Dye Wastewater Treatment By Natural Activated Carbon From Millet Carbon

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Abstract- *Dyeing industry is one of the major water polluting industry in current world scenario. The fabric colors looks very beautiful but the wastewater generated is of huge amount. Activated carbon is one of the best absorbers when used in water but here in this paper we tried performing this achievement from Cereal Husk of Jawar also known as Millet. This absorption is done by an agriculture bi-product it is cheaper and can be performed on a large scale.*

The results depicts that this absorption is also very effective and efficient for heavy metals too which were present in wastewater. We have taken Millet 3gm/100mL this gives us the removal of about 96% of Colour, 60% of COD, 42% of BOD, 64% of Total solids and 39% of total hardness. So by this we can say that it's a very good natural biotic method for wastewater treatment.

Keywords- Dyeing industry, Activated carbon, Millet, adsorption, cheaper method, colour removal.

I. INTRODUCTION

The textile industry is one of the biggest industries in India for providing jobs and also for generating large amount of wastewater, as from sizing to de-sizing, dyeing, printing and finishing all processes need a large amount of water. This fabric treated water contains high concentrations of colour pigments and organic matter. This leads to a very high COD and Total solid in textile wastewater. This high percentage pollutant removal is very difficult and needs a large effort so here we try to propose a biotic technique which can remove a large percentage of pollution form wastewater and also reduces load of effluent treatment plant.

Colour is the first indicator of water pollution, the discharge of this colored water damages the aesthetic values of streams but is also very hazardous to the aquatic biodiversity as it blocks and reduces the photosynthetic action of aquatic plants. In recent studies various non-conventional absorbents are been used for colour removal from wastewater. Some of them are Coconut Husk (Lee et. al., 1990), Orange peel (Shivraj et. al., 2001), Sawdust (Sengil et. al., 2005), fly ash and furnace slag (Gupta et. al., 2003), coir pith (Radhika et. al., 2001), red mud (Namasivayam et. al., 1997). Various environmental protection agencies of world combine and they have given straight limits of colour concentrations of dye industry effluents but this removal from economic fashion is still a big problem. Now a day's chemical treatment process like coagulation, oxidation and precipitation are mainly used. The major drawbacks of these processes are their running cost and the amount of sludge produced. So it's been concluded that absorption is the best process we can apply to dye wastewater.

The activated carbon has been most widely used absorbent for the purpose till now. The only disadvantage of it is its high cost, as large amount of waste water is produced in a textile industry. So for the purpose of cost cutting this research is been focused to less expensive absorbent, of this cost-effectiveness, availability, good absorption characteristics are the main criteria for selection.

The Characteristics of Millet carbon are –

Table – 1

Parameters	Values
pH of 1% solution	9.15
Bulk Density (g/ml)	0.689
Moisture (%)	3.1
Porosity (%)	83.5
Ash (%)	7.6
Water Solubility	2
Solubility in 0.25M HCl	8.6
Iron content(mg/g)	0.10
Surface area (m^2/g)	352

II. MATERIAL AND METHODS

Two samples were collected from dyeing industries of Bhairavgad Ujjain district of Madhya Pradesh, India and is been used for this study. These samples are collected at a specific time interval of 12 hrs from a same point of sewer coming out of the factory. The parameters are been analyzed at standard methods given in APHA 1998.

Table – 2 Wastewater characteristics of Dyeing Industry

Parameters	Values	
	Sample 1	Sample 2
pH	8.91	10.86
Total Solids (mg/L)	12278	12598
Dissolved Solids (mg/L)	10852	11526
Oil & Grease (mg/L)	5	7
BOD (mg/L)	425	465
COD (mg/L)	1998	2089
Hardness (Total) (mg/L)	905	652
Chlorine (mg/L)	2897	1687.2

III. ABSORBENT PREPARATION

The millet carbon is prepared for absorption as firstly it is been collected from local farmers which throw it away after threshing of Jawar seeds from it. After collection, millet is properly meshed in very small pieces. The material is than washed by tap water 2 times and than by distilled water till all dirt and dust is removed from it. After washing the material is dried at 65°c for 24 hrs, than the material is cooled down to room temperature and crushed to sieve number 100 {i.e. 150 µ(microns)} and then stored in a air tight container or bottle. After this the material is subjected to carbonization which is a treatment at 700°c under the stream of 2.5Lit/min of Nitrogen for 30 mins. For the carbonization step the heating rate of 30°c/min was been used. The raw millet is been carbonized in a horizontal alumina flask oven with a alumina tube of 1.8Lit volume. The hot material is taken out from tube is immediately transferred to an air tight container to avoid air contact. This carbon can be stored and used accordingly in various treatment studies.

As we all know that the absorption is a slow process and also possess fewer errors as the maximum σ (standard deviation) is about 3%. The samples 1 and 2 were been used to test the capacity of carbon from millet for this we take about 100mL of wastewater in a tight bottle and insert about 1gm of absorbent in each bottle of sizes 300mL, 500mL and a Liter. These bottles are rotated by a mechanical shaker for about 10 mins at 1500 RPM and it's been analyzed using a UV Spectrophotometer (Systronics 2101). The same method is again carried out in variation with the absorbent to 2gm/100mL and 3gm/100mL. The experiments are been carried out in duplicate and σ is 3%.

IV. RESULT & DISCUSSIONS

The UV Spectrophotometer is been used at a wavelength of 540 nm for the analysis of colour removal from various samples present. In the majority of samples the equilibrium is attended after 60 mins and then it remained constant. After about 55 mins in subsequent studies the treatments by carbonized Coconut Husk (Lee et. al., 1990), Orange peel (Shivraj et. al., 2001), Sawdust (Sengil et. al., 2005), fly ash and furnace slag (Gupta et. al., 2003), coir pith (Radhika et. al., 2001), red mud (Namasivayam et. al., 1997) were readily comparible with agitation time in our work. In the analysis the maximum efficiency is attended at 3gms/100ml sample used in all bottles.

Table 3 – Percentage removal after treatment with 3gms/100mL

Parameters	Removal percentage
Colour	96
COD	60
BOD	42
Total Solids	64
Total Hardness	39
pH removes to about 8 from 10.86	

In general the pH does not possess any significant role in de-colorization of textile wastewater. The findings suggested that in the given significant time of contact the substrate are able to penetrate the absorbents pores of saturated carbons. So it's been found out that millet is also a efficient substrate for removal of colour, organics and heavy metals and can easily be applied to a textile industry and is also economically feasible.

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