain HTTP, network headers, and environmental variables. Web applications use these server variables in a variety of ways, such as logging usage statistics and identifying browsing trends. If these variables are logged to a database without sanitization, this could create an SQL injection vulnerability. Because attackers can forge the values that are placed in HTTP and network headers, they can exploit this vulnerability by placing an SQLIA directly into the headers. When the query to log the server variable is issued to the database, the attack in the forged header is then triggered.

## **2.4 Second Order Injection**

In second-order injections, attackers put malicious inputs into a system or database and indirectly trigger an SQLIA when that input is used at a later time. The objective of this kind of attack differs significantly from a regular injection attack. Second-order injections are not trying to cause the attack to occur when the malicious input initially reaches the database. Instead, attackers rely on knowledge of where their input will be subsequently used and craft their attack so that it occurs during that usage.

## **III. SQLIA TYPES**

There are various types of SQLIA, these are not applied in isolation but are used in aggregation or in sequence depending on the target of the hacker. There are various variations of each SQLIA type, majority of them are as follows:

### **3.1 Tautology**

The general goal of a tautology-based attack is to inject code in one or more conditional statements so that they always evaluate to true.<sup>[3]</sup> The consequences of this attack depend on how the results of the query are used within the application. The most common usages are to bypass authentication pages and extract data. In this type of injection, an attacker exploits an injectable field that is used in a query's WHERE conditional. Transforming the conditional into a tautology causes all of the rows in the database table targeted by the query to be returned. In general, for a tautology-based attack to work, an attacker must consider not only the injectable/vulnerable parameters, but also the coding constructs that evaluate the query results. Typically, the attack is successful when the code either displays all of the returned records or performs some action if at least one record is returned.

### 3.2 Illegal or Illogical Queries

This attack lets an attacker gather important information about the type and structure of the back end database of a Web application. The attack is considered a preliminary, information gathering step for other attacks. The vulnerability leveraged by this attack is that the default error page returned by application servers is often overly descriptive. In fact, the simple fact that an error messages is generated can often reveal vulnerable/injectable parameters to an attacker. Additional error information, originally intended to help programmers debug their applications, further helps attackers gain information about the schema of the back-end database. When performing this attack, an attacker tries to inject statements that cause a syntax, type conversion, or logical error into the database. Syntax errors can be used to identify injectable parameters. Type errors can be used to deduce the data types of certain columns or to extract data. Logical errors often reveal the names of the tables and columns that caused the error.

### 3.3 Union Query

In union-query attacks, an attacker exploits a vulnerable parameter to change the data set returned for a given query. With this technique, an attacker can trick the application into returning data from a table different from the one that was intended by the developer. Attackers do this by injecting a statement of the form: UNION SELECT <rest of injected query>. Because the attackers completely control the second/injected query, they can use that query to retrieve information from a specified table. The result of this attack is that the database returns a dataset that is the union of the results of the original first query and the results of the injected second query.<sup>[3]</sup>

### 3.4 Piggy-Backed Queries

In this attack type, an attacker tries to inject additional queries into the original query. We distinguish this type from others because, in this case, attackers are not trying to modify the original intended query; instead, they are trying to include new and distinct queries that “piggy-back” on the original query. As a result, the database receives multiple SQL queries. The first is the intended query which is executed as normal; the subsequent ones are the injected queries, which are executed in addition to the first. This type of attack can be extremely harmful. If successful, attackers can insert virtually any type of SQL command, including stored procedures, into the additional queries and have them executed along with the original query. Vulnerability to this type of attack is often dependent on having a database configuration that allows multiple statements to be contained in a single string.

### 3.5 Stored Procedures

SQLIAs of this type try to execute stored procedures present in the database.<sup>[4]</sup> Today, most database vendors ship databases with a standard set of stored procedures that extend the functionality of the database and allow for interaction with the operating system. Therefore, once an attacker determines which back-end-database is in use, SQLIAs can be crafted to execute stored procedures provided by that specific database, including procedures that interact with the operating system. It is a common misconception that using stored procedures to write Web applications renders them invulnerable to SQLIAs. Developers are often surprised to find that their stored procedures can be just as vulnerable to attacks as their normal applications. Additionally, because stored procedures are often written in special scripting languages, they can contain other types of vulnerabilities, such as buffer overflows, that allow attackers to run arbitrary code on the server or escalate their privileges.<sup>[3]</sup>

### **3.6 Inference**

In this attack, the query is modified to recast it in the form of an action that is executed based on the answer to a true/false question about data values in the database. In this type of injection, attackers are generally trying to attack a site that has been secured enough so that, when an injection has succeeded, there is no usable feedback via database error messages. Since database error messages are unavailable to provide the attacker with feedback, attackers must use a different method of obtaining a response from the database. In this situation, the attacker injects commands into the site and then observes how the function/response of the website changes. By carefully noting when the site behaves the same and when its behavior changes, the attacker can deduce not only whether certain parameters are vulnerable, but also additional information about the values in the database. There are two well known attack techniques that are based on inference. They allow an attacker to extract data from a database and detect vulnerable parameters.

### **3.7 Blind Injection**

In this technique, the information must be inferred from the behavior of the page by asking the server true/false questions. If the injected statement evaluates to true, the site continues to function normally. If the statement evaluates to false, although there is no descriptive error message, the page differs significantly from the normally-functioning page.

### **3.8 Timing Attacks**

A timing attack allows an attacker to gain information from a database by observing timing delays in the response of the database. This attack is very similar to blind injection, but uses a different method of inference. To perform a timing attack, attackers structure their injected query in the form of an if/then statement, whose branch predicate corresponds to an unknown about the contents of the database. Along one of the branches, the attacker uses a SQL construct that takes a known amount of time to execute. By measuring the increase or decrease in response time of the database, the attacker can infer which branch was taken in his injection and therefore the answer to the injected question.

### **3.9 Alternate coding**

In this attack, the injected text is modified so as to avoid detection by defensive coding practices and also many automated prevention techniques. This attack type is used in conjunction with other attacks. In other words, alternate encodings do not provide any unique way to attack an application; they are simply an enabling technique that allows attackers to evade detection and prevention techniques and exploit vulnerabilities that might not otherwise be exploitable. These evasion techniques are often necessary because a common defensive coding practice is to scan for certain known “bad characters,” such as single quotes and comment operators. To evade this defense, attackers have employed alternate methods of encoding their attack strings (e.g., using hexadecimal, ASCII, and Unicode character encoding). Common scanning and detection techniques do not try to evaluate all specially encoded strings, thus allowing these attacks to go undetected. Contributing to the problem is that different layers in an application have different ways of handling alternate encodings. The application may scan for certain types of escape characters that represent alternate encodings in its language domain. Another may use different escape characters or even completely different ways of encoding. For example, a database could use the expression `char(120)` to represent an alternately-encoded character “x”, but

char (120) has no special meaning in the application language's context. An effective code-based defense against alternate encodings is difficult to implement in practice because it requires developers to consider all of the possible encodings that could affect a given query string as it passes through the different application layers. Therefore, attackers have been very successful in using alternate encodings to conceal their attack strings.<sup>[4]</sup>

#### **IV. CONCLUSION**

In this paper we have explored various types of SQLIA possible and their effects on the underlying database of the web application. Future evaluation work should focus on evaluating the techniques precision and effectiveness in practice.

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# FLOW OVER NACA-4415 AEROFOIL AT EXTREME REYNOLDS NUMBERS

**Kamma Pradeep<sup>1</sup>, Enugurthi Manasa<sup>2</sup>, Adimulam Neha<sup>3</sup>**

*<sup>1, 2, 3</sup>Student, Mechanical Engineering, CVR College of Engineering (India)*

## ABSTRACT

*Computational Flow analysis is done on NACA Aerofoil 4415 at low and high Reynolds number. Flow is considered when Aerofoil is at zero degrees angle of attack & Reynolds numbers 5000, 6000, 100000 & 120000. Lift and drag forces, velocity vectors, contours of pressure and velocity are considered to analyze and compare the flow when Reynolds number increases. At Reynolds number 6000 the aerofoil shows maximum coefficient of lift and drag. At extremely high Reynolds numbers the aerofoil doesn't show any significant effect even with increase in Reynolds number.*

**Keywords:** *Aerofoil, Contours of velocity and pressure, Fluent, Leading Edge, Trailing Edge*

## I. INTRODUCTION

Aerofoil's and aerodynamic shaped objects are extensively used in all types of air vehicles for example space shuttle, aircrafts, helicopters and even in various types of missiles. Besides, when it comes to fluid machineries such as pump, turbine, windmill, the shape of impeller, propeller is very important. Historically, interest in low Reynolds number aerodynamics has been restricted to model radio controlled aircraft applications and did not garner a great deal of scientific interest. This situation is changing with the interest in small unmanned aerial vehicles, predominantly for military purposes. As such, our understanding of low Reynolds number flow over airfoils is limited to a few sources that are growing as time evolves<sup>[1-4]</sup>. Observation made in the Selig work was that they could not reliably measure airfoil characteristics if the Reynolds number fell below 40,000 due to flow unsteadiness. Vortex shedding and instability at low-Reynolds numbers using smoke-streak and hot-wires measurements of the flow over a NACA 0012 airfoil<sup>[5]</sup>. Attack angle on the non-stationary aerodynamic characteristics and flutter resistance of a grid of bent vibrating compressor blades shows significant effect<sup>[6]</sup>. Spoiler position on aerodynamics characteristic of an aero foil shows significant effect<sup>[7]</sup>. A computational study of unsteady boundary-layer separation over an Eppler 387 airfoil at low- Reynolds numbers done appears to support this view<sup>[8]</sup>.

The rapid evolution of CFD has been driven for faster and accurate method for solving problems related to aerodynamics. The flow of air over the aerofoil's is the most important thing that has to be considered during designing an aircraft, missile, sport vehicles or any other aerodynamic objects. Analyzing the flow of a compressible fluid is always complex and consists of different terms and characteristics. By using ANSYS, flow analysis becomes more effective as it investigates everything more thoroughly than experimental method. CFD analysis enables an engineer to compute the flow numerically in a 'virtual flow laboratory'.

## II.COMPUTATIONAL METHODOLOGIES

Computational analysis is carried out to solve a flow field in two-dimensional NACA 4415 Aerofoil to analyze flow characteristics, and the effect of increase Reynolds number. Aerofoil is generated by using an online aerofoil generator from which the co-ordinates were imported to create the geometry of that aerofoil. After obtaining the co-ordinates, they were imported to Ansys 14.0 Workbench for creating the desired geometry. The 2D view of the aerofoil was shown in Fig.2.1. Standard  $k-\varepsilon$  model is used to predict the flow field. A UN steady state based implicit solver is used to achieve convergence. Second-order upwind scheme was used for the discretization of all the equations to achieve higher accuracy in results. Velocity-pressure coupling is established by pressure-velocity correlation using a PISO algorithm. Under-relaxation factors are used for all equation to satisfy Scarborough condition. Residuals are continuously monitored for continuity,  $x$ -velocity,  $y$ -velocity,  $z$ -velocity,  $k$ , and  $\varepsilon$ . Convergence of the solution is assumed when the values of all residuals goes below  $10^{-6}$  Enhanced wall treatment is used to solve for the near wall treatment, as  $y^+$  is more than 30 in the whole domain.

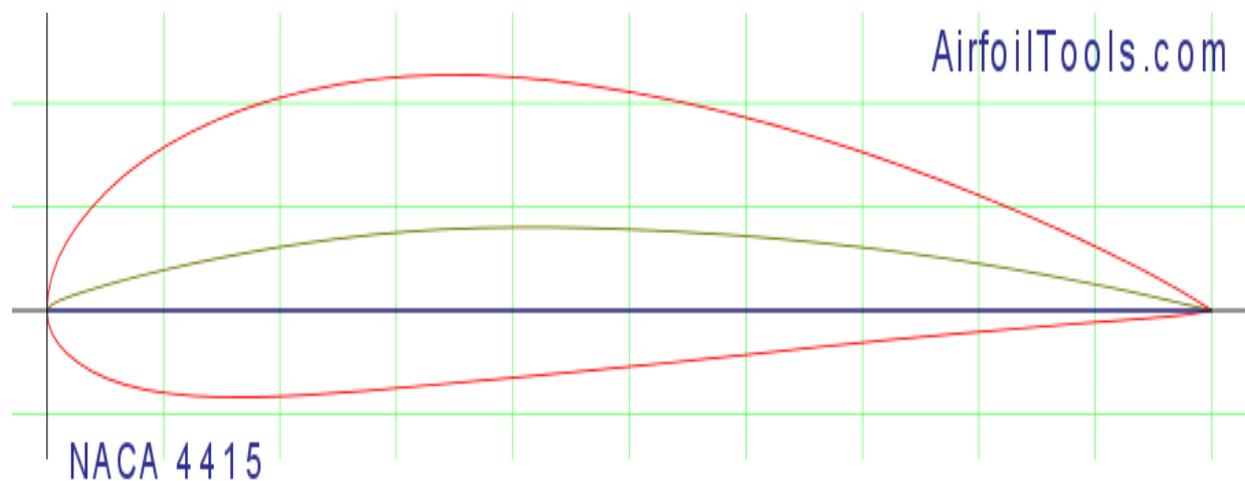


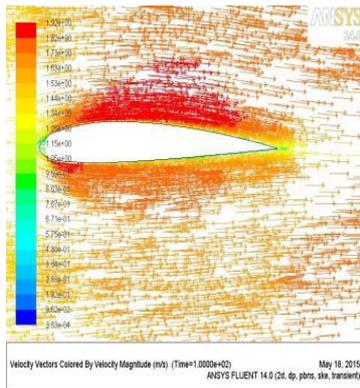
Fig 2.1: 2D view of NACA 4415 aerofoil

## III. RESULTS AND DISCUSSION

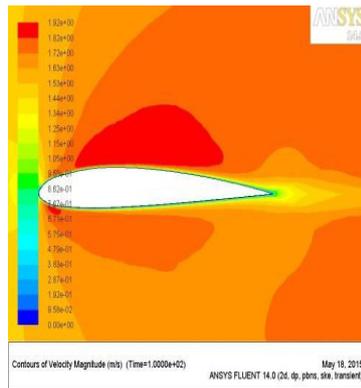
Velocity vectors, contours of pressure and velocity and coefficient of drag have taken to analyze the flow over NACA 4415 aerofoil at Reynolds no.5000, 6000, 100000, and 120000. Snaps of velocity vectors and contours of pressure and velocity taken for each and every model to give detailed view of the flow.

### 3.1 Flow at Reynolds Number 5000

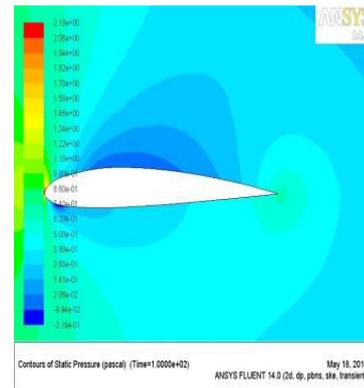
Figures 3.1.1, 3.1.2, 3.1.3 show the velocity vectors, contours of velocity and pressure at Reynolds no. 5000. At this low Reynolds number flow is steady laminar and no vortex formation behind the trailing edge. Contours of pressure and velocity show the formation low and high pressure on top and bottom part of the aerofoil. This has to create lift force.



**Fig 3.1.1: Velocity vectors**



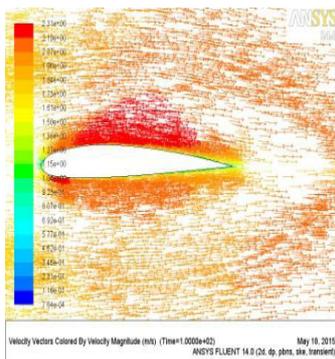
**Fig 3.1.2: Velocity contours**



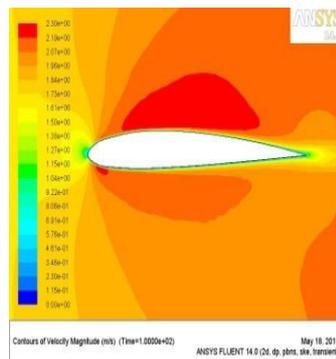
**Fig 3.1.3: Pressure contours**

### 3.2 Flow at Reynolds Number 6000

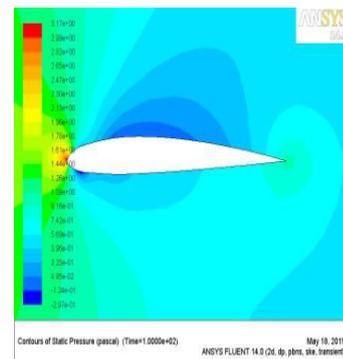
Figures 3.2.1, 3.2.2, 3.2.3 show the velocity vectors, contours of velocity and pressure at Reynolds no. 6000. At this low Reynolds number flow is steady laminar and no vortex formation behind the trailing edge. Contours of pressure and velocity show the formation low and high pressure on top and bottom part of the aerofoil. This has to create lift force



**Fig 3.2.1: Velocity vectors**



**Fig 3.2.1: Velocity contours**

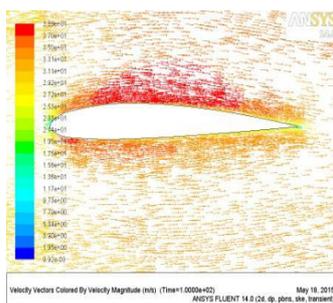


**Fig 3.2.3: Pressure contours**

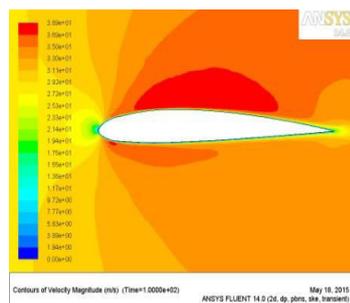
As the increasing Reynolds number in low Reynolds region there is no significant effect on the flow.

### 3.3 Flow at Reynolds Number 100000

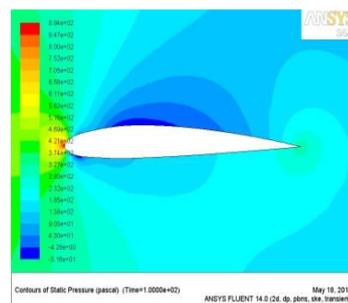
Figures 3.3.1, 3.3.2, 3.3.3 show the velocity vectors, contours of velocity and pressure at Reynolds no. 100000. At this low Reynolds number flow is steady laminar and no vortex formation behind the trailing edge. Contours of pressure and velocity show the formation low and high pressure on top and bottom part of the aerofoil. This has to create lift force. Compared to the low Reynolds number contour shows the pressure and velocity regions formation changes around the aerofoil



**Fig 3.3.1: Velocity vectors**



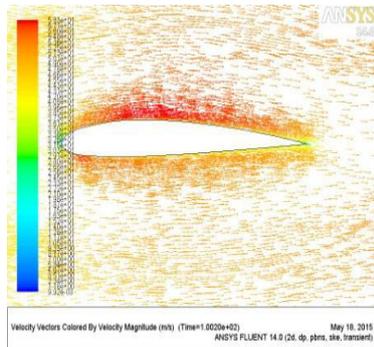
**Fig 3.3.2: Velocity contours**



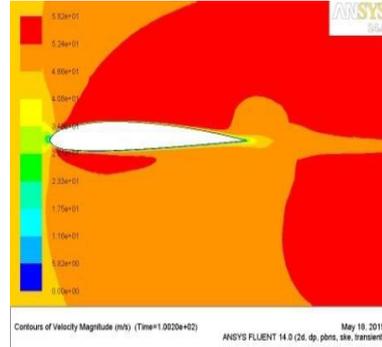
**Fig 3.3.3: Pressure contours**

**3.4 Flow at Reynolds Number 120000**

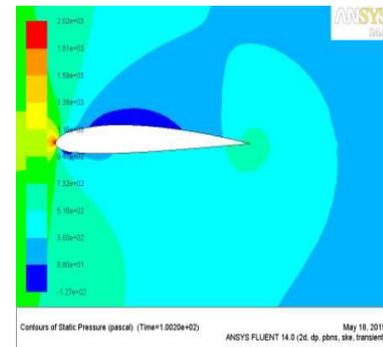
Figures 3.4.1, 3.4.2, 3.4.3 show the velocity vectors, contours of velocity and pressure at Reynolds no. 120000. At this low Reynolds number flow is steady laminar and no vortex formation behind the trailing edge. Contours of pressure and velocity show the formation low and high pressure on top and bottom part of the aerofoil. This has to create lift force.



**3.4.1: Velocity vector**



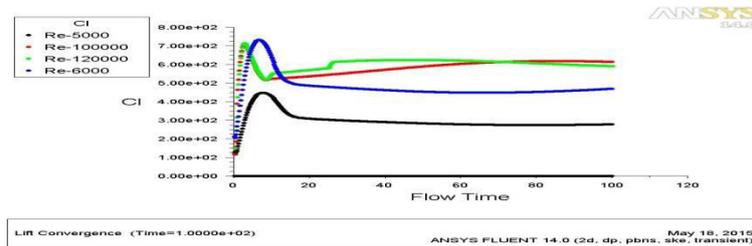
**Fig 3.4.2: Velocity contour**



**Fig 3.4.3: Pressure contours**

As the increase in Reynolds number in High Reynolds number region contours of velocity and pressure shows drastic change in region formation at upper part of the flow and is carry forward to behind the plate there is significant effect on the flow. High velocity region covers throughout the upper part of the aerofoil which compared to the flow at Reynolds number of 100000.

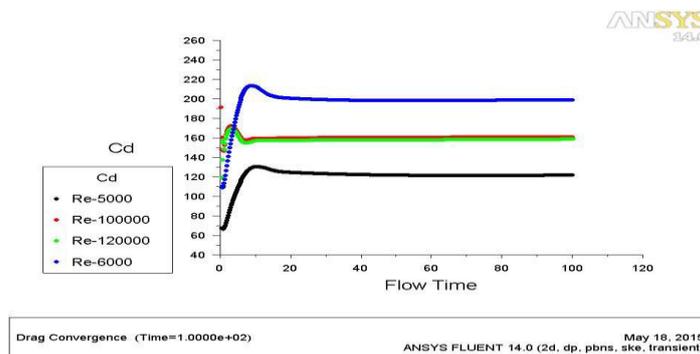
**3.4 Effect of Coefficient of Lift**



**Fig 3.5:Plot of Coefficient Lift w.r.to Flow time.**

At Reynolds number 6000 aerofoil has maximum coefficient of lift and at Reynolds number 5000 it has minimum Coefficient of lift. As Reynolds number increases from 100000 to 120000 no significant effect in coefficient of lift at starting time and later it shows effect.

**3.5 Effect of Coefficient of Drag**



**Fig 3.6: Plot of Coefficient Drag w.r.to Flow time.**

As we increase Reynolds number in high zone there is no significant effect on coefficient of drag. At Reynolds number 6000 it has maximum coefficient of drag compared to all other Reynolds number.

#### **IV. CONCLUSION**

Flow analysis is done NACA 4415 aerofoil at Reynolds number 5000, 6000,100000 and 120000. In the low Reynolds number region with the increase in Reynolds number there is no significant effect on regions surrounded by the aerofoil. Coefficient of drag is increased as Reynolds number increases. In the high Reynolds number as the Reynolds number increases drastic changes in the pressure regions on aerofoil surfaces and behind the aerofoil region.

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