Universal Journal of Environmental Research and Technology
 eISSN 2249 0256
Available Online at: **www.environmentaljournal.org**
2013 Volume 3, Issue 6: 695-698

Open Access **Short Communication**

Studies on Textile Industry Waste Water Using Saw Dust as a Low Cost Adsorbent

[1]S. Vijayakumar, [1]C. Arunprakash, [2]V. Sivakumar, [2]M. sangeetha,[2]T. Narmatha,[2]M. Nishanth,[3]R. Gobinath

1, 2 Department of Civil engineering, Jay Shriram Group of Institutions, Avinashipalayam, Tirupur, India
3Department of Civil engineering, Jay Shriram Group of Institutions, Avinashipalayam, Tirupur, India

Corrosponding author: vijay.tip@rediffmail.com

Abstract:

The textile wastewater contains different colors which are harmful to the environment. The removal of dyes from effluent using adsorption process provides an attractive alternative treatment, especially if the adsorbant is inexpensive and readily available. In this present research paper natural adsorbant saw dust 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 saw dust was approximately 70% 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 12.5g/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. It is found that the transmittance was found to be 67% with an absorbance of 0.16, BOD too was reduced from 400mg/l to 300mg/l. also owing to the adsorption process several other parameter such as chloride, sulfate, iron, COD was also reduced considerably.

Keywords: Adsorption, Color Removal, saw dust, Textile Industry Wastewater, dyes, pollution.

1 Introduction:

Industrial effluents are one of the major pollutants of water. Many dyes are carcinogenic and affect the life of Aquatic organisms (Baughman et al., 1998; Hassan et al., 2009). The worldwide annual growth rates of reactive dyes are four times as much as for conventional dyes (Zollinger, 2003).Presence of such dyes in effluents causes a lot of pollution in water. Various challenges have been made to remove these harmful dyes from industrial wastes (Ho et al., 2005;Mohantyet al. 2006; Sousa et al., 2012). Adsorption is one of the cheapest and most effective techniques (Cotorueloet al., 2007; Dee et al., 2006).Different adsorbants are used for the removal of dyes from aqueous solutions such as alumina, crushed bricks, peat, sand, charcoal bentonite, silica, apricot etc. (Hu et al.,2006; Jain et al., 2009; Senthilkumaa et al.,2006). The most widely used adsorbant for the removal of dyes were dust which is in expensive and easily available. Therefore, the interest isgrowing to find out an alternative adsorbant to commercial adsorbant. The conventional biological treatment processes are not very effective in treating textile wastewater due to the chemical stability of the dye components (Garget al., 2003). Various methods have been used to remove color from industrial effluents to decrease their impact on the environment. These technologies include adsorption on inorganic or organic matrices, Decolorisation by photo catalysis or photo-oxidation processes, microbiological decomposition, chemical oxidation, ozonation and coagulation (Shuklaet al.,2002; Malaviya and Rathore, 2007). Among these, photo-oxidation, microbiological decomposition, chemical oxidation, ozonation and coagulation are considered very expensive in terms of energy and reagents consumption (Churchley, 1994; Stern et al., 2003).However, adsorption process is considered very effective in textile wastewater treatment as it proves superior to the other processes by being sludge free and can completely remove even very minute amounts of dyes in wastewaters (Nigam et al., 1996). The most widely used adsorbant for industrial applications is activated carbon (Walker and Weatherley, 1997; Khalil and Girgis, 1998), but it is very expensive. Hence, numerous studies on adsorption properties of naturally occurring and low cost adsorbants, such as agricultural by products and natural fibers, namely; waste coir pith (Namasivayamet al., 2001), corncob and barley husk (Robinson et al., 2002),ash (Isa et al., 2007 and sawdust (Garget al., 2003; Khattri& Singh, 2009) have been reported in recent years. In the present study an attempt has been made to use sawdust as an adsorbant for removal of pollutants from textile effluent.

Table 1.Initial parameters of textile wastewater

pH	6.96
Conductivity	6.01mS
TDS	3.23ppt
Adsorption	0.36
Transmittance	43%
Turbidity	13NTU
BOD	440mg/l
COD	1680mg/l
Chloride	1052mg/l
Iron	18.7mg/l
Sulfate	318.45mg/l

2 Materials and Methods

2.1 Saw dust

The sawdust was collected from the local saw mill and sieved through a mesh of size 420µm. Then, it was washed with distilled water to remove the surface adhered particles and dried at a temperature of 60-80^{0}C in an oven.

2.2 Collection of samples:

The wastewater samples were collected at the end of unit operation in dying unit at tirupur which contains the wastewater of process as dyeing in acid washed cans.

2.3 Analysis of samples

The effluent samples which contain several metals and organic compounds were analyzed to measure their pH, electrical conductivity, dissolved oxygen, turbidity and chemical oxygen demand (COD), using standard methods.

2.4 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.

Picture 1.

3 Results and Discussion

3.1 Effect of Adsorbent Dosage

A number of investigations were carried out by varying the amount of saw dust from 2.5 to 12.5 g at the fixed initial dye concentration of 1 liter, pH of 7 and room temperature of 25±1 °C. These studies showed an increase in adsorption with the increase in the dose of adsorbant. Optimum adsorbant dose was found to be 12.5 g/l. it was found that the maximum transmittance of 67% and turbidity 8.1NTU.

Picture 2.

3.2 Effect of time

To study the effect of time on efficient removal of color from textile waste the study was carried out. The wastewater sample was taken in a 200 ml conical flask and kept in an orbital shaker at temperature 25±1^{o}C and 150 rpm. The sample was withdrawn from the conical flask and results are compared with original color concentration of waste water to know the color removal efficiency of adsorbants. It is clear from the results that time plays an important role in color removal of dye waste. The optimum time duration required for color removal is 24hours retention period.

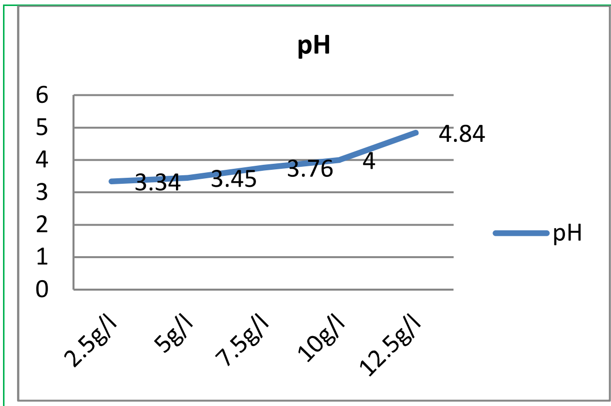

Figure 1.pH Vs Adsorbant dosage

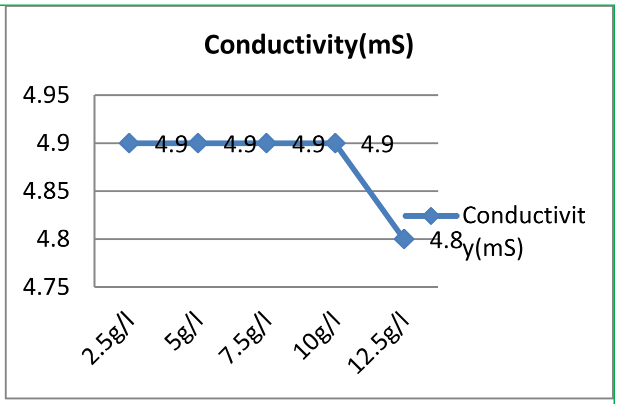

Figure 2.Conductivity Vs Adsorbant dosage

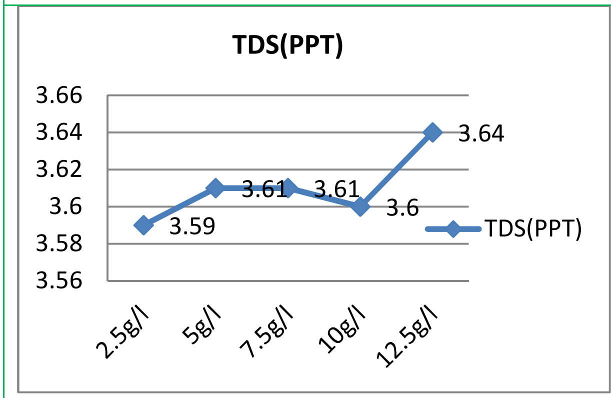

Figure 3.TDS Vs Adsorbant dosage

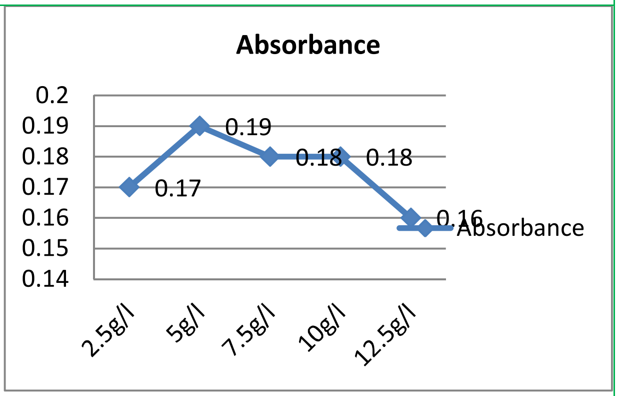

Figure 4.Absorbance Vs Adsorbant dosage

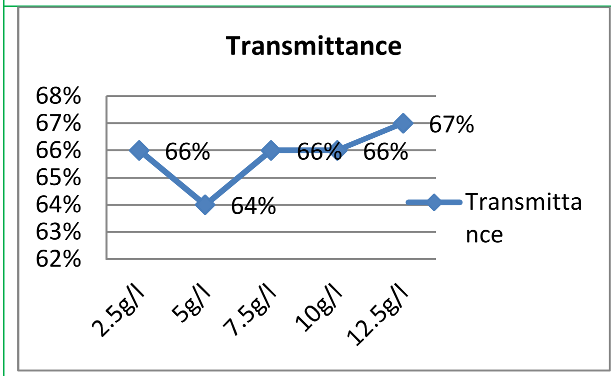

Figure 5.Transmittance Vs Adsorbant dosage

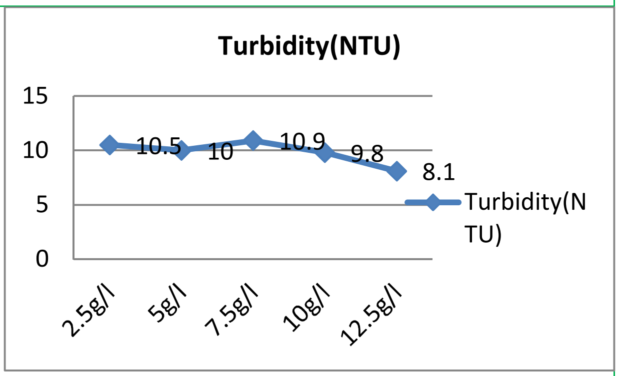

Figure 6.Turbidity Vs Adsorbant dosage

4 Conclusions:

In present work attempt have been made for studying the color removal efficiency of low cost adsorbant prepared from saw dust. From the experimental finding it has been observed that saw dust can be used as an effective adsorbant material which can be used successfully for removal of color. The maximum color removal efficiency was observed up to 70% for prepared saw dust. It was found that color removal efficiency was achieved maximum a very low dose of 12.5g/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 saw dust adsorbant reduced the sulfate content from 318.45mg/l to 67.6 mg/l (79%), chloride content from 1052 mg/l to 555 mg/l (48%), iron from 18.7mg/l to 2 mg/l (90%), BOD from 400mg/l to 300mg/l and COD from1680 mg/l to 240mg/l. Which proved to be a more effective treatment solution, also there is a 38% turbidity reduction and 56% absorbance reduction in this study. Thus it is proved that saw dust can be effectively used as a low cost adsorbant. It is further advised that column studies may be performed to analyze the performance of sawdust as a low cost adsorbant.

5.0 Acknowledgement:
Authors sincerely acknowledge the Shri. Thangaraj, Chairman of Jay Shriram Group of institutions Shri. Govindasamy, Treasure of Jay Shriram Group of Institutions, Shri T.Karupannasamy, Vice Chairman of Jay Shriram Group of Institutions for providing the necessary facility and also for supporting morally for performing this project. We also acknowledge the support rendered by Prof.R.Magudeshwaran, Principal of Jay Shriram Group of Institutions for all the technical support rendered during this work without which this work may not be materialized.

References:
1) Baughman.G.L, and Perenich.T.A., 1988, Fate of dyes in aquatic systems: I. Solubility and partitioning of some hydrophobic dyes and related compounds, Environmental journal of Toxico and Chemicals, 7, pp.183-199.
2) Churchley.J.H., 1994, Removal of sewage effluent-the use of a full scale ozone plant., Water Science Technology, 30, pp.275-284.
3) Cotoruelo.M.L, Marques.M.D and Rodriguez.J.J., 2007, Adsorption of aromatic compounds on activated carbons from lignin: Equilibrium and thermodynamic study. Industrial and engineering Chemical Research, 46, pp.4982-4990.
4) Garg.V.K, Gupta.R, Yadav.A.B and Kumar.R., 2003, Dye removal from aqueous solution by adsorption on treated sawdust, Bio resource Technology, 89, pp.121-124.
5) Hassan.S.M.S, Awwad.N.S, Aboterika.A.H.A, 2009, Removal of synthetic reactive dyes from textile wastewater by Sorel's cement, Journal of Hazardous Materials,162, pp.994-999.
6) Ho.Y.S, Chiu.W.T and Wang.C.C, 2005, Regression analysis for the sorption isotherms of basic dyes on sugarcane dust, Bio resource Technology, 96, pp.1285-1291.
7) Hu.Q.H, Qiao.S.Z and Haghseresht.F, Wilson.M.A and Lu.G.Q., 2006, Adsorption study for removal of basic red dye using bentonite. Industrial and engineering Chemical Research, 45, pp.733-738.
8) Isa.M.H, Long.L.S, Ansari.F.A.H, Aziz.H.A, Ramli.N.A and Dhas.J.P.A., 2007, Low cost removal of disperse dyes from aqueous solution using palm ash, Dyes and Pigments 74, pp.446-453.
9) Jain.R, Sharma.N and Radhapyar.K 2009, Electrochemical treatment of pharmaceutical azo dye amaranth from waste water, Journal of Applied Electrochemical,39, pp.577-582
10) Khalil.L.B and Girgis.B.S., 1998, Column removal of some dyestuffs by activated carbons derived from apricot stone shells, Adsorption Science and Technology, 16, pp.405-414.
11) Malaviya.P and Rathore.V.S., 2007, Bioremediation of pulp and paper mill effluent by a novel fungal consortium isolated from polluted soil, Bio resource Technology, 98, pp.3647-3651.
12) Mohanty.K, Naidu.J.T, Meikap.B.C and Biswas.M.N., 2006, Removal of crystal violet from waste water by activated carbons prepared from rice husk. Industrial and engineering Chemical Research, 45, pp.5165-5171.
13) Namasivayam.C, Radhika.R and Suba.S., 2001, Uptake of dyes by a promising locally available agricultural solid waste: coir Pith, Waste Management, 21, pp.381–387.
14) Nigam.P, Banat.C.M, Singh.D and Marchant.R., 1996, Microbial process for decolorisation of textile effluents containing azo, diazo and reactive dyes, Process Biochemistry, 3, pp.435-442.
15) Robinson.T, Chandran.B and Nigam.P., 2002, Removal of dyes from an artificial textile dye effluent by two agricultural waste residues, corncob and barley husk, Environmental Int 28, pp.29-33.
16) Senthilkumaa.S, Kalaamani.P, Porkodi.K, Varadarajan.P.R and Subburaam.C.V., 2006, Journal of Bioresearch and Technology,97, pp.1618-1625.
17) Shukla.A, Zhang.Y.H, Dubey.P, Margrave.J.L and Shukla.S.S., 2002, The role of sawdust in the removal of unwanted materials from water. Journal of Hazardous Materials, 95, pp.137-152.
18) Sousa.M.L.de, Moraes.P.B.de, Lopes, Paulo.R.M, Montagnolli.R.N, Angelis.D.de, F.de and Bidoia.E.D., 2012, Contamination by Remazol Red Brilliant Dye and its impact in aquatic photosynthetic microbiota, Environmental Magazine and Sustainable Development,1, pp.129-138.
19) Walker.G.M and Weatherley.L.R, 1997, Adsorption of acid dyes onto granular activated carbon in fixed beds, Water Resource, 8, pp.2093-2101.
20) Zollinger.H, 2003, Color Chemistry: Syntheses, Properties, and Applications of Organic Dyes and Pigments, 3rd edition, Switzerland: WILEY-VCH Publication, pp.432-437.