Comparison of COD Removal from Textile Waste Water by Using Activated Carbon & Activated Lignite

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Abstract -- Environment Protection and sustainability has been a major challenge thrown by rapid industrialization. High level of COD effluent water streams from such source significant harm in human consumption as well as aquatic life. It is very important to use such a treatment process is low cost and sustainable. A number of conventional treatment technologies have been considered for treatment of wastewater such as coagulation process, membrane filtration and oxidation process. These methods are generally expensive. Among them, adsorption process is found to be the most effective method. Adsorption process is gaining interest as one of the effective processes of advanced wastewater treatment for industrial effluent. In case we are using adsorption process for water treatment purpose presently Activated carbon is most widely used as adsorbent, but it is found to be quite expensive. Inexpensive adsorbents like Activated lignite has considered for detailed studies with respect to their performance in treating different waste water streams from effluent. The objective of this work is to study sustainable process which benefit for small and large scale industry by using low cost adsorbent like Activated lignite for remove organic pollutants from water. The results of COD reduction are fitted into different models available in literature which requires least experimentation for predicting COD values.

Indexed Terms: Activated carbon, COD, Activated Lignite, Waste water

I. INTRODUCTION

Water is the most important and it is used in all type of industries for different processes. It may be widely used for washing, dilution, fermentation and condensing the steam. Generally all industry generates waste water that needs urgent attention. Wastewater discharged by industrial activities is often contaminated by a variety of toxic or otherwise harmful substances which have negative effects on the water environment. Pollution of water by organic and inorganic chemicals is of serious environmental concern Waste water generated from different industry has a high percentage of COD and other different contamination available in waste water, which cannot be discharged in water resources without any treatment [5].A number of conventional treatment technologies have been considered for treatment of wastewater such as coagulation process [7], membrane filtration [10] and oxidation process [8]. These methods are generally expensive. Among them, adsorption process is found to be the most effective method. Adsorption process is gaining interest as one of the effective processes of advanced wastewater treatment for industrial effluent [3].

II. LITERATURE REVIEW

Adsorbent	Adsorbate	Amount adsorbed(mg/g)	Reference
Activated Lignite	Methylene Blue	41.94	[11]
Activated Lignite	Cadmium	40	[12]
Activated Lignite	Organic matter	56.65	[13]

III. EXPERIMENTAL PROCEDURE

- Sample preparation:

For the contact time experiments, waste water sample was collected in labelled carboys and the carboys were then sealed. The samples were taken from the ETP inlet stream. These samples are directly collected from the process plant streams before these had any chance of getting mixed with any other stream. In most of the cases these were concentrated streams, often referred as mother liquor.

- Procedure:

While carrying out experimental studies on the waste water from each carboy sample was analyzed for pH and COD. During experiment 200ml of sample was taken from the respective carboy in a cylindrical flask. In which 1% (2gm) Activated carbon (A/C)

was added in to the flask and magnetic stirrer was started. 5-10 ml of sample was drawn in time interval of 10, 20, 30, 40, 60 min from this mass. Then Filtered on filter paper and the filtrate analyzed for COD. At the end of 60 min the stirring is stopped and the experiment is terminated. The experiments were repeated terminated. The experiments are to be repeated with 2% A/C, 3% A/C and 4% A/C, and similar procedure followed for Activated Lignite adsorbent. All the experiments were to be carried out at room temperature of around 30°C.

- Activation method of Lignite:

Fig. 1: Activation method of Lignite

IV. RESULTS & DISCUSSION

- Effect of time of contact:

The value of COD reduction increases with increase in time and after that the stage is reached when further increase in COD reduction value is practically increased small. Initially in the time period of 10min to 30min the span of COD reduction is higher than that of time period of 30 min to 60 min.

- Effect of Quantity of adsorbent:

COD Reduction for sample using Activated Lignite is 21% to 58% for 1% Activated Lignite to 4% Activated Lignite and activated carbon is 48.7% to 72.4 % for 1% activated carbon to 4% activated carbon and. The above observations were made for two different adsorbents such as Activated carbon and Activated Lignite. Activated Lignite gives better results for COD reduction compare to that of Activated Carbon under identical conditions.

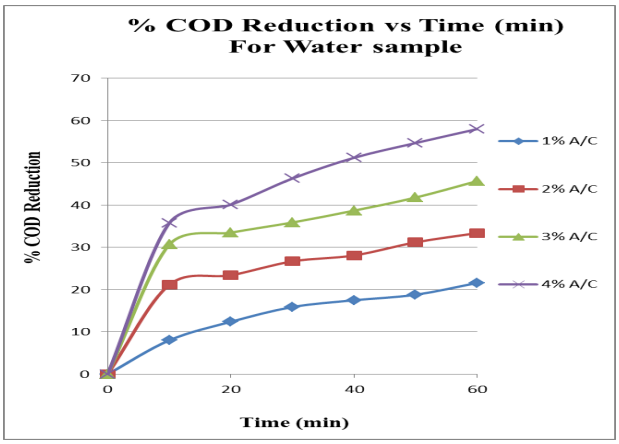


Fig. 2: %COD Reduction vs. Time for A/C

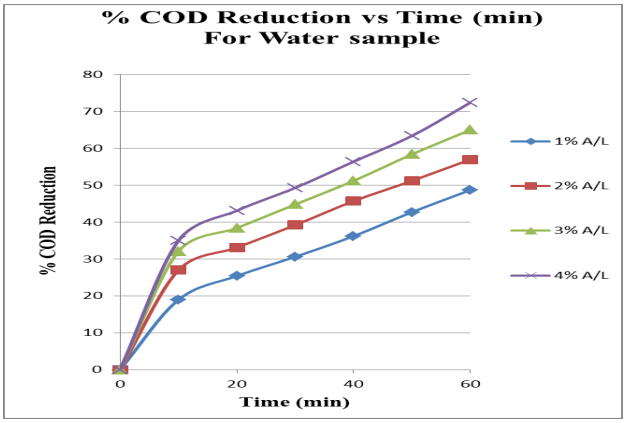


Fig. 3: %COD Reduction vs. Time for A/L

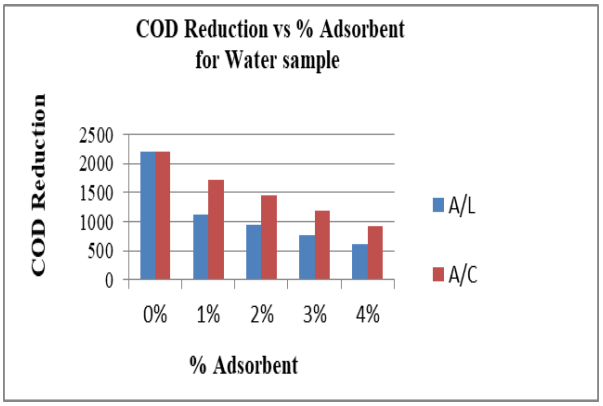


Fig. 4: Comparison of A/L & A/C for COD Red. vs %Adsorbent

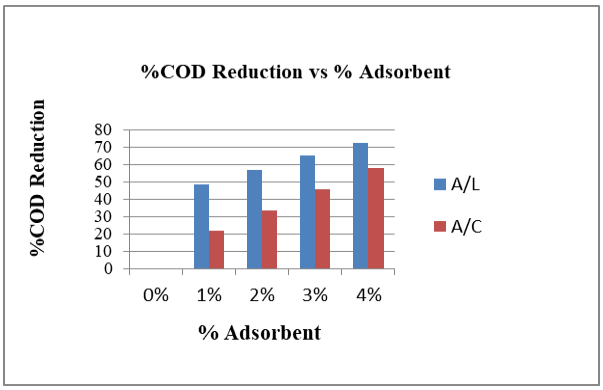


Fig. 5: Comparison of A/L & A/C for %COD red vs. %Adsorbent

V. MATHEMATICAL MODEL'S

1. Rathi-Puranik equation

   Log (CODRT) = m t + c

   Where, CODRT = (Ci-C)/t

   Ci = Initial concentration

   C= Concentration at time t

   t = time in minute

   m = slope

2. Weber - Morri's equation

   $(Ci-C)/Ci = m_1 t^{0.5} + c_1$

   Where, Ci = initial concentration

   C= Concentration at time t

3. Lagergean equation

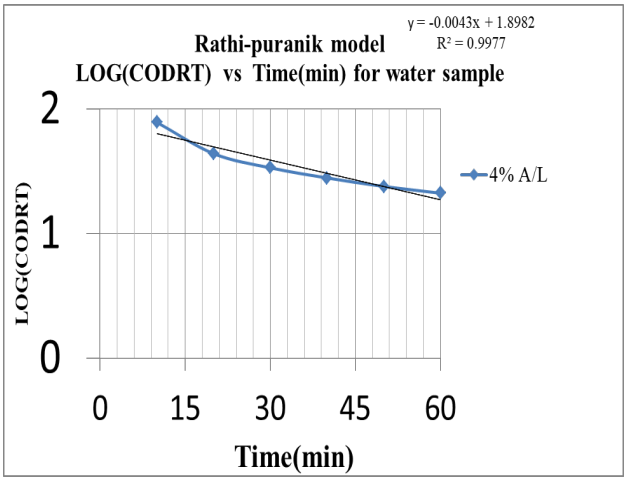
   $\log (C-C_{eq}) = m_2 + c_2$

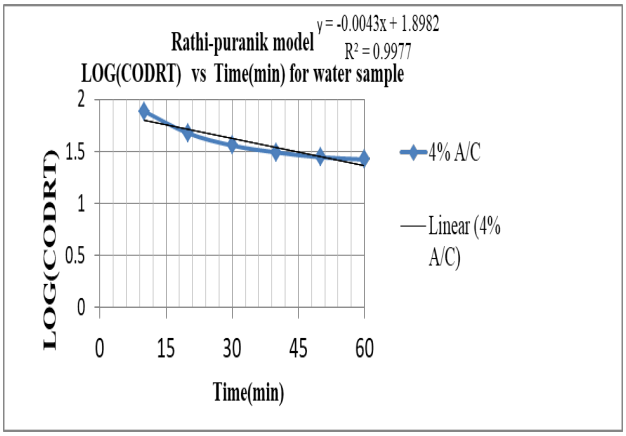
Where,

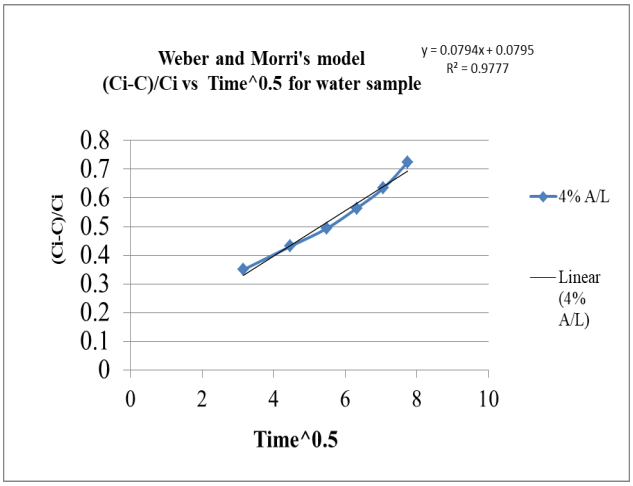
C=Concentration at time t

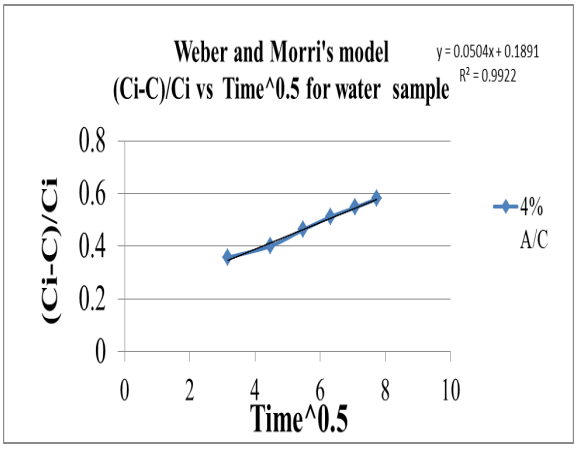
Ceq= Equilibrium concentration

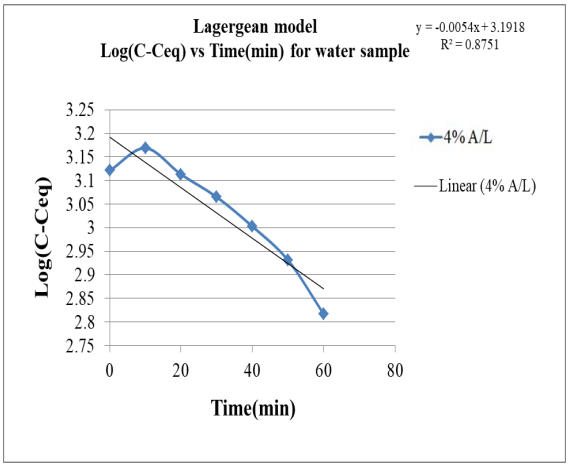
These model are useful to predict COD value at different time interval

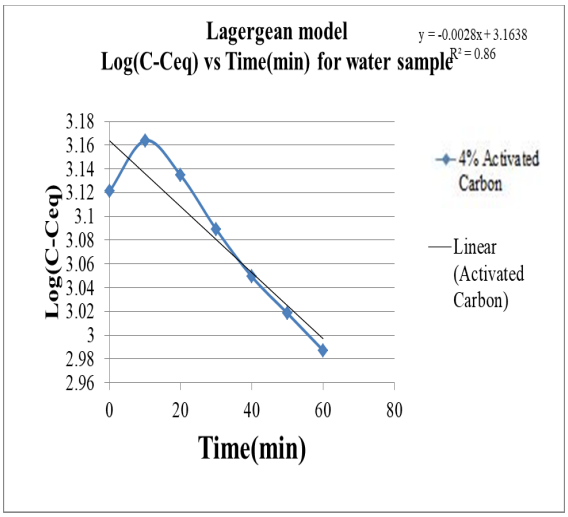












VI. CONCLUSION

From the comparison of COD values and %COD reduction values between Activated carbon and Activated lignite it is found that, %COD reduction value are higher for Activated Lignite than Activated Carbon. and Activated carbon is generally expensive it is not suitable for small scale industry and the cost of activation process of Lignite is quit low as compare to activated carbon Thus, high cost activated carbon can be replaced by Activated lignite .

Study on mathematical modelling for three mathematical models – Rathi - Puranik model, Weber- Morri's model, and Lagergean model ,we conclude that Rathi - Puranik model is more appropriate than Weber-Morri's model and Lagergean model to predict the COD value at any time in a given system.

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