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A Study on the Efficiency of Activated Carbon in Removal of Turbidity and Colour from Textile Industry Wastewater

M. Sravanthi[1], P. Bhargavi[2], S. Abdul Kalam[3], A. Hari Kumar[4], E. Divya Sri[5], Gavvala Rammohan[6]
[1, 2, 3, 4, 5]*B.Tech Student,* [6]*Assistant Professor, Civil Engineering Department, Sanskrithi school of Engineering, Puttaparthi, India.*

Abstract: ***Water contamination with dyes is a common issue in various industries, including textiles, food processing, and cosmetics. These colored substances not only affect the aesthetic quality of water but can also pose environmental and health risks. One effective method for removing colors from water is using activated carbon, a powerful adsorbent known for its high surface area and ability to attract and hold organic molecules. The present study explores how activated carbon can be used to separate colors in water, detailing the process and its effectiveness. Removal of color from water was studied by preparing batch adsorptions performed by varying absorbents dosage and contact time. The main objectives of our project are to collect waste water releasing from the dye industries, analyzing physical and chemical parameters of water and compare with standard values. Batch adsorptions performed by varying absorbents dosage and contact time The results obtained indicate that maximum removal 98.3% took place for the dosage of 100 mg/l at150 min. Activated carbon is a Good material for adsorption of color to treat waste water containing lower concentration of color.***

Keywords: activated carbon, color, adsorption, waste water, adsorbent.

I. INTRODUCTION

The rapid increase of industrialization and urbanization in the last few decades had caused a dramatic increase in the demanded water, as well as significant deteriorations in water quality throughout the world. Water contamination with dyes is a common issue in various industries, including textiles, food processing, and cosmetics, these colored substances not only affect the aesthetic quality of water but can also pose environmental and health risks. Activated carbon is a form of carbon processed to have numerous tiny pores, increasing its surface area significantly. This unique structure makes it highly effective in adsorbing organic compounds, including dyes and pigments, from water. The adsorption process occurs when these colored molecules adhere to the surface of activated carbon, removing them from the water. Activated carbon is typically made from charcoal, coconut shells, or other carbon-rich materials that are treated to create a porous structure. This porosity allows activated carbon to capture a wide range of impurities, including those that cause color in water. The adsorption process involves the attraction of colored molecules to the surface of activated carbon. The effectiveness of adsorption depends on factors such as the surface area of the activated carbon, the contact time between the carbon and the colored water, and the nature of the dye or pigment.

II. BACK GROUND

An easy way to comply with IJRASET paper formatting requirements is to use this document as a template and simply type your text into it. Researchers have focused on the remediation of dye wastewater using coagulation/flocculation, electrocoagulation, filtration, adsorption, ion-exchange, advanced oxidation processes (aops), activated sludge processes (asp), sequencing batch reactors (sbr), membrane bioreactors (mbr), moving bed biofilm reactors (mbbr), and constructed wetlands (cw). According to the available literature, several techniques such as chemical oxidation, coagulation, filtration with coagulation, precipitation, adsorption, and biological treatments have been frequently used to remove dyes from industrial and domestic effluents. However, the use of each of these methods in separation has merits and disadvantages. Adsorption process is considered to be one of the most effective and inexpensive treatment processes to remove dyes in wastewater.

III.AIM AND OBJECTIVES OF THE STUDY

The aim of this study is to investigate the efficiency of activated carbon in removal of dyes from wastewater using by adsorption method:

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A. *Objectives*

1) To collect the waste water samples from the Dye industry at Dharmavaram. .
2) To Collect of Activated Carbon for experimental study.
3) To analyze physico-chemical parameters ph, Turbidity, Total solids, TSS, TDS and Color of waste water samples using standard procedure.
4) To assess the efficiency of Activated Carbon in removal of dyes from wastewater .
5) To study the effect of activated carbon on physio-chemical parameters.

IV. METHODS AND MATERIAL

A. *Methodology*

Separating colors in water using activated carbon involves a straightforward process that can be applied both in industrial settings and at home:

1) Step 1: Preparation of Activated Carbon: Activated carbon can be purchased in various forms, such as powder, granules, or pellets. For water treatment, granular or powdered forms are often preferred due to their larger surface area.
2) Step 2: Application Process:
    - Mix the activated carbon with the colored water in a container. The amount of carbon needed depends on the concentration of dyes and the volume of water.
    - Stir the mixture thoroughly to ensure maximum contact between the activated carbon and the colored molecules.
    - Allow the mixture to sit for a specified period, typically ranging from a few minutes to several hours, depending on the severity of the coloration.
3) Step 3: Filtration and Removal: After the activated carbon has adsorbed the colored molecules, the mixture is filtered to separate the carbon particles from the now-clear water. This can be done using a standard filter paper, a fine mesh, or specialized filtration systems.

B. *Material*

1) *Collection Of Water Samples:* Located at a distance of 40 kms from Puttaparthi, Dharmavaram is well-connected both by rail and road. Dharmavaram is also known for its cotton and silk weaving-industry with it's silk sarees popular all over the world. In Dharmavaram there are 138 dye industries from which approximately 1000 liters of waste water is released from each industry every day.A major contribution to colour in textile wastewater is usually the dyeing and the washing operation after dyeing which as much as 50% of the dye might be released into the effluents.
2) *Collection Of Activated Carbon:* The adsorbent wood was collected from the natural areas. The wood was burnt and made into activated carbon. Charcoal is carbon. Activated charcoal is charcoal that has been treated with oxygen to open up millions of tiny pores between the carbon atoms. The use of special manufacturing techniques results in highly porous charcoals that have surface areas of 300-2,000 square metres per gram. These so-called active, or activated, charcoals are widely used to adsorb odorous or coloured substances from gases or liquids.



Fig 1. Industrial Waste Water Sample



Fig 2. Activated carbon

V. RESULTS AND DISCUSSION

TABLE.1.VARIATION OF VARIOUS PARAMETERS BEFORE AND AFTER TREATING WITH ACTIVATED CARBON

S.NO	PARAMETERS	BEFORE TREATMENT	DOSAGE OF ACTIVATED CARBON (gm/l)	RESULTS AFTER TREATMENT	STANDARD VALUES
1	pH	7.14	50 100 150 200	7. 05 7. 07 7. 02 7. 12	6.5 – 8.5
2	TURBIDITY	65.5 NTU	50 100 150 200	8.83 NTU 7.65 NTU 5.08 NTU 4.93 NTU	< 5 NTU
3	TDS	767 mg/L	50 100 150 200	285 mg/L 257 mg/L 229 mg/L 254 mg/L	< 500 mg/L
4	TSS	236 mg/L	50 100 150 200	57 mg/L 52 mg/L 54 mg/L 49 mg/L	< 75 mg/L

Table.2. Percentage of color removal by varying dosages of Activated carbon

Contact time (min)	% of color removal at 50 gm/l of activated carbon	% of color removal at 100 gm/l of activated carbon	% of color removal at 150 gm/l of activated carbon	% of color removal at 200 gm/l of activated carbon
0	0	0	0	0
10	78.6	72.3	82.6	75.9
30	74.9	66.4	84.4	81.2
60	67.8	84	87.2	85.6
90	81.5	83.5	92.9	86.7
120	86.3	80.4	94.5	88
150	78.3	77.5	98.3	88.3
180	80.5	84.9	95.5	89
240	82.6	84.2	95.9	89.5

VI. CONCLUSIONS

The main conclusions that can be withdrawn from this study are as follows:

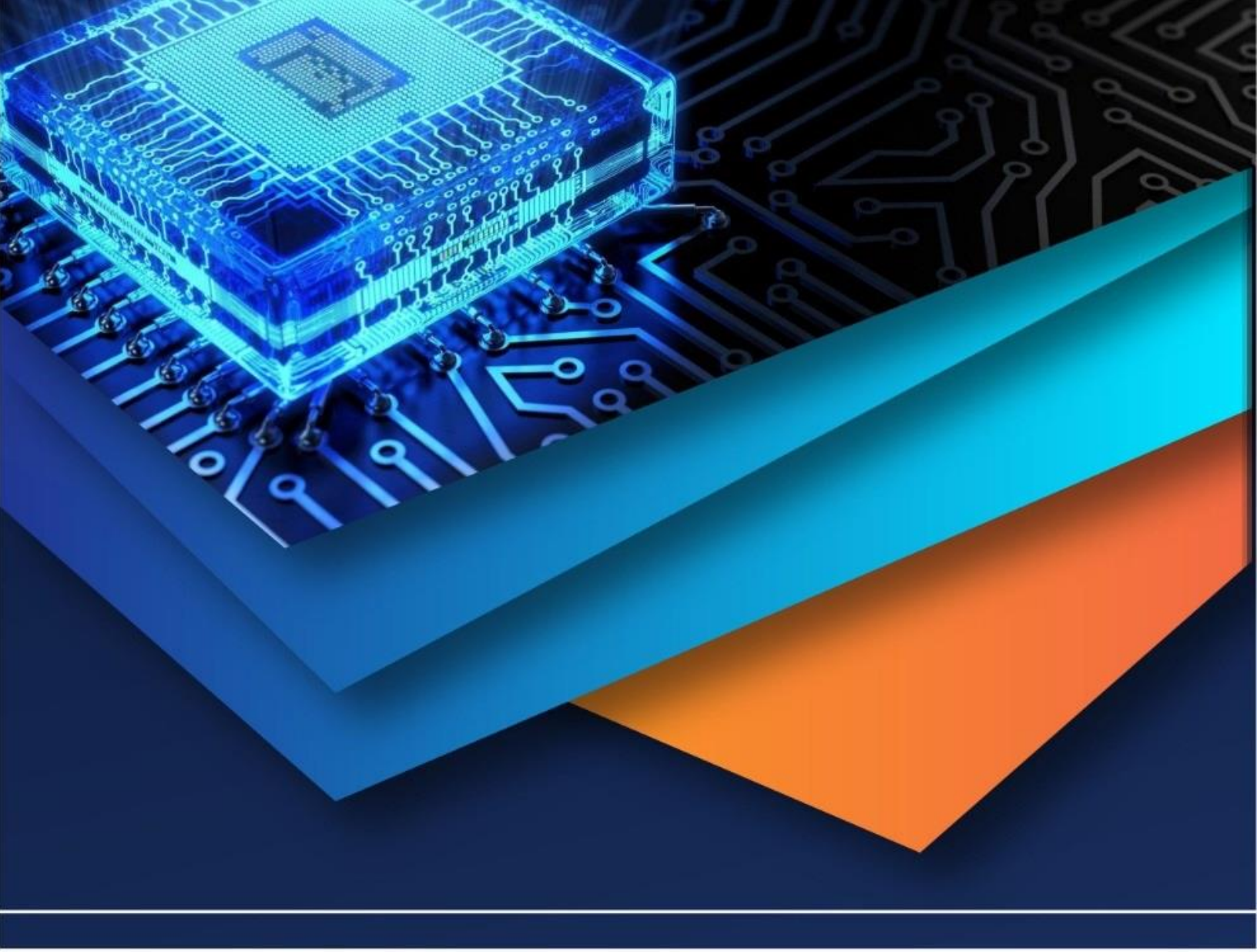
1) More efficient treatment was achieved in Color, turbidity, TDS and TSS removal from low turbid waste water.
2) The results obtained indicate that maximum Color removal as 98.3% took place for the dosage of 150 mg/l at contact time of 150 min.
3) Increasing the concentration and contact time of the activated carbon has an efficient effect in increasing the color removal efficiency.
4) It is concluded that the activated carbon gives better results for turbidity, TDS, and TSS removal.
5) The scope of adsorbents for the removal of dyes in water is increasing day by day as compared to other chemicals.
6) The water treated with activated carbon is much use full for further uses like irrigation, public uses parks, cleaning of roads etc.
7) Activated carbon is a Good material for adsorption of color to treat waste water containing lower concentration of color.

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