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Preliminary Adsorption Studies on Textile Industry Waste Water Using Sugarcane Bagasse as an Adsorbant

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Abstract:
In this present research paper natural adsorbant sugarcane bagasse was used for removal of color from waste effluent of textile industry. The adsorbant prepared was employed for the removal of color at the different doses. The adsorbant was found to be capable of removing color from wastewater; the color removal capacity for sugarcane bagasse was approximately 88% at normal pH and temperature from the experimental investigations, the maximum color removal from the textile industry wastewater was obtained at an optimum adsorbant dosage of 10g/l of wastewater, with an optimum contact time of 24 hours, at room temperature. This result was higher than the results obtained by different process parameters for various adsorbants. Finally, from the results of adsorption study, it was concluded that adsorbants has the capacity of removing the color from textile industry wastewater especially sugarcane bagasse because of its higher adsorptive capacity. Thus it was found that sugarcane bagasse can be used as an effective adsorbent for removing color and other pollutant parameters such chloride, sulfate, iron, BOD, COD from textile industry wastewater. As the result of this study transmittance was found to be at the increased level of 88%, absorbance was reduced up to the level of 0.05, the sulfate was reduced from 318.45mg/l to 92 mg/l.

Key words: *Adsorption, sugarcane bagasse,transmittance, Textile Industry Wastewater, Colour Removal*

1. Introduction

Expansion of business activities and explosion of the population coupled with industrial revolution results in pollution of water, air and soil. The discharge of pollutants from various industries poses threat to Earth's biodiversity. Among various types of environmental pollution, water pollution is of major concern and for its occurrence dye-based industries are the main cause and foremost [Pankaj Sharma and Harleen Kaur]. Dyes production industries and many other industries which used dyes and pigments generated wastewater, characteristically high in colour and organic content [Gong. R et al.,]. It is usually treated with either by physical or chemical processes. However, these processes are very expensive and cannot effectively be used to treat the wide range of dyeswaste. The adsorption process is one of the effective methods for removal of dyes from the waste effluent. The Process of adsorption has an edge over the other methods due to its sludge free clean operation and completely removed dyes, even from the diluted solution [Mane. V. S et al.,].The commonly used adsorbent is activated carbon. However, commercially available activated carbons are very expensive. Therefore, there is a need to produce low cost and effective adsorbant can be used to control water pollution problem.

In recent years, Many studies have been carried out to find out inexpensive alternatives such as coir pith, banana pith, rice husk, clay, groundnut shell, maize cob, orange peel, coconut husk, wheat straw dust etc. The use of sugarcane bagasse has also been studied as an adsorbent for the colour removal from the aqueous solution. Instead of just disposing the bagasse has a waste, the efficient utilization can be made to remove the dyes from the wastewater. Related to this, the utilization of sugarcane bagasse for

the removal of dye from aqueous solutions has been dealt here in this review.Various non-conventional and low cost materials have been studied for the removal of dyes from aqueous solution. These include orange peel, spent tea leaves.
[Ardejani.F.D et al., and Hameed.B.H.,]
Nowadays, there are numerous low cost, commercially available adsorbants which are used for dye removal. However, the adsorption efficiencies of this adsorbants are not very high. This has led to the further research on the use of low-cost, easily available adsorbants with high efficiencies [Ashoka .H.S and Inamdar .S.S].

pH	6.96
Conductivity	6.01 mS
TDS	3.23ppt
Adsorption	0.36
Transmittance	43%
Turbidity	13 NTU
BOD	400mg/l
COD	1680mg/l
Chloride	1052mg/l
Iron	18.7mg/l
Sulfate	318.45mg/l

Table 1: Initial parameters of textile waste water

2. Materials and Methods

2.1. Bagasse
Also called Megass, it is the fiber remaining after extraction of sugar bearing juice from sugar cane .It is a waste material obtained after all the juice has been extracted from sugarcane The bagasse can be easily obtained from any sugar cane juice corner or sugar manufacturing industry at nominal cost in abundant quantities. [Pooja V Shrivastava]

2.2. Preparation of adsorbant
Sugarcane bagasse was collected and cut into small pieces. It was rinsed several timewith tap water and dried overnight at 60°C. The driedbagasse was ground and used an adsorbant.

2.3. Experimental setup
The dye waste is taken in a clean, dry 250 ml Erlenmeyer flask and its initial pH value is fixed. Adsorbant which is pre-prepared is added into this with a dosage rate of 2.5g, 5g, 7.5g, 10g, and 12.5 grams per litter. The flask are initially stirred with a glass rod for mixing, it's shaken in orbital shaker for 24 hours. Samples were drawn at regular intervals and checked for pH, conductivity, TDS, turbidity, transmittance, absorbance, BOD, COD, chloride, sulfate as per APHA standards. All the tests are done in triplicate and the concordant values were taken for the results comparison, which are given in figure 1 to figure 6. For the full study analytical grade chemicals were used from, Merck, loba chemic and fisher scientific.

3. Results and Discussion

3.1. Effect of adsorption time
Tostudy the effect of adsorption time, the observations were plotted in figure 5.Thisfigure shows that the %Transmittance increases with adsorption time for constant adsorbent amount of 2 gm. Itis observed that initial uptake of dye is quite fast showing 88 % Transmittance during the first24 hours.

3.2. Effect of amount of adsorbant
Experiment was performed for four different amounts of adsorbant and it wasobserved that % Transmittance increases with increasing the amount of adsorbent for the same adsorption time for a constant dye composition Figure 4. For instance the solution of 5% composition gave 81% transmittance for 1.5gm of adsorbent and 88%transmittance for 2 gm adsorbant, when observed for 24 hours adsorption time.

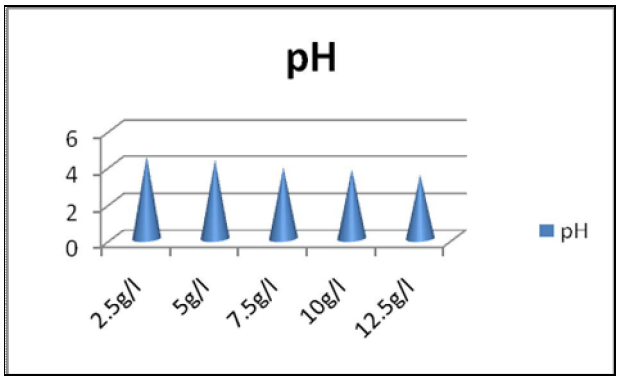

Figure 1: pH Vs Adsorbant dosage

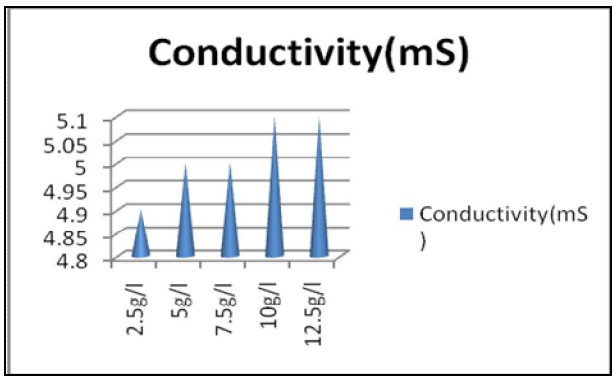

Figure 2: Conductivity Vs Adsorbant dosage

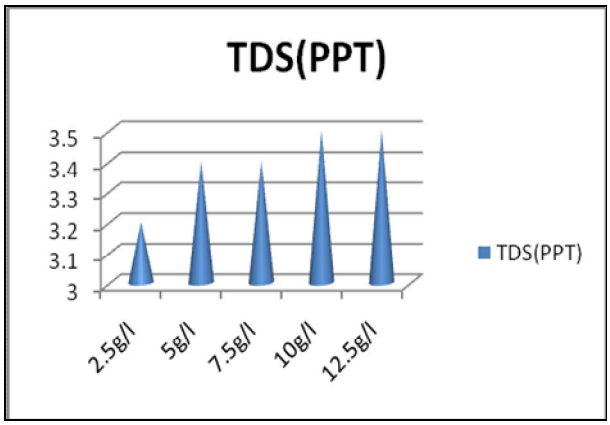

Figure 3: TDS Vs Adsorbant dosage

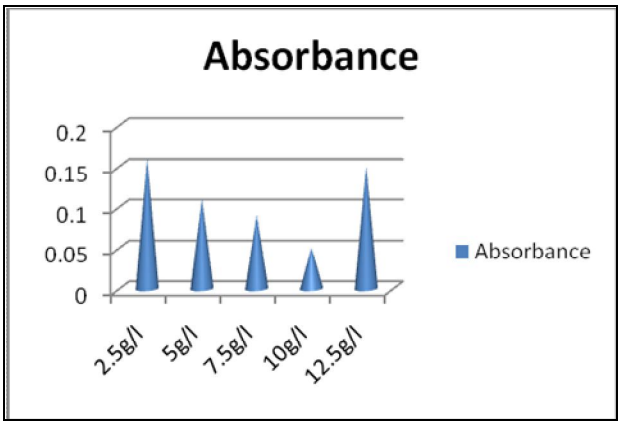

Figure 4: Absorbance Vs Adsorbant dosage

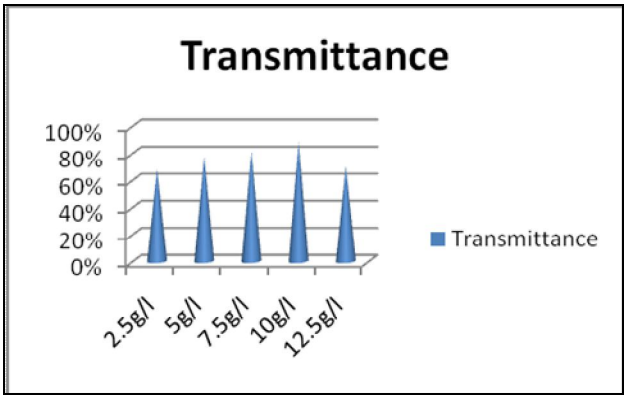

Figure 5: Transmittance Vs Adsorbant dosage

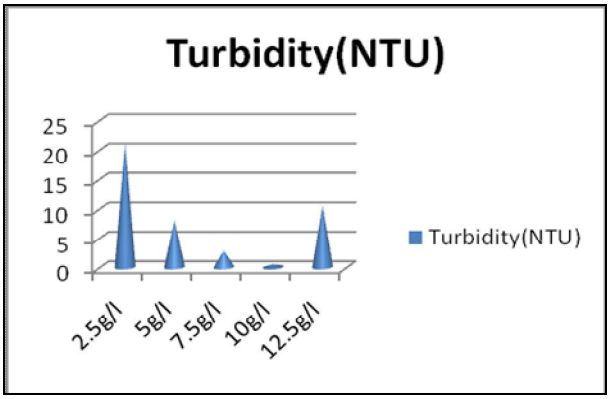

Figure 6: Turbidity Vs Adsorbant dosage

4. Conclusion

In present work attempt have been made for studying the colour removal efficiency of low cost adsorbant prepared from sugarcane bagasse. From the experimental finding it has been observed that sugarcane bagasse can be used as an effective adsorbant material which can be used successfully for removal of colour. The maximum color removal efficiency was observed up to 88% for prepared sugarcane bagasse. It was found that colour removal efficiency was achieved maximum a very low dose of 10g/l with retention time of 24 hours. The result of pH study shows that the adsorbant was effective at neutral pH. It is also found that sugarcane bagasse adsorbant reduced the sulfate content from 318.45 mg/l to 42.6 mg/l (87%), chloride content from 1052 mg/l to 425 mg/l (59.6%), iron from 18.7mg/l to 4 mg/l (79%), BOD from 400mg/l to 40mg/l (90%) and COD from 1680mg/l to 1280mg/l. Which proved to be a more effective treatment solution, also there is a 96% turbidity reduction and 87% absorbance reduction in this study. Thus it is proved that sugarcane bagasse can be effectively used as a low cost adsorbant. It is further advised that column studies may be performed to analyze the performance of sugarcane bagasse as a low cost adsorbant.

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