Treatability Study for Reduction of Colour Using Industrial Waste Material - A Case Study

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Abstract -- Environment Protection and sustainability has been a major challenge thrown by rapid industrialization. Due to increasing demand of colour free water in many industries like dye industry, textile industry, etc. So, it becomes interesting deals for researcher to find the most economical and efficient method for removal of colour from industrial waste water. The most important technologies are useful the waste water treatment such coagulation, membrane technology filtration ion exchange and advanced oxidation processes However, most of them above depend on the substantial financial input and their use is restricted because of cost factors, it is very important to use such a treatment process is low cost and sustainable. Among various water purification and recycling technologies but adsorption is a fast, inexpensive and universal method. It is most effective for waste water treatment. In case of adsorption process, activated carbon is widely used, but it is restricted within small scale industries due to high cost. So, inexpensive adsorbents like bagasses, fly ash are used for waste water treatment. There are different types of waste which can be converted into activated carbon by chemical activation using different activating agents like Hcl, H2So4.These activating agents are used by different investigators for activation of carbon prepared from waste at different performing conditions.

Indexed Terms - Activated carbon, Bagasses, Fly ash, Industrial waste effluent. Colour

I. INTRODUCTION

The quality of our water resources is getting worse day by day due to the continuous addition of undesirable chemicals in them. The world-wide high level of production and use of dyes and textile industries are generates colored wastewaters, which give cause of environmental concern. Because of these the discharge of such effluents in the environment is worrying for both toxicological and esthetical reasons. Therefore, the importance of water quality preservation and improvement is essential in life and increasing continuously. The scientists, academicians and governmental agencies are very serious on the pollution of water resources globally. The surface and ground waters at many places of the world are contaminated and not fit for drinking purpose. By 2050, the global population is expected to reach up to 9.3 billion and the world may be under great fresh water scarcity. Therefore, the removal of toxic organic pollutants from water is essential in the present scenario

The chemical contamination of water from a wide range of toxic derivatives, in particular heavy metals, aromatic molecules and colours, is a serious environmental problem owing to their potential human toxicity. Therefore, there is a need to develop technologies that can remove toxic pollutants found in wastewaters. Among all the treatments proposed, adsorption is one of the more popular methods for the removal of pollutants from the wastewater.

Activated carbon is the most popular adsorbent, which can adsorb many dyes with a high adsorption capacity. It is very expensive, and the cost of regeneration is high because desorption of the dye molecules is not easily achieved. Various low cost and sustainable adsorbents have been investigated as alternatives to activated carbon. Fly ash is a waste material originating in large amounts from high-temperature combustion of coal and wood. It exhibits good sorption capacity, non-toxicity, hydrophilicity, biocompatibility and susceptibility to biodegradation. Also, fly ash has been found to be an efficient adsorbent for water treatment in the removal of dissolved organic carbon.

Literature reports adsorption method for the expulsion of color from waste water. Adsorption is considered as the best wastewater treatment technique because of its all-inclusive nature, modesty and simplicity of operation. Adsorption can likewise evacuate soluble and insoluble organic pollutants. Due to these facts, adsorption has been used for the removal of a variety of organic pollutants from various contaminated water sources. Basically, adsorption is the accumulation of a substance at a surface or interface. In case of water treatment, the process occurs at an interface between solid adsorbent and contaminated water. The pollutant being adsorbed is called as adsorbate and the adsorbing phase as adsorbent.

II. EXPERIMENTAL PROCEDURES

A. 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 outlet / CETP 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.

B. Procedure

While carrying out experimental studies on the waste water from each carboy sample was analyzed for pH and Colour. During experiment 100 ml of sample was taken from the respective carboy in a cylindrical flask. In which 1% Fly Ash was added in to the flask and magnetic stirrer was started. At the end of 1 hour the stirring is stopped and the experiment was terminated. The experiments were repeated terminated. The experiments are to be repeated with 2% Fly Ash, 3% Fly Ash and 4% Fly Ash, and similar procedure followed by Bagasse adsorbent. All the experiments were to be carried out at room temperature of around 30 oC.

C. Activation of bagasse

The bagasse is crushed into small particle. And then washed by distilled water, after washing bagasse they are dried at room temperature for 24 hours. The small bagasse are placed into the furnace and heated at high temperature about 450 0C. From the furnace we obtain carbonized bagasse. This bagasse is washed and dried at room temperature. The chemical activation of this material is done by adding a strong acid into a material. 0.1 N HCL are adding into the bagasse powder and heated at high temperature (4500C-6000C).

D. Activation of fly ash

Fly ash from thermal power plant are washed by distillate water and dried at room temperature for 24 hours. Strong acid like H_2SO_4 is take 0.1 N and add into fly ash and they are heated at high temperature (4500C-6000C).

III. RESULTS AND DISCUSSION

A. Effect of Quantity of adsorbent

At 15-minute Colour Reduction for waste water sample of using bagasse is 8.33% to 16.67% for 1% bagasse to 4% bagasse and using fly ash 5.83% to 9.17% for 1% fly ash to 4% fly ash.

At 30-minute Colour Reduction for waste water sample of using bagasse is 12.50% to 26.67% for 1% bagasse to 4% bagasse and using fly ash is 6.17% to 15.50% for 1% fly ash to 4% fly ash.

At 45-minute Colour Reduction for waste water sample using bagasse is 16.33% to 50% for 1% to 4% bagasse and using fly ash is 6.83% to 23.17% for 1% fly ash to 4% fly ash.

At 60-minute Colour Reduction for waste water Sample using bagasse is 16.50% to 58.33% for 1% bagasse to 4% bagasse and using fly ash is 7% to 33.33% for 1% fly ash to 4% fly ash.

The above observations were made for two different adsorbents such as bagasse and fly ash, it was found that %Colour reduction value for bagasses is higher than that for fly ash for same contact time under identical conditions.

Therefore, bagasses is more effective than fly ash for neutral sample.

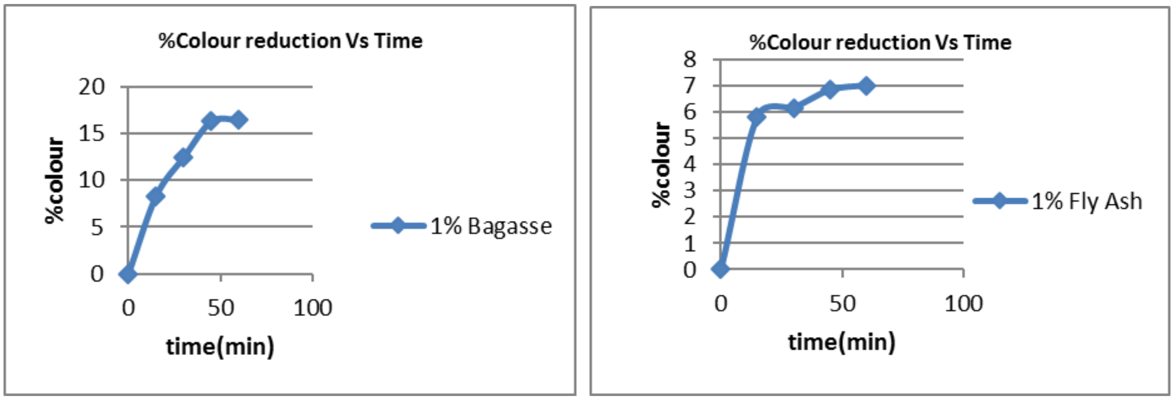

Figure 1: % Colour Reduction v/s Time for waste water sample (1% Adsorbent).

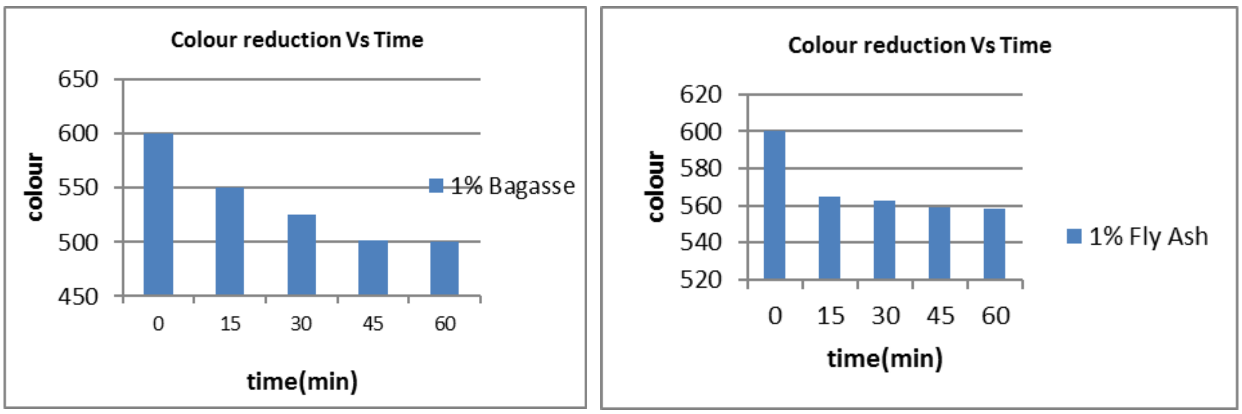

Figure 2: Colour Reduction v/s Time for waste water sample (1% Adsorbent).

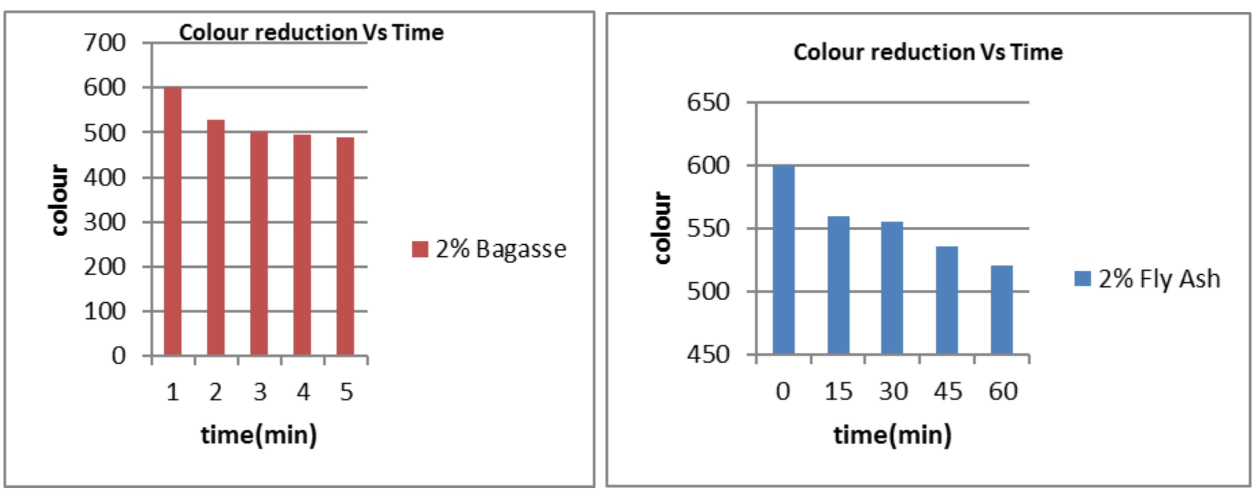

Figure 3: Colour Reduction v/s Time for waste water sample (2% Adsorbent).

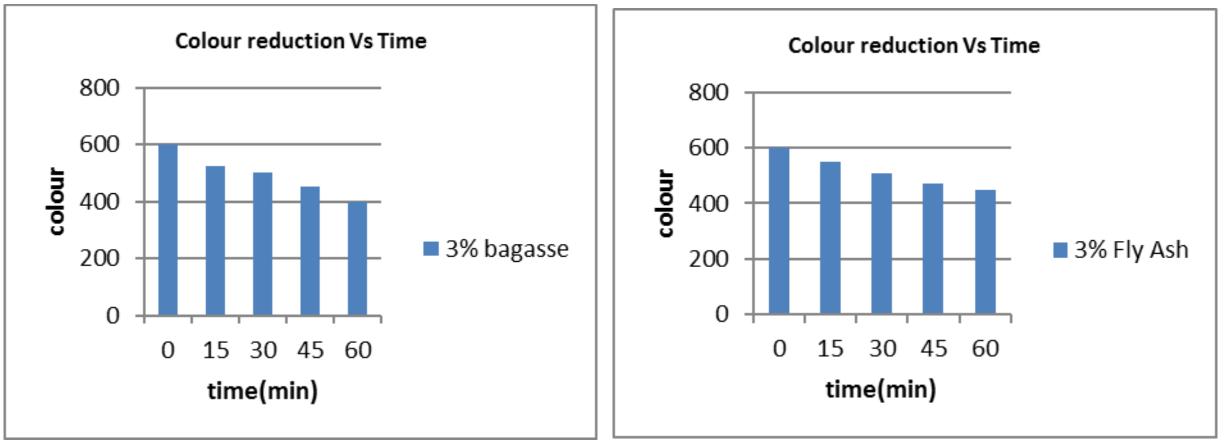

Figure 4: Colour Reduction v/s Time for waste water sample (3% Adsorbent).

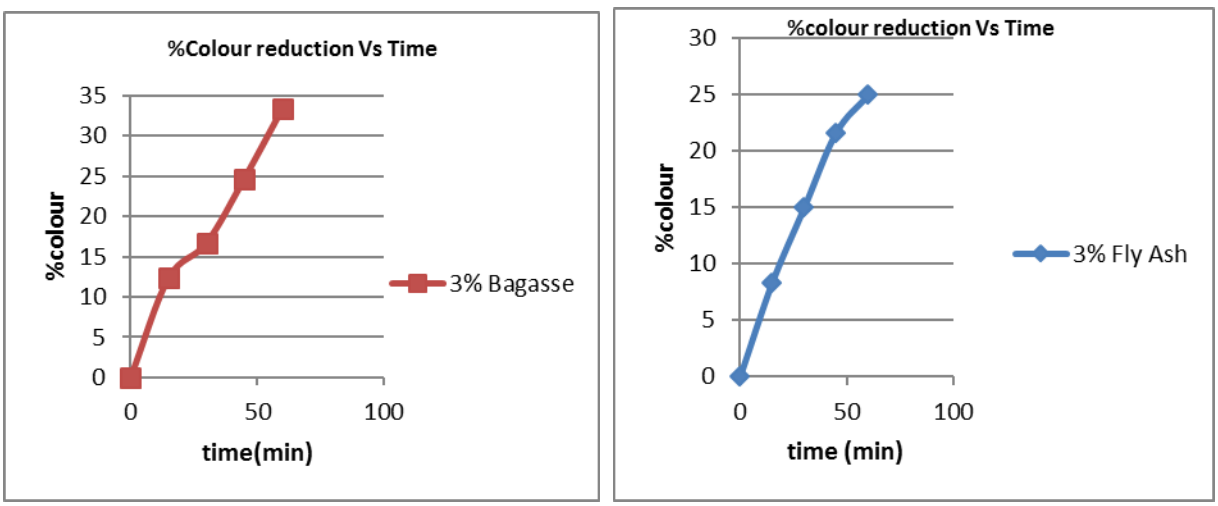

Figure 5: %Colour Reduction v/s Time for waste water sample (3% Adsorbent).

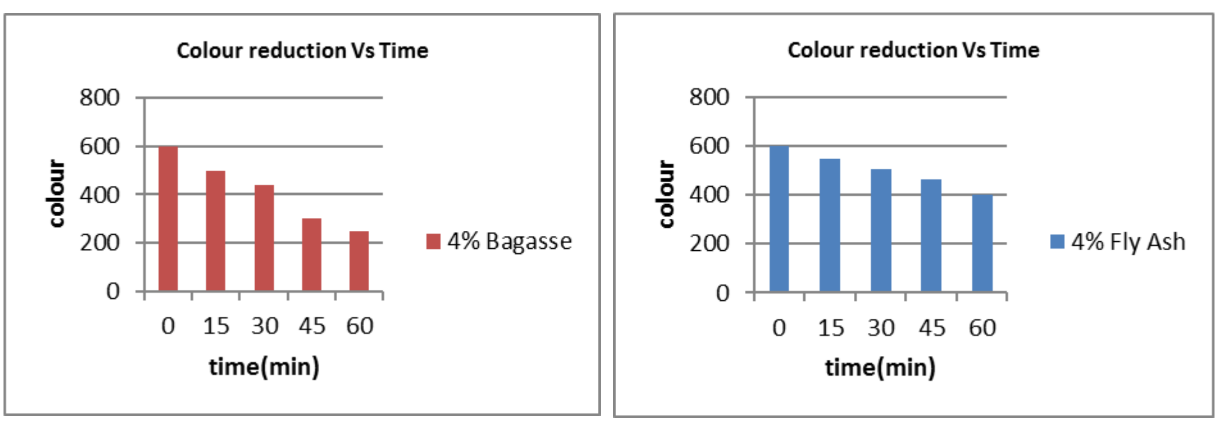

Figure 6: Colour Reduction v/s Time for waste water sample (4% Adsorbent).

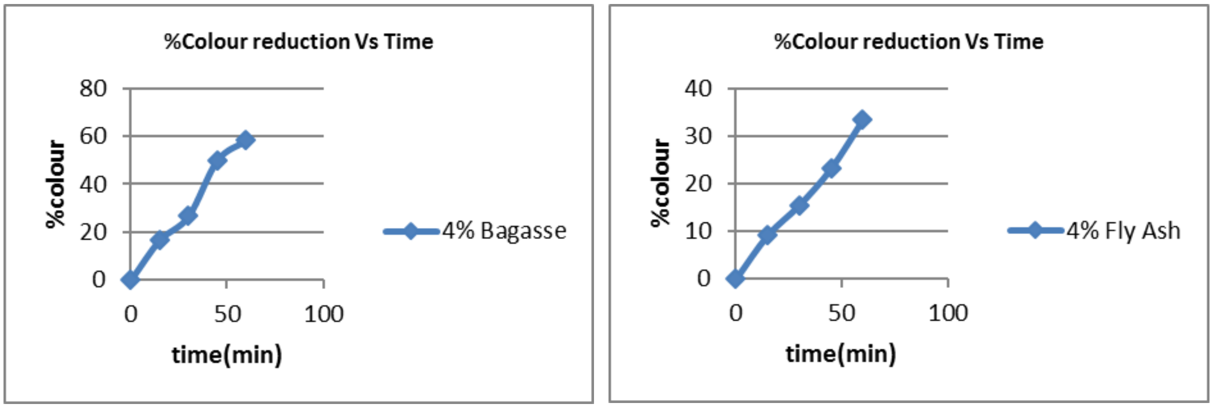

Figure 7: % Colour Reduction v/s Time for waste water sample (4% Adsorbent).

IV. CONCLUSION

From the comparison of colour and %colour reduction values for waste water sample, we can conclude that, as time increases, and adsorbent quantity increases the color value decreases and % colour reduction increases.

From the comparison of colour values and %colour reduction values between bagasse and fly ash it is found that, %colour reduction value is higher for bagasse than fly ash. Thus, fly ash can be replaced by bagasses.

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