

# Characterization of Textile Wastewater by Renewable Airborne Spinning Dust (Cotton Dust)

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## Abstract

Colored fabric effluents stand for significant ecological troubles when they incorporate mix of substances, auxiliaries along with dyestuffs involving distinct instructional classes along with compound constitutions. Removing involving inorganic dyes inside fabric wastewater by simply regular wastewater treatment procedures is incredibly tough. At present, there is a growing interest in using inexpensive and potential materials for the adsorption of reactive dyes. **Cotton dusts** have been described becoming a probable advertising to take out coloring via wastewater. Within this analyze, **Cotton dusts** ended up applied just as one adsorbent. The final results revealed that this decided on bio adsorbents get very good risk of eradication involving reactive dyes via textile effluent. This research was carried out with the interaction of sumifix supra reactive dyes and **cotton dust** and obtained very good results.

**Key words:** Adsorbent, Biochemical oxygen demand, Chemical oxygen demand, Wastewater, Reactive dyes, Cotton Dust.

### 1. Introduction:

This textile market place is amongst the almost all challenging companies involving creation marketplace. Wastewater treatment method is amongst the important complications challenged by means of textile makers [2]. Wastewater on the textile marketplace can certainly comprise a range of polluting chemicals as well as dyes. Color would be the primary toxin for being known from the wastewater in addition to really needs to be taken away previous to discharging in mineral water figures or maybe with area. The presence of very small amounts of dyes in water (less than 1 ppm for some dyes) is highly visible and affects the aesthetic merit, water transparency and gas solubility in lakes, rivers and other water bodies. [3].

Dyes, even so, are definitely more complicated to manage for their man-made foundation in addition to largely difficult aromatic molecular structure [4]. To remove color from textile wastewater adsorption is one of the most important techniques. This is an efficient approach to decreasing the actual focus associated with mixed chemical dyes within the effluent leading to color elimination. Additional way of coloring elimination for example chemical substance oxidation, coagulation as well as change osmosis commonly are not achievable because of financial factors [5].

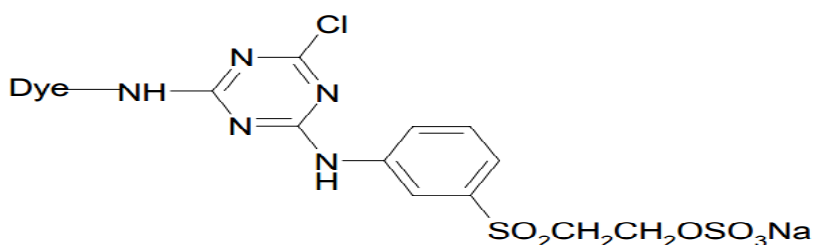
The actual adsorption procedure is among the most effective techniques to get rid of chemical dyes through effluent. The procedure associated with adsorption comes with an advantage within the additional techniques because of this sludge free of charge thoroughly clean procedure as well as total elimination associated with chemical dyes actually through thin down answer (Malik, 2003).

Cotton dust would be the recently thought adsorbents for their prolonged area, mini porous framework, higher adsorption capability as well as higher level of reactivity [4]. Cotton dust tends to be completely new adsorbents with regard to waste materials drinking water remedy. Because of this I've utilized these types of adsorbents with regard to wastewater remedy.

## 2. Specific Pollutants from different Textile processing [6]

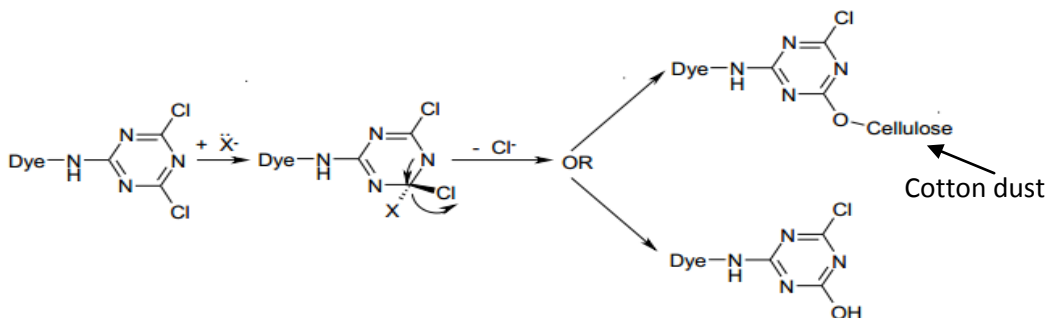
Process	Various Pyhsico-chemicals
Fibre manufacturing	Contain high amount of organic compound, which contribute to BOD and COD, it also contain SS which are mainly the loose fibre.
Spinning and Weaving	Contains sizing agents such as starch, poly vinyl alcohol, wax, acrylic size, loose fibre etc. All these components contribute to high amount of BOD, COD and SS.
Desizing	Enzymes, Starch, Waxes, CMC
Bleaching	H <sub>2</sub> O <sub>2</sub> , Sodium Silicate, Organic Stabilizer, Surfactant
Mercerizing	NaOH, Cotton Wax
Dyeing	Dyes, Salts, Surfactant, Urea, Soda Ash,
Printing	Urea, Dyes, Pigments, Binder, Soda Ash, Thickener
Finishing	Resins, Formaldehyde, PVA, Waxes, Hydrocarbon

## 3. General structure of sumifix supra dyes:[7]



### 3.1 Nucleophilic substitution reactions of reactive dyes with cotton dust:[7]

As cotton dust contain cellulose and this cellulose form covalant bond with the reactive dyestuff.



## 4. Experimental Resources & Procedures:

### 4.1. Materials/Resources list:

**Dyes and chemicals:** Sumifix supra red Reactive dye, Hydrochloric acid, Sodium hydroxide, Hydrogen per Oxide, Sodium carbonate, Sodium silicate, Acetic acid, Distilled water

#### Assortment /Collection of Cotton dust & Waste Water:

The particular bioadsorbent useful for this kind of examine has been the particular Natural cotton airborne dirt and dust that has been collected from Viyellatex, Mawna, Gazipur, Bangladesh.

The waste water sample was collected from Givency Group (Dyeing Unit), Gazipur, Bangladesh.

#### Instruments list:

Glassware and apparatus, UV-Vis Spectrophotometer , Portable multi-parameter meter , Electronic balance , Vacuum Oven , Magnetic/ Hotplate stirrer , Incubator, Refrigerator, Digital pH meter.

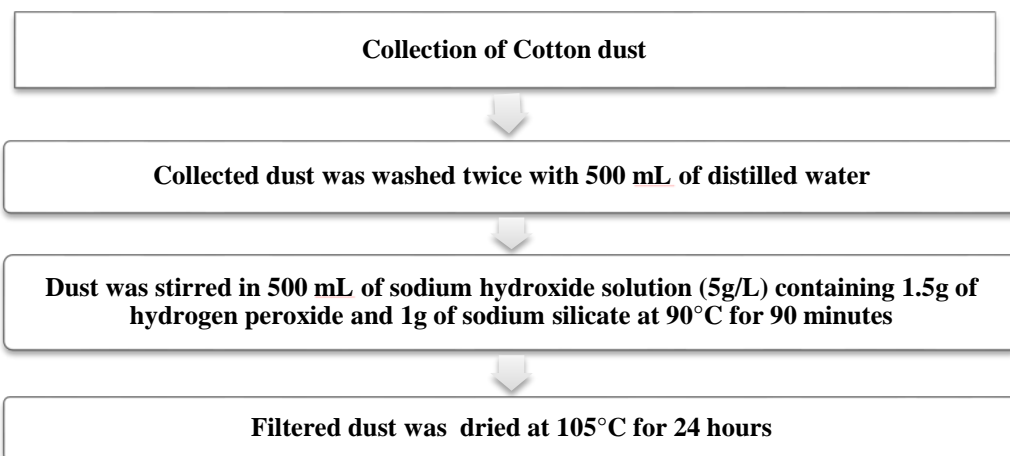
### 4.2. Experimental Procedures:

#### 4.2.1. Standard solution preparation:

A new investment option involving Sumifix supra dyes ended up being cooked by dissolving a variety of 0. 1 gm dyes in a 1000 mL volumetric flask as well as dilution sufficient supplement involving de-ionized normal water. Absorb dyes examination option ended up being geared up by way of suitable dilution in the investment strategy to the desired attention. De-ionized normal water ended up being employed to make each of the option within this analyzes.

#### 4.2.2. Adsorbent preparation:

Natural cotton airborne dirt and dust has been well prepared inside the pursuing methods:



#### 4.2.3. Adsorption and Analytical Treatments:

Natural cotton airborne dirt and dust (1.5 g) has been included with the particular beaker. The particular adsorption studies have been performed inside beakers. Adsorption aspects which includes how much adsorbents (1.5 g), initial sample concentration for waste water and dye solutions 100 mL and 10 mg/L respectively, contact time 120 minutes and pH 8 have been looked at.

Following adjusting pH for the wanted benefit together with 0.01 M HCL and 0.01 M NaOH solution, the particular trial remedy has been stirred employing a permanent magnet stirrer.

The particular adsorption from aqueous solution has been evaluated. The aqueous phases were separated from the materials, after the desired contact period for each batch experiment, and the dye concentration of dye was measured using a UV-Vis Spectrophotometer.

Finally calculate the removal efficiency from the following formula:

$$\frac{C_0 - C_e}{C_0} \times 100 \%$$

Where,

$C_0$ = initial concentration (in mg/L) of dye solution

$C_e$ = final concentration (in mg/L) of dye solution

#### 4.2.4. Characterization of wastewater for different parameters:

##### (a) Total Solids:

Total solids were obtained by evaporating 50 mL waste water sample in a beaker. After evaporating the sample the solid residues were dried.

**Analysis:** It was determined by conventional method (Subtracting the weight of beaker containing residue and empty beaker)

##### (b) Total Dissolved Solids (TDS):

Total dissolved solids contents of water and waste water is defined as the residue left upon evaporation at 103°C to 105°C. Total Dissolved Solids was obtained by evaporating 50 mL filtered waste water sample in a beaker. After evaporating the sample the solid residues were dried.

**Analysis:** It was determined by using a digital TDS meter.

##### (c) Total Suspended Solids

**Analysis** Total Suspended Solids was obtained by deducting Total Dissolved Solids from Total solids.

##### (d) Dissolved Oxygen (DO):

Dissolved oxygen shows the ability of the stream to purify itself through biochemical process. Oxygen is dissolved in most waters in varying concentrations. The Dissolved Oxygen of waste water sample was measured by taking 50 mL of wastewater in a 100 mL beaker and immersing the electrode of portable multi parameter meter (Sension 153, HACH, USA) into the sample.

**Analysis:** It was determined by digital DO meter or by conventional trite-metric method.

**(e) Biological Oxygen Demand (BOD):**

Bio-chemical oxygen demand tests show the amount of molecular oxygen required by bacteria to reduce the carbonaceous materials. The determination of DO of a sample before and after five days incubation at 20°C is the basic of BOD determination.

**Analysis:** It was determined by Winkler’s method of 5 day BOD test.

**(f) Chemical Oxygen Demand (COD):**

COD test shows the oxygen equivalent of the organic matter that can be oxidized by using a strong oxidizing agents e.g. potassium dichromate in acidic solution, at elevated temperature, for two and half hour. It indicates the amount of oxygen required to oxidize the carbonaceous matter.

**Analysis:** It was determined by closed/open refluxed trite-metric method.

**(g) pH:**

pH is a term used universally to express the intensity of the acidic or alkaline condition of solution. It is a measure of hydrogen ion concentration or more precisely the hydrogen ion activity.

**Analysis:** It was determined by digital pH meter.

**Analysis of samples by UV-Vis Spectrophotometer**

The amounts of dye onto the adsorbents have been examined by measuring the absorbance of dye after batch experiment by UV-Vis Spectrophotometer. The sample were analyzed against a calibration curve prepare by standard solution of dye.

**5. Results & Discussions:**

**Waste water parameters before &after treatment by adsorbent (Cotton dust):**

Sl.	Parameters	Unit	Before treatment	After treatment
a	Total Solid	mg/L	3355	2150
b	Total dissolved solid	mg/L	3234	2010
c	Total Suspended Solids	mg/L	226	120
d	Dissolved Oxygen (DO)	mg/L	6.7	9.08

e	<b>Biological Oxygen Demand (BOD)</b>	mg/L	98	40.2
f	<b>Chemical Oxygen Demand (COD)</b>	mg/L	992	315
g	<b>pH</b>		11.5	8

**6. Effect of different factors and all experiment were carried out in batch process:**

From the above result it is clearly shown that the pH, BOD, COD, TS, TDS, TSS has reduced & DO has increased which is remarkable.

**6.1. Calibration Curve of Sumifix supra dye:**

Calibrations were obtained by determining the concentrations of Sumifix supra Red dye solution by UV-vis Spectrophotometer at wavelength of 536 nm where maximum absorbance were observed. The Absorbance vs. Concentration of Sumifix supra red dye solution is presented in fig. 01.

**6.2. Effect of initial dye concentration:**

The effects connected with primary Sumifix supra dye attentiveness with regards to treatment by means of Cotton dust is usually presented in fig. 02. From these figures it is proved that as the initial dye concentration increased, the adsorption capacity decreased. On the graph, it truly is distinct of which cotton dust possesses better adsorptive volume on 10 ppm.

**6.3. Effect of contact time:**

The actual get in touch with period in between pollutant and also the adsorbent is actually associated with substantial significance within the wastewater remedy through adsorption. A rapid uptake of pollutants and establishment of equilibrium in short period signifies the efficiency of that adsorbate for its use in wastewater treatment. Available adsorption studied in literature reveal that the uptake of the adsorbate species is fast at the initial stages of the contact period, and therefore, it becomes slower near the equilibrium. The results associated with get in touch with period for that adsorption associated with Sumifix supra red dye had been analyzed for any amount of 180 minutes and results are shown in fig.03. It is showed that the dye removal was rapid at a certain time then the rate was decreased after saturation. In the event of determine, cotton dust demonstrated greatest adsorptive capability at 120 minutes.

**6.4. Effect of pH variation:**

The particular pH with the remedy has an effect on the outer lining demand with the adsorbents plus the amount of ionization regarding diverse pollution. Modify regarding pH furthermore has an effect on the particular adsorptive method by means of dissociation regarding useful teams around the adsorbent surface area lively web sites. For that reason, this kind of contributes to any move inside effect kinetics and also adsorption stability. The consequence

regarding pH of sumifix supra on cotton dust is presented in fig. 04; cotton dust confirmed the utmost color adsorption 98 % with pH 8.

### 6.5. Effect of adsorbent dosage:

The issues connected with cotton dust quantity with the removal of sumifix supra dyes usually are shown in the Fig. 05. This fraction treatment enhanced while using the adsorbent quantity up to and including a number of control subsequently the item gotten to towards frequent importance. Cotton dust exhibited the ideal dye adsorption 98.5 % on adsorbent connected with 15 g/L.

It had been located on the graph of which the removal of dye by means of cotton dust adsorbents will increase with the raise from the adsorbent dosage (ad) initially and, thereafter, becomes constant after some value of adsorbent dosage. That importance is usually considered for the reason that perfect quantity ad. This raise with adsorption while using the adsorbent quantity is usually assigned to this accessibility to larger surface area in addition to much larger volume of adsorption web-sites. At  $ad < optimum$ , the adsorbent surface becomes saturated with dye particle and the residual dye concentration in the solution is large. With the raise of ad, this take dye removal will increase caused by enhanced number of adsorbent.

### Graphical representation of different parameters:

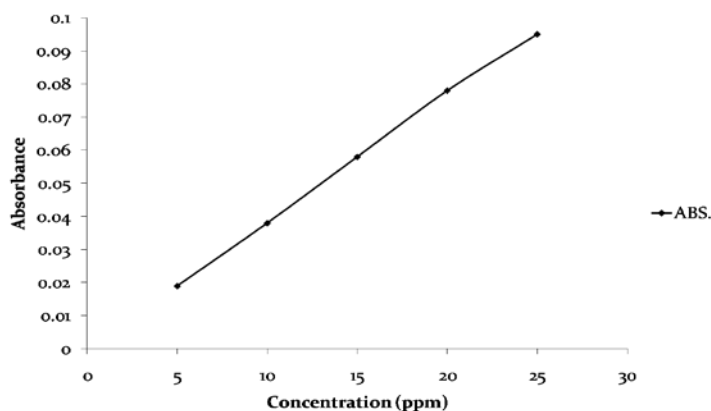
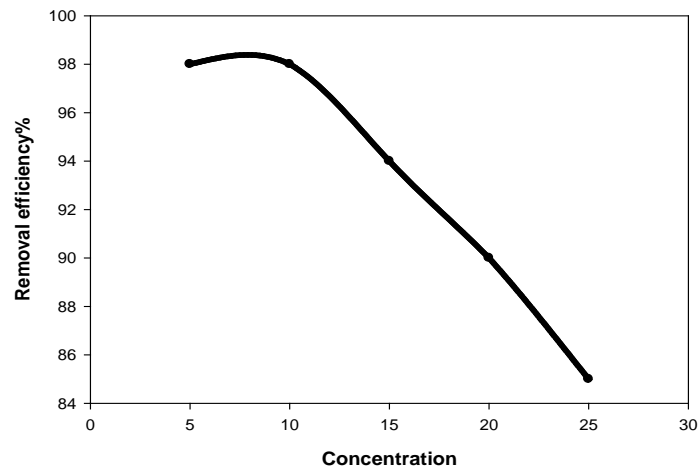
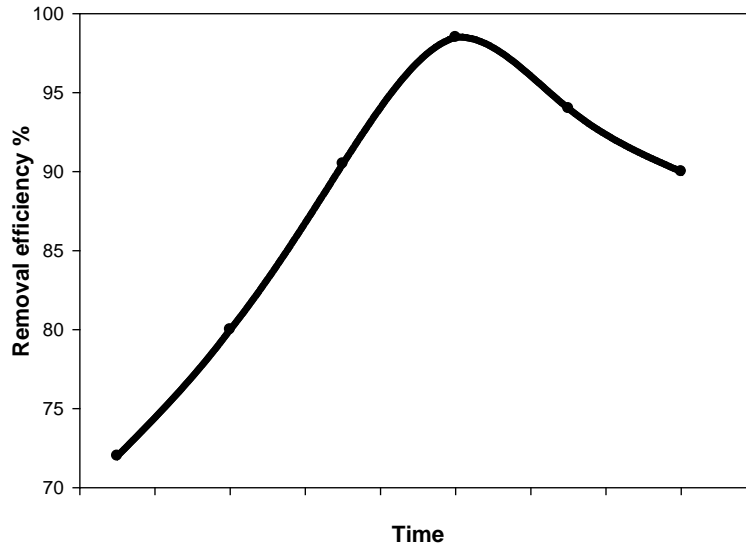


Fig. 01: Calibration Curve Sumifix supra Red dye

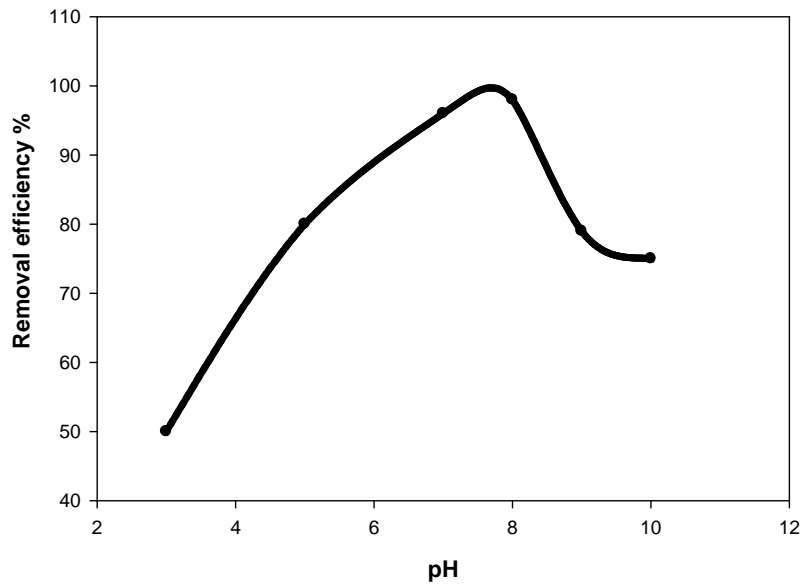


**Fig. 02: Effect of dye concentration for cotton dust**

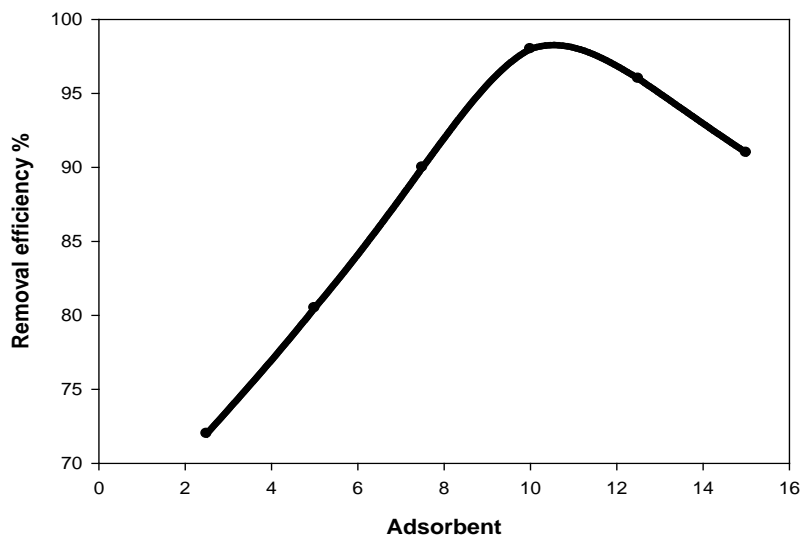




**Fig. 03: Effect of contact time for cotton dust**



**Fig. 04: Effect of pH for cotton dust**



**Fig. 05: Effect of Adsorbent variation for cotton dust**

### Conclusion:

In my research work, Cotton dust was used as bio adsorbents for the removal of reactive dyes from the textile waste water. Maximum amount of the reactive dyes adsorbed by cotton dust was obtained when the initial pH is 8, initial concentration is 10 ppm and temperature is 45°C then. 98.5% removal of dye was found at adsorbent mass of 15 gm/L, pH 8 and 120 minutes of contact time by cotton dust.

The factors which favors the selection of Cotton dust as an adsorbent are its low cost, widespread presence and organic composition which shows strong affinity for some selected dyes.[03]

The actual adsorption could be affected through numerous elements, for example, adsorbent bulk, get in touch with period, disappointment pace, heat as well as pH and so on. Therefore, there's a have to enhance these types of elements to maximize the therapy effectiveness associated with cotton dust as well as reduce the therapy price with regard to wastewater.[10]

The experiments were performed at the optimum conditions to obtain these results and Since removal of the reactive dyes from the wastewaters is difficult, this results is important.[10]

As cotton dust adsorbent perform well for minimization of different wastewater parameters which have adverse effect on the environment, they may be used as well as popular within sectors not just to reduce price inefficiency, but additionally enhance success.

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