REMOVAL OF TEXTILE DYES FROM AQUEOUS SOLUTION USING SUGARCANE BAGASSE AND FRUIT PEELS

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Abstract - *In this project work an attempt has been made to remove color from textile dye waste water by sugarcane bagasse and orange peels as adsorbents. A special experimental setup was made with beakers as a filtration unit. The natural adsorbents such as charcoal, sugarcane bagasse, orange peels & sand were tried for absorbing the color from dye waste waters.*

Synthetically prepared textile dye waste water was loaded in the form of columns with different combinations of adsorbents in the beaker which acted as filtration unit in order to obtain clear water. The treated waste water was tested for its color removal efficiency and tests on various filtration parameters such as depth of adsorbent bed and contact time were conducted. It was interesting to note that, after color removal, the waste water turns out to be almost clear and transparent and can be useful for redyeing process.

Key Words: Orange peels in powder form, Sugarcane bagasse, Nylon bolting cloth, aqueous solution of textile dye, Natural adsorbents.

1. INTRODUCTION

One of the major problems concerning textile wastewater is colored effluent. Though not particularly toxic, dyes are having an adverse aesthetic effect because they are visible pollutants. The presence of color will reduce aquatic diversity by blocking the passage light through the water. In some cases, less than 1ppm of dye concentration produces obvious water coloration. There are more than 8000 chemicals associated with the dying process. These chemicals include several structural varieties of dyes, such as acid, reactive, basic, disperse, azo, diazo, anthraquinone-based and metal complex dyes. Interest in pollution potential of textile dyes has been primarily prompted by concern over the possible toxicity and carcinogenicity (Clare and Anliker. 1980). The textile industry occupies an important place in the economy of the India.

The textile industry contributes to 7% of industry out puthin the value terms, 2% of India's GDP and to 12%of the country's export earnings.

1.1 Evolution of Dyes

Dyeing of textiles has been practiced for thousands of years with the first written record of the use of dyestuff dated at 2600 BC in China. All dyes were natural substances obtained from plant, animal or mineral sources. Perhaps one of the real breakthroughs in the history of dyes came in 1856 when a teenager who was experimenting at his makeshift laboratory in home made a certain discovery that acted as a sort of launching pad for the modern chemicals industry.

1.2 Orange peels and Sugarcane bagasse

Orange peels were collected from local juice shops which they were throwing as waste. These orange peels were sun dried for 7 days and ground into fine powder then used. Sugar cane bagasses were collected from local juice shops which they were throwing as waste. These sugarcane bagasse were sun dried for 7 days and ground into fine powder then used.

Different materials used in this project work are 1. Sand 2. Charcoal 3. Sugarcane bagasse 4. Orange peels in powder form 5. Nylon bolting cloth

2. METHODOLOGY

Initially the study states on preparing the adsorbents without modifying its chemical properties. Sugarcane Bagasse and peels of orange were cleaned by washing with distilled water and sun dried to remove the moisture content. Post drying the peels and bagasse was grinded to powder form. The adsorbent is sieved in order to obtain the uniform size particles. The filtration unit was designed and fabricated; prepared dye water is passed through the filtration unit. The initial and final color concentration of the waste water sample was measured by using "Color Analysis" software application (version 4; offered by Roy Leizer) to determine the removal percentage. The effect of change in contact time and adsorbent dosage was studied to arrive at the efficient removal technique. The experimental setup is shown in below figures.

Principle

Color analysis software allows to perform deep color analysis for chemicals scanned from camera connect to it after the image has been processed the software gives the color information such as color name, RGB, Hex code, color percent etc.

Procedure

The steps of measurement is shown below. a. Illumination Light from the xenon lamps diffuses in the integrating sphere and illuminates the specimen uniformly Receiving

- **i.** Light reflected from the specimen is received.
- **ii.** Light diffused in the integratinghsphere is received. Sensing Light is received with the specimen-measuring and illumination-monitoring optical system. The light in the wavelength range of 360 to 740mm is divided into 10nmpitch components and signals proportional to the light intensity of each component are output to the analog processing circuit.
- **iii.** Light from the pulse hxenon lamp diffuses on the inner surface of the integrating sphere and illuminateshthe specimenhuniformly.
- **iv.** The light reflected from the specime surface at an angle of 8" to the normal of the surface is received by the specimen-measuring optical system.
- **v.** The light diffused in the integratinghsphere is received by the hillumination-monitoring optical system and guidedhto the sensor.
- **vi.** The light reflected from the specimen surface and the diffused light are divided into each wavelength component by the specimen-measuring opticalhsystem and illumination-monitoring optical sensor respectively, and then signalshproportional to the light intensity of each component are output to the analoghprocessing circuit.
- **vii.** By processing the outputs from the specimen-measuring optical system and the illumination monitoring sensor with the calculation by the CPU, the instrument compensates for slight fluctuations in the spectral characteristics and intensity of the illumination light. (Double beam system).

Fig-2.1 Experimental Setup

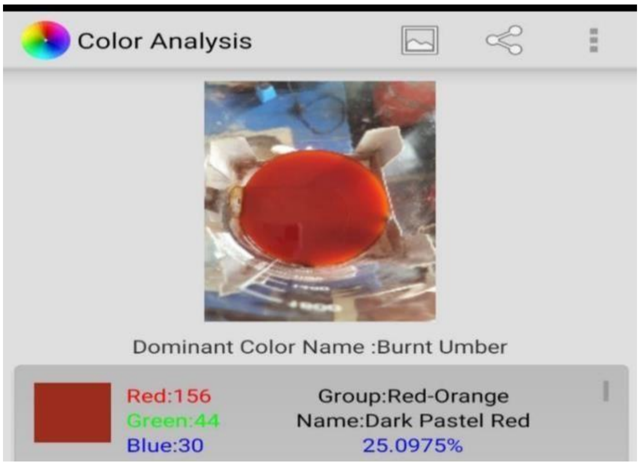

Fig-2.2 Dye Sample

Natural adsorbents namely sand, charcoal, Sugarcane bagasse and orange peel powder were used for color removal from synthetically prepared acid dye waste water using adsorption technique. In order to know the potentiality of these adsorbents on the removing dye, filtration unit experiments were conducted. The dye water which was synthetically prepared was passed through fabricated filtration unit. Initial and final dye concentration were determined using "Color Analysis" software application (version 4; offered by Roy Leizer) to know the percentage dye removal.

Several trials have been carried out in the fabricated set up. Samples of around 5litres were prepared and made to pass through the bed of samples. The fabricated set up include a bed of 15cm of course aggregates at the bottom followed by the fine aggregates of 15 cm thickness and over which the beds of adsorbent materials are placed which are varied. The trials include the passage of sample through individual beds of orange peelpowder and Sugarcane bagasse. However, parameters like contact time and dosage of the adsorbent are monitored and results have been analysed.

The adsorbent dosage is varied by varying the bed thickness of the adsorbent material over which the samples have to be passed through. It is known from the obvious theory that 39 surface adsorption is more as the adsorbent is more.

The untreated water was kept under the camera scanner and it was set at standard dye concentration of 100 and Then the filtered dye water was scanned under the camera based on the data received the software showed the color removal percentage. The water to be tested was filtered under different condition in order to study the relationship of filtration efficiency to varying factors such as contact time and depth of adsorbent beds.

Fig-2.3 Sample after results

3. RESULT AND CONCLUSIONS

Natural adsorbents namely sand, charcoal, Sugarcane bagasse and orange peel powder were used for colour removal from synthetically prepared acid dye waste water using adsorption technique. In order to know the potentiality of these adsorbents on the removing dye, filtration unit experiments were conducted. The dye water which was synthetically prepared was passed through fabricated filtration unit. Initial and final dye concentration were determined using "Color Analysis" software application (version 4; offered by Roy Leizer) to know the percentage dye removal. The two combinations such as Sepots seed powder + Charcoal Sand, (Sas bagasse, in came baal peer(Charcoal Sand Sapotepeckposer), and (Sepots seed powder Charcoal + Sand+ Sugarcane bagasse) were used for colour removal. The results of various treatments and tests have been presented in this work.

Filtration Unit Studies

Several trials have been carried out in the fabricated set up. Samples of around 5 litres were prepared and made to pass through the bed of samples. The fabricated set up include a bed of 15cm of course aggregates at the bottom followed by the fine aggregates of 15 cm thickness and over which the beds of adsorbent materials are placed which are varied. The trials include the passage of sample through individual beds of orange powder. However, parameters like contact time and dosage of the adsorbent are monitored and results have been analysed.

Adsorbent dosage The adsorbent dosage is varied by varying the bed thickness of the adsorbent material over which the samples have to be passed through. It is known from the obvious theory that 37 surface adsorption is more as the adsorbent is more. Hence more adsorption takes place if the adsorbent taken is more. The thickness was varied from 1 cm, 2 cm and 3 cm for apote reeds powder. As the thickness increases, the adsorption increases owing to the lesser concentration. Experimental results of final outlet concentration owing to a percentage dye removal of 17.65, 26.14 and 43.75% respectively

Large amount of sugarcane bagasses and orange peels are dumped as waste all around the world. These are very fine and have greater surface area. these are many juice centers and factories which make use of sugarcane and orange and discard their bagasses and peels as waste. Sugarcane bagasses is an effective bio adsorbent for removing dyes. These organic wastes have a considerable potential for the removal of dye in textile industrial systems due to its greater surface area. A filtration unit was fabricated where the synthetically prepared dye water was passed through it with varying bed thickness and contact time.

Contact Time

The amount of time left for the trials carried out in the experiment influences the ant of adsorption taking place. However, an optimum performance of the adsorbents is seen at a contact time of around 23 minutes.

The untreated water was used for redyeing the silk and cotton fabric samples using acid and reactive dyes respectively. The K/S was measured using Minolta Reflectance Spectrophotometer using standard conditions. The results are tabulated it may be observed from the table that, K/S values for both reactive dyed and acid dyed samples dyed using untreated and treated water show same value i.e., around 4,932 to 4.305. This trend is similar for acid dye too.

This trend clearly indicates that, the water treated from natural adsorbents appears to be clean and clear and could be effectively reused for another dyeing. The impurities present in the water have been removed by these adsorbents to the maximum extent which is also quite evident from the previous results.

The following conclusions were made:

↔ As the adsorbent dosage increases, dye removal efficiency also increases. This may be due to the greater availability of adsorption sites. No significant increase in the dye removal was observed beyond the optimum values.

↔ As the contact time increases, dye removal efficiency also increases. This may be due to the greater availability of time for the adsorbents to adsorb the dyes present in the waste water.

↔ Higher dye removal was observed at higher bed depth. This may be due to large surface area of the adsorbent and more contact time with the adsorbent to interact with adsorbate.

↔ The water that was treated appears to be colorless so that it can be used for redyeing process.

↔ Redyed sample using treated water shows better dye uptake which was equivalent to original sample as observed from K/S value

. Finally it may be concluded that the normal adsorbents have profound effect on colour removal efficiency from textile dye waste water. The treated water could be used for redyeing purpose.

Scope for future studies

↔ Same type of experiment procedure can be carried out on textile waste water

↔ Similar experiments can be carried out with varying quantities of sugarcane bagasse powder as absorbent.

↔ In order to know the economy of process regeneration studies can he done.

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