Adsorption of Textile Effluent Toxicity on Palmyra Wood

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Abstract

The use of cheap and ecofriendly adsorbents studied as an alternative substitution of inorganic chemicals for removal of dyes and toxicity constituents from textile effluent. Palmyra wood is from south region of Tamilnadu, successfully used to remove of dyes and toxicity constituents from textile effluent in a batch wise column. In this project, first adsorbent Palmyra wood (PW) is used as a filtration bed and second supportable adsorbent river sand, used for removal of dyes, toxicity and also for better adsorption of heavy metals from textile effluent. Increase in height of the adsorbent bed, increase in removal of dye and toxicity present in textile effluent.

Introduction

Environmental issues in Tirupur

Environmental pollution problems in Tirupur have been a long history. River pollution by Dye wastewater and sludge began with the rapid development of Processing industry, of about 25years ago. It is therefore a unique environmental problem that will not be easy to solve. Although India has a host of environmental problems that demand solution, the government is implementing more effective pollution controls than other South region nations. It is also committing resources to construction of environmental infrastructures, such as sewerage systems to deal with industries wastewater. Given these positive moves, environmental problems in Tirupur do not appear to be as grave as in the well developed countries.

Waste water from processing industry

One of the major problems concerning environmental pollutants is wastewater problem. Wastewater comes from domestic and industry. In industry, the biggest sources of industrial wastewater come from textiles industries, paper, leather industries, plastic and other dying industries. Because of the lack of space and financial resources to install on-site treatment facilities, small and medium-sized enterprises (SMEs) are also major contributors to industrial wastewater pollution.Wastewater is any water that has been adversely affected in quality by anthropogenic influence. Moreover, contaminated water also contains organics, bleaches, and salts. It comprises liquid waste discharged by agriculture, industry, commercial properties and domestic residences. It can encompass a wide range of potential contaminants and concentrations. One of the highly polluted wastewater generated among all industrial sectors, considering both the volume discharged, as well as the effluent composition is wastewater generated from textile

industries (Anjaneyulu et al. 2005).Textile wastewater includes a large variety of dyes and chemicals additions that make the environmental challenge for textile industry not only as liquid waste but also in its chemical Composition.

Methods to remove Toxicity

For removal of contaminants from industrial wastewaters, many conventional methods such as precipitation, solvent extraction, filtration, ion exchange, biosorption, electrochemical treatment have been applied. These methods are either expensive or could not cope with high concentration of contaminants (Alkan *et al.*, 2005). All these methods have significant disadvantages such as requirements and production of toxic sludge, incomplete ion removal or other waste products that require further disposal. Hence, these processes do not suit the needs of developing countries. Adsorption process has been a prominent method of treating aqueous effluent in industrial processes (Benkli *et al.*, 2005) for a variety of separation and purification purposes. This technique is also found to be highly efficient for the removal of colour in terms of initial cost, ease of operation, simplicity of design and insensitivity to toxic substances (Garg *et al.*, 2004). Most of the absorbents were active in removal of dye from the dye effluent. This is shown by the study. Especially, the efficiency of water hyacinth for dye removal was satisfactory. In microbiological analysis, viable bacteria (TVBC) were found in all samples. The COD values in all samples were higher than the recommended value. The lowest count was 3x106 whereas the highest count was 6 x 106.Fecal Coliform (TFCC) and Total Coliform were not found in any sample. (S.K. Pramanik et al / Chemistry Journal, 2011)

In this project cheap and ecofriendly adsorbents have been studied to find an alternative substitution of above mentioned methods for the removal toxicity from Textile effluent. Absorbency of Palmyra wood successfully removes the major toxicity from Textile effluent.

Material & Method:

Filtration Chamber Preparation:

A miniature of effluent treatment tank have designed for treatment in 18 inches Height,18 inches length and 12 inched width made of Glass and a collection box made of same height ,length and 3 inches width.

Adsorbent Preparation:

Palmyra wood: The Palmyra tree (Borassus flabellifer) from the southern part of Tamilnadu selected as a main adsorbent. This type of trees consists of high level of adsorption properties due to highly amorphous in nature. The center part the wood (sap wood) is collected and crushed evenly to form a thick bed.

Sand: River sand collected is washed thoroughly to form a thick bed.

Filling:

Prepared adsorbents are filled in two layers with various Heights as in table (1)

Filling no	Layer I	Thickness (in inches)	Layer II	Thickness (in inches)
1	Sand	3	Palmyra Wood	3
2		3		6
3		3		9
4		6		3
5		6		6
6		6		9
7		9		3
8		9		6
9		9		9

Results and discussion:

Table (2): Treated water quality with various fillings

No	Material Filling In Inches			PH	TSS	TDS	TH	BOD	COD	Sulphates
	Effluent Water(EW)			9.1	700	5090	110	-	408	4640
T1	Sand (Layer 1) -	Palmyra Wood (Layer 2) 2		**6.6**	**400**	**4380**	440	-	942	**3920**
	Effluent Water(EW)			9.26	800	3420	130	-	1020	2307
T2	Sand (Layer 1)	Palmyra Wood (Layer 2)	Charcoal (Layer3)	**4.47**	**300**	**2500**	1008	-	4200	**1483**
	2	3	-							
T3	2	3	2	**4.86**	1100	3840	860	-	3871	2966
	Effluent Water(EW)			8.2	645	4060	1992	149	637	1409
F1	Sand (Layer 1)	Palmyra Wood (Layer 2)		**4.5**	**545**	**2960**	**1195**	3909	5378	**398**
	3	3								
F2	3	6		**5.0**	**384**	8610	**1414**	2667	9940	**874**
F3	3	9		**4.8**	**352**	7630	**1066**	3125	9330	1559
F4	6	3		**3.8**	**425**	4190	2191	14250	19721	**1360**
F5	6	6		**3.8**	**565**	**4010**	**1792**	15000	22510	**460**
F6	6	9		**5.7**	**272**	6510	**319**	1125	4215	1606
F7	9	3		**5.6**	**380**	8240	**936**	1012	4014	**1159**
F8	9	6		**5.3**	**406**	8500	**1215**	2182	7728	3675
F9	9	9		**4.6**	**425**	4530	**996**	5000	10757	**424**

An important problem still faced by the textile industry is the decolorization of effluent by removal of dyes and toxicity reduction through a commercially viable method. To over- come this problem, various natural adsorbents have been tried like wood ash, sugarcane bagasse, charcoal, brick powder egg shell empty fruit bunches and tea leaves

ash has already proved with reduction of toxicity. It is already proved that activated carbon is found to be the best adsorbent for most of the dyes in solution except for a few vat dyes, pigments and disperse but activated carbon method is very expensive and by every reactivation process about 15% of its sorbent property gets lost.

These natural adsorbents are eco-friendly too. The presents study, focused on the palm sap as a low cost adsorbent for removal of color, dyes & reduce level of TDS, SS, BOD, COD from wastewater at low concentration and to determine the effects of adsorbent dosage, pH, shaking speed, contact time. The results obtained show the adsorption rates of heavy metals is high in this adsorbent .The optimum value of p^H , TDS & TSS found to be decreased. The adsorption is practically achieved in 2-12 minutes. The results suggest that pore and adsorption behavior by multi layer technique

Table 2 indicates the results show that efficiency of adsorption of two adsorbents by various thicknesses. Multiple thicknesses of adsorbent beds are used for analysis in removal of dye and toxicity shows that the amount of the adsorbent was increased, the percentage of dye and toxicity removal increased accordingly.

Conclusion:

With the above found results to that the thickness of palm tree bed may increase the reduction of toxicity level and due to natural adsorbent the BOD & COD level may increase which doesn't affect the environmental. Moreover the other quality parameters levels can be reduced increase in thickness in future analysis and also removal dyes vice-versa.

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