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EFFECTIVE COLOUR REMOVAL IN TEXTILE WASTE WATER USING NATURAL ADSORBENT

Ms N.U.Yuvasri[1] , Dr J B Veeramalini[1], Madesh K [1], Siddharth [1], Vignesh [1]

Department of Chemical Engineering,

Vel tech High tech Dr. Rangarajan Dr. Sakunthala Engineering College, Avadi, Chennai -62.

ABSTRACT

In this study, the textile industries are ecologically unfriendly, and they substantially contaminate the environment with coloured water. This study collects responsible information to discharge colour from textile water utilising an absorbent (orange peel), which acts as an effective absorbent. Absorption in batches. The removal of colour from effluent water has been studied at various flow rates, bed heights, beginning dye concentrations, column diameters, and temperatures. the treatment of dairy waste-water for various parameters like pH, TDS, TSS, BOD, COD, sulphates, chlorides & turbidity with varying percentages of dose of adsorbents so as to assess the efficiency & degree of impurity eliminated from the waste-water. The pH was decreased from 8.4 to 6.2, and the BOD and COD removal rates were found to be 70.79%. The reduction of turbidity and sulphates was found to be 35.53% and 47.61%, respectively. The chloride and total suspended solids levels have increased by 36.47% and 80.66%, respectively. Total dissolved solids in the 86.86% range. This study have been suggested correction measures to eliminate colour from this method.

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Key words: Textile wastewater, colour removal, dye, orange peel

1. INTRODUCTION

This research work is investigated in the treatment of colour removal using natural adsorbent. Several papers in the literature presented the principles of Textile Dye Treatment and assessments of physical, chemical and biological procedures employing Advanced Oxidation Processes. This work presents a thorough overview of advanced oxidation processes (AOPs) on textile wastewater treatment throughout the last two decades, including their performances, mechanisms, benefits, drawbacks, influencing variables, and electrical energy per order (EEO) needs [1]. Rapid industrialisation in recent years has increased pollution discharge into the environment [2]. Water contamination is caused by the disposal of municipal and other industrial pollutants into bodies of water [3]. A typical mill in India that produces $60*10^4$ m of fabric releases roughly 1.5 million litres of wastewater per day. Alternative cost-effective colour removal techniques based on microbiological processes have been investigated, although with limited applicability and effectiveness [4]. The textile industry requires a large volume of water for their process. The effluent from textile is an important source of dye pollution. Textile dyes are complex aromatic organic compounds that are designed to resist fading when subjected to perspiration, light, water, a variety of oxidising and reducing agents. Microbial assault. Their uses in the textile industry vary depending on the kind of fabric created (cotton, silk, rayon, wool, and so on). According to reports, the global dye annual market is roughly $7*10^5$ tonnes per year. The dyes are soluble organic chemicals classes as direct, reactive, acidic, or basic. Dyes have a high solubility in water, making them more difficult to remove using traditional methods [5]. The industrial dyes are hazardous in nature so proper treatment is needed. Because of their impact on ground and surface water, as well as human health, industrial pollution constitutes one of the most serious environmental issues [5].

For the treatment of dye industrial wastewater, many methods such as enhanced oxidation, membrane filtration, microbial technologies, bio electrochemical degradation, and photocatalytic degradation have been documented [6]. The dyeing method include colouring the materials and treating it with dye. Temperature and time are the two most important parameters in this operation. Both printing and dyeing wastewater contain waste elements. Reducers (sulphide), dyestuff, soap, mordant, acetic acids, metal salts, cationic compounds, and surfactants, and chromophores are released during the dyeing process. Orange peel is largely composed of cellulose pectin, hemi cellulose, lignin and other low molecular weight compounds including lime stone. In the textile manufacturing sector, the finishing process converts knitted or woven material into useable material with higher quality and specific features such as waterproofing and smoothness. This last technique contributes significantly to water contamination. The present study is to explore the feasibility of orange peel as a low-cost natural adsorbent with respect to various parameters such as colour adsorbent capacity of material with initial concentration at different doses, time and pH. The study shows that material as good potential for the removal of colour from textile effluent [7].

2. MATERIALS AND METHODS

2.1.SAMPLE AND ADSORBENT COLLECTION

The sample wastewater was collected from the dyeing industry. The sample contains three different reactive dyes like golden yellow, Black B and red 6L. The adsorbent used for this study is orange peel. Orange peels were collected from local fruit stall.

2.1.2 PREPARATION OF ABSORBENT

Orange peel were selected and washed with water for several times to remove ash and other contaminants, followed by double distilled water (DDW) washing. The washed peels were left to dry at ambient temperature for 36 hrs, then crushed and sieve to small particles (3.35 mm sieve)[8].

2.2 PREPARATION OF TEXTILE EFFLUENTS

A synthetic textile effluent by dissolving dye in waste water is prepared. With known concentration of 1000 ppm dye solution is prepared by dissolving 1gm of dye in 1 litre. To that sample different weight of adsorbent is added and allowed for a period of time with continuous shaking. The samples are collected and the concentration of the dye solution is analysed by UV spectrophotometers[9].

3. BATCH ADSORPTION STUDY

In this experiment, a batch adsorption technique was used. Study of effects of various important parameters such as amount of adsorbent, pH values, the contact time between adsorbate and adsorbent. 100 ml of sample waste water was taken in flask. A desired amount of adsorbent then added to sample. The experiment was carried out at room temperature. Samples were withdrawn from the stirrer at different time intervals. then the adsorbent was separated from the sample using filter paper. The adsorbents were measured using suitable UV spectroscopy[10]. Then the final concentration of dye was estimated.

4. SPECTROMETERS:

It is used to evaluate metals to determine the chemical composition with very high accuracy. The instrument measures the properties of light over a specific section of the electromagnetic spectrum. The role of the spectrometer is to measure the interaction (absorption, reflection, scattering. In this research work UV spectroscopy and infrared spectroscopy is used[11].

4.1 UV SPECTROSCOPY

The principal of UV-visible SPECTROSCOPY is based on the absorption of ultra violet light or visible length by chemical compound which result is the production of distinct spectra is based on the interaction between the light and matter UV visible spectroscopy is used in analytical chemistry for the quantitative determination of analytes such as torsion metal iron highly conjugated organic compound and biological macro molecules. This technique is used for multiple sample types including liquids, solids, thin films and glass. This UV spectroscopy is used in water treatment for the removal of dyes in industrial waste water using various adsorbent[11].

4.2 INFRARED SPECTROSCOPY

Table 1 % of colour removal

S. No	Sample concentration	Adsorbent -weight	Colour removed in ppm				% Of colour Removed
			0 min	10 min	20 min	30 min	
1	1000 ppm	Initial raw	4620	-	-	-	100%
1	1000 ppm	0.3 gm	4620	4300	3900	3330	72%
2	1000 ppm	0.6 gm	4620	4150	3700	3210	69%
3	1000 ppm	0.9 gm	4620	3900	3400	2910	63%
4	1000 ppm	1.2 gm	4620	3600	2750	1660	36%

Theory utilizes the concept that molecular absorb the specific frequency of the light that are characteristics of the corresponding structure of the molecules. Infrared is the measurement of the interaction of infrared radiation with melted by absorption reflection. IR is used to study and identify chemical substance are functional groups in solid, liquid or gaseous in form. This UV spectroscopy is used in prediction of concentration of salts in waste water[12].

5. RESULT AND DISCUSSION

5.1 Effect of synthetic absorbent:

Effects of concentration time on absorption were studied and results are shown. This figure shows that, increase in removal efficiency with increase in time between adsorbate and absorbent. It can be attributed to the fact that more time becomes available for the dye to make an attraction complex with orange peels. Concentration prepares a known amount of dye solution byceing dye, take 100 ml of textile waste water in different flask of known concentration 100 ml/1 litre, add 0.3 gm, 0.6gm, 0.9gm and 1.2gm of orange peel in different flask, the colour removed from 0 min, 10min, 20 min, 30 min were noted. pH values also analysed and graph has been showed, by continuous shaking, the dyes are removed by using orange peel. Finally, the percentage of colour removed is calculated. From this it was found that as the amount of absorbent is increased the % of colour removed decreases from 100% to 36 %[13].

The above sample tested as received and results are as follows.

5.2 Effect of adsorbent over the textile effluent

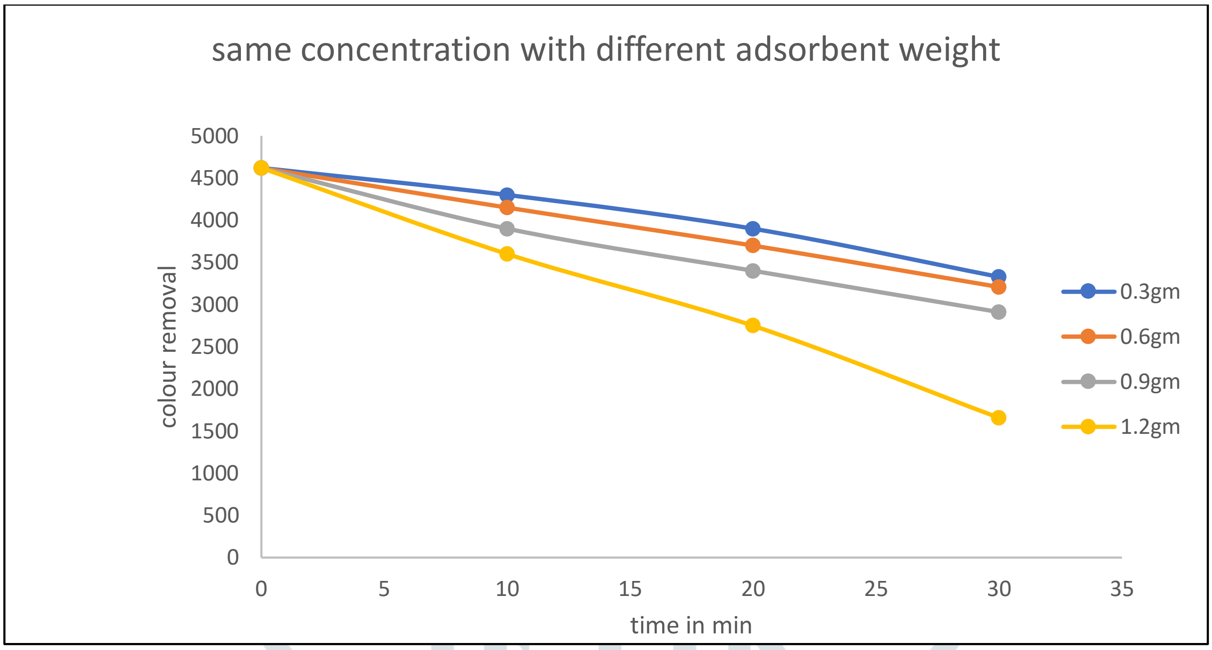

Figure 1: effect of adsorbent over textile effluent

5.2. Effect of concentration

In concentration is 0.25ppm,0.5ppm,0.75ppm, in Particular 100 ml. At 0.5gm of orange peel in each flask. In the same solution filter in 10 min filtered solution and 20 min filtered solution, then last 30 min filtered solution are collected. Ph values also analysed and graph has been showed. Different concentration solution is prepared as 0.25ppm, 0.5ppm, a known weight of adsorbent says 0.5gm is added to all ppm concentration of solution. The samples were collected at regular internal of time[14,15]. It is analysed by using UV Spectrophotometer.
The above sample are tested and received; the results are as followed.

Table 2 Effects of concentration of colour removal with respect to time

S. No	Sample no	Sample Id	Units	Results			
				Colour			
				0 min	10 min	20 min	30 min
1	N-11239	0.25 ppm	CU	3900	2950	1150	573
2	N-11240	0.5 ppm	CU	7750	6900	5200	3566
3	N-11241	0.75 ppm	CU	12100	11100	9400	7132

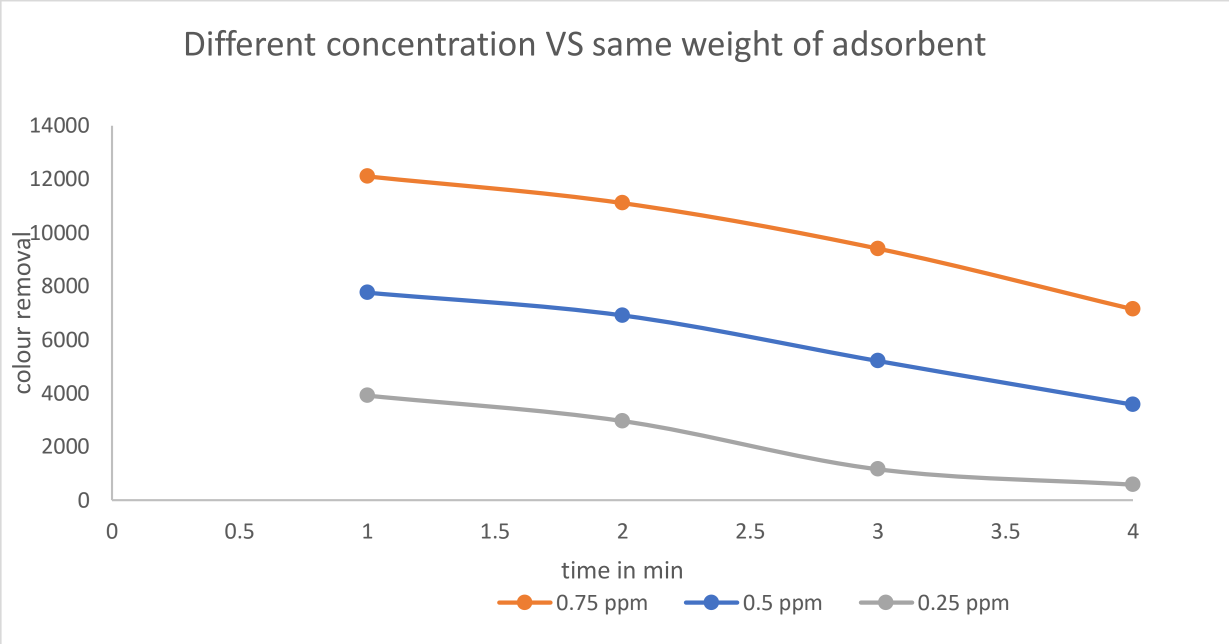

Figure 2: effect of concentration over an adsorbent

5.3 Effects of pH

The pH of the solution significantly affects the absorption of dyes by orange peels. At average pH, the more effective dye absorption capacity of orange peels was observed. The optimum absorption capacity was achieved at pH 7[16,17]. At lower pH, functional oxidized groups of the peels are promoted and thus active site of orange peels for binding of dye become less available, as a result removal efficiency decreases. The pH content is analysed with 0.25ppm, 0.5 ppm, 0.75 ppm, 1 ppm for the above sample solution. The initial and final values are calculated. For the above concentration (ppm) the initial value is same as 8.5 ppm. The final value changes with concentration as 7.8, 7.7, 7.6, 7.5[18].

The table and corresponding graph are depicted below.

Table 3 Effects of PH

ppm	Initial	Final
0.25	8.5	7.8
0.5	8.5	7.7
0.75	8.5	7.6
1	8.5	7.5

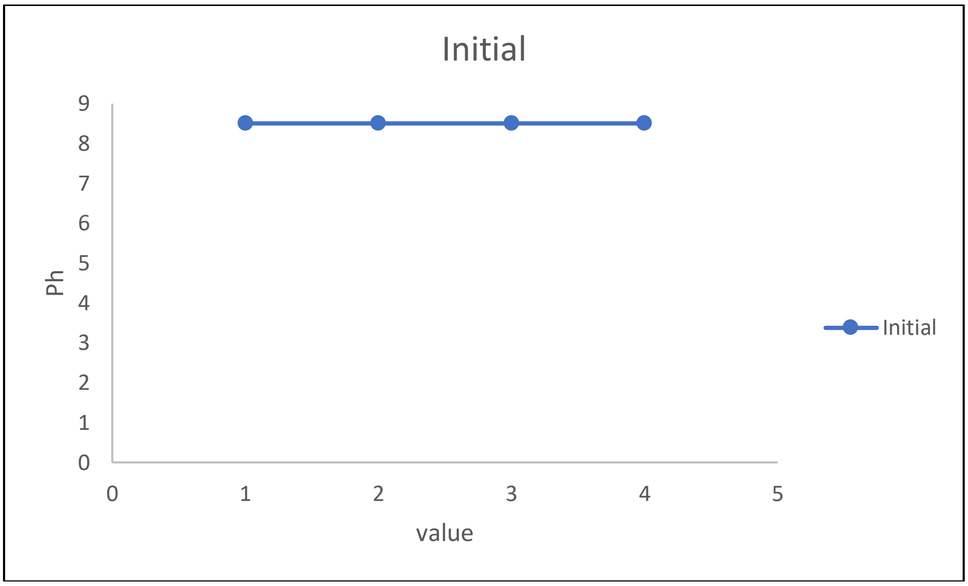

Figure 3: effect of pH at initial time

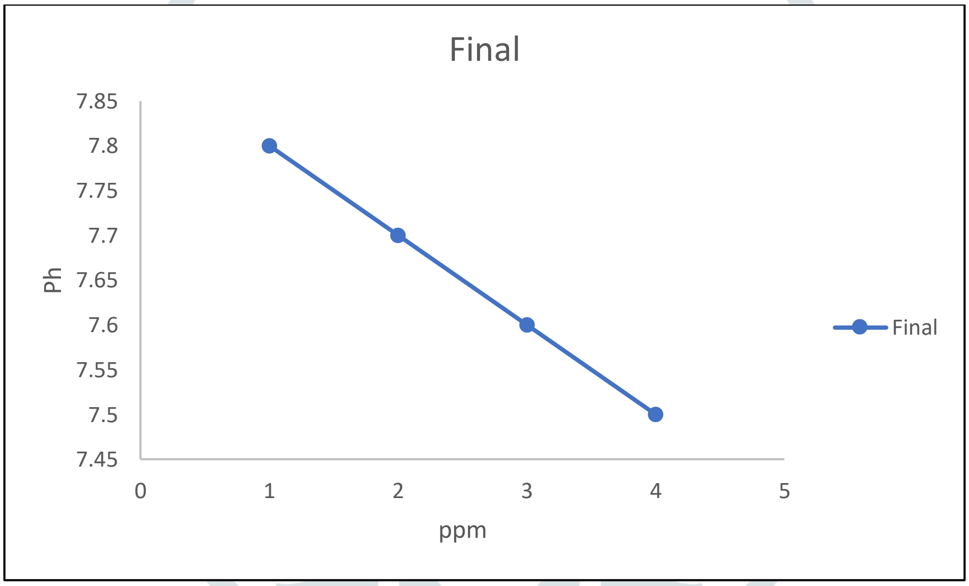

Figure 4: effect of pH at final time

6. CONCLUSION:

From this research, dye adsorption may be used to remove different dyes from textile waste water. In terms of environmental awareness and economics, this study was carried out to identify one of the natural waste materials that may be used as an adsorbent for colour textile effluents. Orange peel (OP), which was thrown as a waste item from a fruit stand, has a high potential for removing anionic dyes from coloured textile effluent. The adsorption of dyes onto orange peels is controlled by pH, the amount of adsorbents, and the contact time. The pH value has a significant impact on adsorption efficiency, with low pH values exhibiting comparatively high adsorption efficiency. A batch adsorption investigation was carried out for the removal of colour from textile effluent. Adsorbents are particularly effective in decolorized textile effluent. The removal of dye by orange peel as an adsorbent has been examined at various flow rates (contact duration), concentrations, and pH. It has been discovered that lowering flow and altering concentration promotes dye adsorption. The experimental results are properly documented, according to the findings of this study. Orange peels are not significantly more expensive than other bio adsorbents, and they are widely accessible. Significant colour removal may be accomplished with this inexpensive and environmentally friendly adsorbent. With the experimental data collected from this work, it is feasible to build and optimise an affordable treatment procedure for dye removal from industrial effluents.

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