IJSBAR
International Journal of Sciences: Basic and Applied Research

International Journal of Sciences: Basic and Applied Research (IJSBAR)

ISSN 2307-4531
(Print & Online)

http://gssrr.org/index.php?journal=JournalOfBasicAndApplied

Removal of pH, TDS, TSS & Color from Textile Effluent by Using Sawdust as Adsorbent

Nitin P. Khatmode [a]*, Dr. Sunil B. Thakare [b]

[a] *Civil Environmental Engineering Department ABMSP'S APCOER, Parvati Paytha, Pune, Maharashtra 411009, India.*

[b] *Principal , ABMSP'S APCOER, Parvati Paytha, Pune, Maharashtra 411009, India.*

[a]*Email:khatmodenitin8989@gmail.com*

[b]*Email:Prof_sbthakare@rediffmail.com*

Abstract

Textile industry is one of the most important and rapidly developing industrial sectors. India has a large network of textile industries of varying capacity i.e. about 10,000 garment manufacturing and 2,100 bleaching and dyeing industries. The characteristics of Textile effluent are generally high because of use of many chemical substances in Textile processing. The pH of Textile effluent is generally high because of use of many alkaline substances in Textile processing. There are several methods available for removal of pH, TDS, TSS and color from Textile effluent such as ion exchange, coagulation and flocculation, biological decolorization, adsorption etc. Among all these methods adsorption is still a procedure of choice for pH, TDS, TSS and color removal. In this paper Sawdust is used as adsorbent for removal of pH, TDS, TSS & Color from textile effluent. It is found that pH is decreased from 7.9 to 7.2, the maximum percent removal of 45.50% was observed for TSS & the maximum percent removal of 27% was observed for TDS. Also the Color of textile effluent changes from Dark Brown to Light Khaki.

Keywords: Sawdust; pH; Color; TDS; TSS; Pollution; Textile Effluent.

---

* Corresponding author.
E-mail address:khatmodenitin8989@gmail.com.

1. Introduction

Textile industry is one of the most important and rapidly developing industrial sectors. India has a large network of textile industries of varying capacity i.e. about 10,000 garment manufacturing and 2,100 bleaching and dyeing industries[1].These are well developed and scattered all over the country with its main centers at Ahmedabad, Mumbai, Chennai, Coimbatore, Bangalore and Kanpur. Al-Kdasi and his colleagues reported that the textile wastewater is characterized mainly by high BOD (80-6,000 mg L-1), COD (150-12,000 mg L-1), suspended solids (15-8000 mg L-1), dissolved solids (2900-3100 mg L-1) and chloride (1000-1600 mg L-1) [2]. Wastewater generated by different production steps of a textile mill also have high pH, temperature, detergents, oil, suspended and dissolved solids, dispersants, color, chlorinated compounds and alkalinity [3]. This when discharged into the receiving water bodies not only affects the aesthetic nature but also interferes with the transmission of sunlight and reduces the photosynthetic activity of plants thereby disturbing the natural equilibrium present in the water [4].The presence of TDS in water may affect its taste. High hardness in conjunction with high alkalinity or sulfates causes scale. A laxative effect can be caused by high sulfate content. Abnormally high or low dissolved solids disturb osmotic balance of native species. Disposal of the salt laden effluents into ground and surface water bodies cause pollution and render them unfit for domestic, industrial and agricultural use. High salt concentration interferes with proper operation of biological wastewater treatment plant. The change in density of water causes trouble in floatation and sedimentation. High salt content may cause an increase in non-settle able suspended solids. Higher doses of salt are toxic to aquatic organisms as they expose the organisms to changes in osmotic pressure, causing swelling or dehydration. The quality of irrigation water mainly depends on its salt content and the proportion of sodium to other ions. Sodium chloride corrodes steel and sodium sulfate corrodes concrete. In the dyeing and finishing processes a considerable amount of effluent is generated, which is very toxic and contains strong color, a large amount of suspended solids, a highly fluctuating pH, high temperature, COD, BOD etc.[5]. There are many methods of effluent treatment such as, ion exchange [6], coagulation and flocculation [7], oxidation [8], reverse osmosis [9], biological decolonization [10] and adsorption[11]. The investigations revealed that after treatment with sawdust, the treated effluent had lower values of all the parameters than the untreated effluent. The reduction in pollution load of treated effluent may be attributed to the adsorption of chemicals in effluent by sawdust through hydrogen bonding and ion exchange mechanism. 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 [18]. The most widely used adsorbent for industrial applications is activated carbon [16, 17], but it is very expensive. Hence numerous studies on adsorption properties of naturally occurring and low cost adsorbents, such as agricultural by products and natural fibers, namely; waste coir pith [4], corncob and barley husk [14], ash [15] and sawdust [3,12] have been reported in recent years. In the present study an attempt has been made to use sawdust as an adsorbent for removal of pollutants from textile effluent.

2. Materials and Methods

2.1. Sawdust

The Sawdust [Figure 1] was collected from Shanti saw mill, Daund which is used as Adsorbent. The sawdust was collected from the local saw mill and sieved through a mesh of size 0.5 mm. 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 [12].

Figure 1: Sawdust Collected from Local Saw Mill

2.2 Effluent Collection

The Inlet and Outlet Textile effluents were collected from the ETP of Baramati Hi-Tech Textile Park Ltd. located at Maharashtra Industrial Development Corporation Area, Baramati, Maharashtra. The inlet effluent is collected from the equalization tank of the ETP.

2.3 Experimental Procedure for Treatment of Textile Effluents with Sawdust

This study was carried out in two steps. The first step consisted of the characterization of the wastewater samples. The analyzed parameters were the pH, TSS, TDS and Color. In the second step physicochemical treatments like adsorption were applied to wastewater in order to reduce pH, TDS, TSS and Color. The sawdust was collected from the local saw mill and sieved through a mesh of size 0.5 mm. Then, it was washed with distilled water to remove the surface adhered particles and dried at a temperature of 60-800C in an oven [12]. The textile wastewater was collected from outlet drain of the ETP of Baramati Hi-Tech Textile Park Ltd. located at Maharashtra Industrial Development Corporation Area, Baramati, Maharashtra in pre-cleaned plastic containers and one part of the effluent was treated by using sawdust as adsorbent at the rate of 2 g L-1 and then filtered [13]. This part of effluent was termed as sawdust treated effluent and the other part was termed as untreated effluent. The sawdust treated and untreated effluent were analysed for pH, TSS (Total suspended solids), TDS (Total dissolved solids).

3. Result

As we earlier discussed in this paper this study was carried out in two steps. The first step consisted of the characterization of the wastewater samples. The analyzed parameters were the pH, TSS, TDS and Color. In the second step physicochemical treatments like adsorption were applied to wastewater in order to reduce pH, TDS, TSS and Color.

3.1 Initial Characteristic of Outlet Effluent

The wastewater samples were collected from outlet drain of the ETP of Baramati Hi-Tech Textile Park Ltd. located at Maharashtra Industrial Development Corporation Area, Baramati, Maharashtra. Samples were collected in sampling bottles and placed at cool place to preserve for analysis. This samples were analyzed for pH, TDS, TSS and Color as per standard method.

Table 1: Initial Characteristic of Outlet Effluent

Sr. No.	Parameters	Untreated Outlet Effluent
1	pH	7.9
2	TDS (mg/l)	1700
3	TSS (mg/l)	400
4	Color	Dark Brown

3.2 Final Characteristic of Outlet Effluent after treatment with Sawdust as Adsorbent

The textile wastewater was collected from outlet drain of the ETP of Baramati Hi-Tech Textile Park Ltd. located at Maharashtra Industrial Development Corporation Area, Baramati, Maharashtra in pre-cleaned plastic containers and one part of the effluent was treated by using sawdust as adsorbent at the rate of 2 g L-1 and then filtered [13]. This part of effluent was termed as sawdust treated effluent and this treated outlet effluent were analyzed for pH, TSS (Total suspended solids), TDS (Total dissolved solids) and Color.

Table 2: Final Characteristic of Outlet Effluent after Treatment with Sawdust

Sr. No.	Parameters	Treated Outlet Effluent
1	pH	7.2
2	TDS (mg/l)	1241
3	TSS (mg/l)	218
4	Color	Light Khaki

3.3 Management of Poisonous Plants

A question should be raised that, after treating the effluent with the sawdust what action should be taken with this sawdust. Since, the sawdust get poisonous effect after treating the effluent, this sawdust could not be dumped here or there.

Anaerobic digestion of sawdust could be the best and economic solution. Anaerobic digestion is a series of processes in which microorganisms break down biodegradable material in the absence of oxygen.

4. Conclusion

In this paper attempt have been made for studying the removal of pH, TDS, TSS and Color from textile effluent by using sawdust as adsorbent. From the experimental finding it has been observed that sawdust can be used as an effective adsorbent for removal of TDS, TSS and Color from textile effluent. The maximum color removal efficiency was observed up to 65% for sawdust. It is found that pH is decreased from 7.9 to 7.2, the maximum percent removal of 45.50% was observed for TSS & the maximum percent removal of 27% was observed for TDS. Also the Color of textile effluent changes from Dark Brown to Light Khaki.

The question remains in the area that how poisoned sawdust would be managed. Anaerobic digestion of sawdust could be the best and economic solution.

References

[1] Nagajyothi, P.C., Prasad, T.N.V.K.V., Dinakar, N., Suresh, S. and Damodharam, T. “Impact of dyeing unit effluent on nutrient content of index leaf of Arachis hypogea L. and Sacchrum officinarum L”, Thai J. Agric. Sci., 43, pp. 55-59, 2010.

[2] Al-Kdasi, A., Idris, A. and Saed, K. “Treatment of textile wastewater by advanced oxidation process” ,Global Nest: the Int. J. , 6, pp. 222-230, 2004.

[3] Garg, V.K. and Kaushik, P. “Influence of textile mill waste water irrigation on the growth of sorghum cultivars”,Appl. Ecol. Environ. Res., 6, pp. 1-12, 2008.

[4] Namasivayam, C., Radhika, R. and Suba, S. “Uptake of dyes by a promising locally available agricultural solid waste: coir pith”, Waste Manage., 21,pp. 381–387, 2001.

[5] Mondal, S. and Guha, A. K. “Characterization of Textile Waste Water of Chittagong and Narayangonj Areas”, Bangladesh Textile Today, issue: Jul-Aug ,2011.

[6] Eliassen, R. and Bennet, G.E. “Anion Exchange and Filtration Techniques for Wastewater Renovation”, J. Water pollution Control Fed, 39,pp. 82-91, 1967.

[7] Anjaneyulee, Y., Chary, N.S. and Raj, D.S. “Decolorization of Industrial Effluents Available Methods for Emerging Technologies”, Rev., Environ. Sci, Biotechnology, 4, pp. 245-273, 2005.

[8] Wu. J.; Doan, H. and Upreti, S. “Decolorization of Aqueous Textile Reactive Dye by Ozone”, Chem. Eng. J., 142, pp. 156-160, 2008.

[9] Dieper, D; Corriea, V.M. and Judd, S.J. “The Use of Membranes for the Recycling of Water and Chemicals From Dye House Effluents: An Economic Assessment”, JSDC, 112, pp. 272-281, 1996.

[10] Kaushik, P. and Malik, A. “Microbial Decolorization of Textile Dyes Through Isolated Obtained From Contaminated Sites”, Journal of Scientific and Industrial Research, 68, pp. 325-331, 2009.

[11] Bansal, R.C. and Goyal, M. “Activated Carbon Adsorption”, Taylor and Francis Group, LCC, ISBN 0-8247-5344-5, 2005.

[12] Khattri, S.D. and Singh, M.K. “Removal of malachite green from dye waste water using neem saw dust by adsorption”, J. Hazard. Mater ,167,pp. 1089-1094, 2009.

[13] Izadyar S. and Rahimi M. “Use of beech wood sawdust for adsorption of textile dyes”, Pak. J. Biol. Sci., 10, pp. 287-293, 2007.

[14] Robinson T., Chandran B. and Nigam P. “Removal of dyes from an artificial textile dye effluent by two agricultural waste residues , corncob and barley husk”, Environmental Int.,28, pp. 29-33, 2002.

[15] Isa M.H, Long L.S, Ansari F.A.H, Aziz H.A, Ramli N.A and Dhas J.P.A. “Low cost removal of disperse dyes from aqueous solution using palm ash, Dyes and Pigments”, Research Gate, 74, pp. 446-453, 2007.

[16] Walker G.M and Weatherley L.R. “Adsorption of acid dyes onto granular activated carbon in fixed beds”, Water Resource, 8, pp. 2093-2101, 1997.

[17] Khalil L.B and Girgis B.S. “Column removal of some dyestuffs by activated carbons derived from apricot stone shells”, Adsorption Science and Technology, 16, pp. 405-414, 1998.

[18] Nigam P., Banat C.M., Singh D. and Marchant R. “Microbial process for decolorisation of textile effluents containing azo, diazo and reactive dyes”, Process Biochemistry, 31, pp.435-442, 1996.