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Treatment of Latex Industry Wastewater Using Chemically Modified Sugar Cane Bagasse

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Abstract: The latex industry generates large volumes of wastewater containing high concentrations of suspended solids, organic matter, and chemical additives, which pose serious environmental hazards if discharged untreated. Conventional treatment methods are often costly and inefficient in removing specific pollutants. This study investigates the potential of chemically modified sugarcane bagasse, an abundant and low-cost agricultural byproduct, as an adsorbent for treating latex industry wastewater. The bagasse was subjected to chemical modification to enhance its surface area and functional groups, thereby improving its adsorption capacity. Batch experiments were conducted to analyse parameters such as pH, contact time, adsorbent dosage, and pollutant concentration. The results demonstrate significant reductions in chemical oxygen demand (COD), total suspended solids (TSS), and turbidity, highlighting the efficiency of modified sugarcane bagasse in wastewater purification. The findings suggest that this approach offers a sustainable, economical, and eco-friendly alternative for latex industry effluent treatment, contributing to both waste valorisation and environmental protection.
Keywords: Latex Industry Wastewater, Sugarcane Bagasse, pH, Turbidity, COD, BOD, Total Solids.

I. INTRODUCTION

The latex industry produces a variety of products such as gloves, balloons, threads, and adhesives, but its manufacturing processes generate wastewater containing high levels of suspended solids, organic matter, ammonia, and chemical additives. The discharge of untreated latex wastewater can cause serious environmental problems, including water pollution, oxygen depletion, and harm to aquatic ecosystems. Therefore, the development of efficient and environmentally friendly treatment methods is essential. Conventional treatment methods such as coagulation, chemical precipitation, and activated carbon adsorption are often costly and may result in secondary pollution. In recent years, agricultural waste–based adsorbents have gained attention as low-cost and sustainable alternatives. Sugarcane bagasse, a fibrous by-product of the sugar industry, has significant adsorption potential due to its high cellulose and lignin content and porous structure. In this study, chemically modified sugarcane bagasse was used as an adsorbent for the treatment of latex industry wastewater. Chemical modification enhances the surface properties and functional groups of the bagasse, improving its pollutant removal efficiency. The study highlights the potential of modified sugarcane bagasse as a cost-effective, eco-friendly, and sustainable material for industrial wastewater treatment while promoting the utilization of agricultural waste.

II. TO SPECIFIC OBJECTIVES

Evaluate the effectiveness of sugarcane bagasse in improving the quality of wastewater by analyzing parameters such as,

- Biochemical Oxygen Demand (BOD)
- Chemical Oxygen Demand (COD)
- pH value
- Turbidity

To compare the test results before and after the treatment

III. MATERIALS AND METHODS

A. Materials

Material used for this study are latex industry waste water, sugarcane bagasse, NaOH, Citric acid. laboratory tests such as pH, turbidity, COD, BOD, Total solids were conducted to determine the properties of collected sample.

1) *Latex Industry Wastewater:* The wastewater sample used for the experiment was collected from a latex processing industry. This wastewater contains high levels of organic matter, suspended solids, and chemical additives, which make it highly polluted and acidic. The collected sample was stored in clean plastic bottles and used for laboratory analysis and treatment experiments.

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2) *Sugarcane Bagasse:* Sugarcane bagasse, an agricultural waste obtained after extracting juice from sugarcane, was used as the primary adsorbent material. It contains cellulose, hemicellulose, and lignin, which provide good adsorption properties. The bagasse was collected from a local sugarcane juice vendor, washed thoroughly to remove sugars and impurities, dried, ground into smaller particles, and then chemically modified before use.
3) *Sodium Hydroxide (NaOH):* Sodium hydroxide solution (0.1 M) was used to chemically treat the raw sugarcane bagasse. This treatment helps remove impurities, increase surface area, and activate the cellulose structure of the bagasse, thereby improving its adsorption capacity for pollutants in wastewater.
4) *Citric Acid ($C_6H_8O_7$):* Citric acid solution (0.4 M) was used for further chemical modification of the bagasse. The treatment with citric acid introduces additional functional groups on the surface of the bagasse, enhancing its ability to adsorb organic pollutants and suspended particles from wastewater

B. Method

The study began with the collection of latex wastewater samples from the Malabar latex industry. Initial or preliminary tests were conducted to determine key parameters such as pH, turbidity, COD, BOD, and total solids.
Next, raw sugarcane bagasse was collected, thoroughly washed to remove impurities, and dried. The bagasse was then chemically treated using sodium hydroxide (NaOH) followed by citric acid to enhance its adsorption properties.
The prepared chemically modified bagasse was added to wastewater samples in varying dosages (2g, 4g, 6g, and 8g). After treatment, the water samples were tested again for the same parameters.
Finally, the results of treated and untreated samples were compared to evaluate the effectiveness of sugarcane bagasse in improving wastewater quality.

IV. RESULT AND DISCUSSIONS

A. Before Treatment

Test results before treatment is given in table 1

TABLE 1
BEFORE TREATMENT

Sl no	Parameters	Result	Acceptable limit
1	PH	1.62	7
2	Turbidity	165 NTU	1-5 NTU
3	Total solids	2200 mg/L	<500 mg/L
4	COD	1950 mg/L	125-500 mg/L
5	BOD	15300 mg/L	30-100 mg/L

B. After treatment test

Test results after treatment is given in table 2

TABLE 2
AFTER TREATMENT

parameters	2 mg/L	4mg/L	6mg/L	8mg/L
pH	3.06	3.09	3.16	3.22
Turbidity	*159 NTU*	*150 NTU*	*146NTU*	*136 NTU*
Total solids	2300	3500 mg/L	4300 mg/L	4100 mg/L
COD	1800	1600 mg/L	1000 mg/L	850 mg/L
BOD	11550	10050 mg/L	9750mg/L	9150mg/L

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C. Graphical Representation

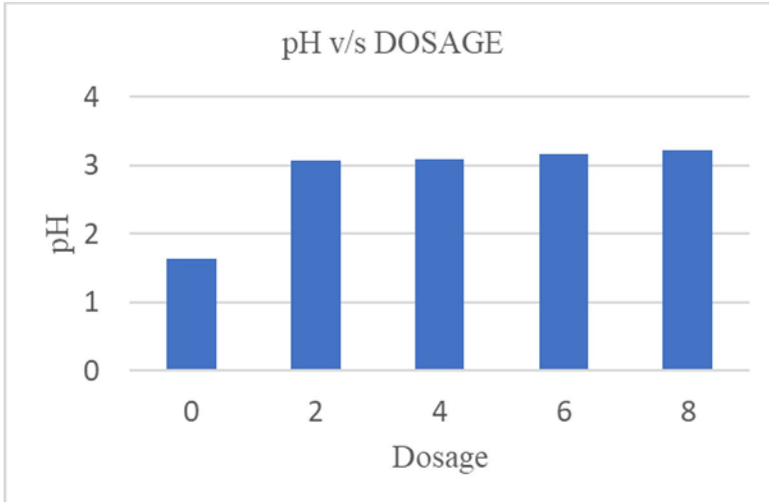

FIG 1 variation of pH with varying dosage

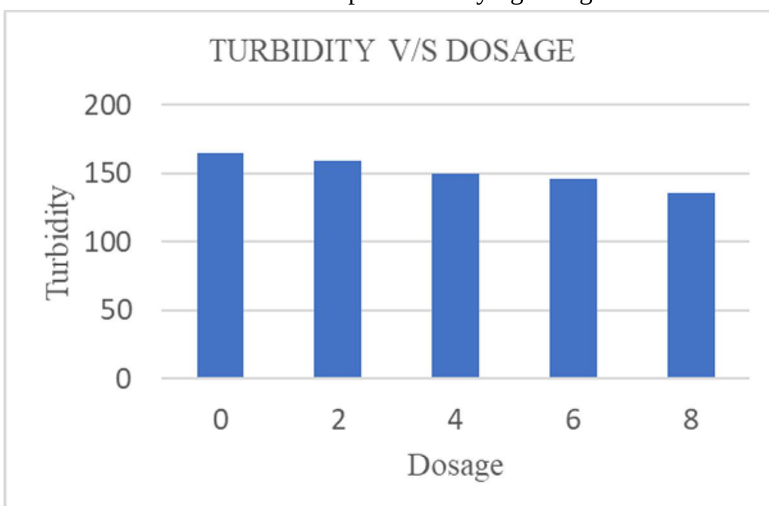

FIG 2 variation of turbidity with varying dosage

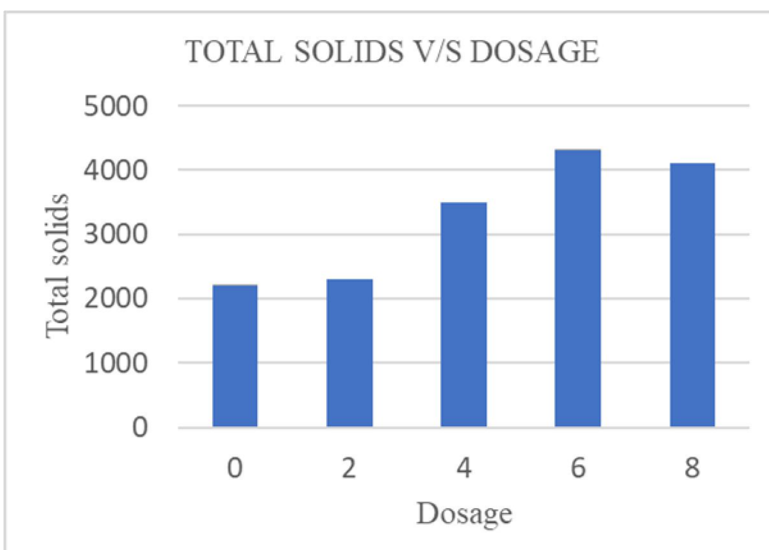

FIG 3 variation of total solids with varying dosage

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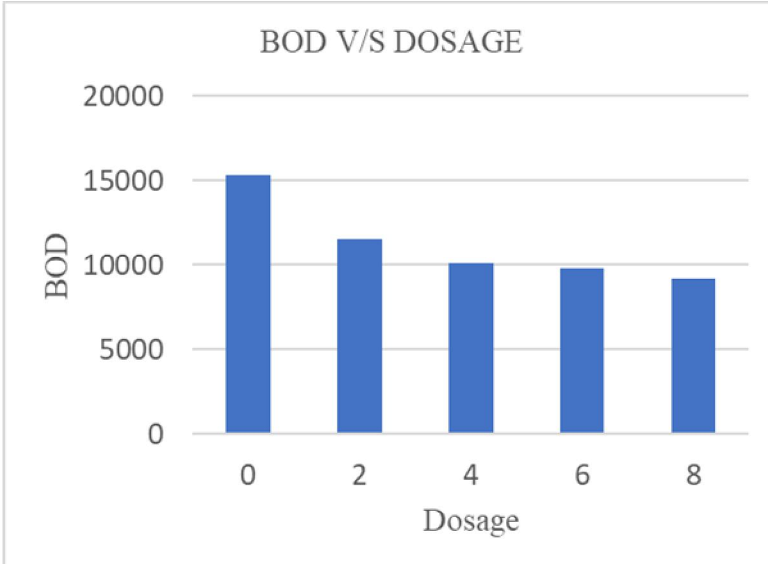

FIG 4 variation of BOD with varying dosage

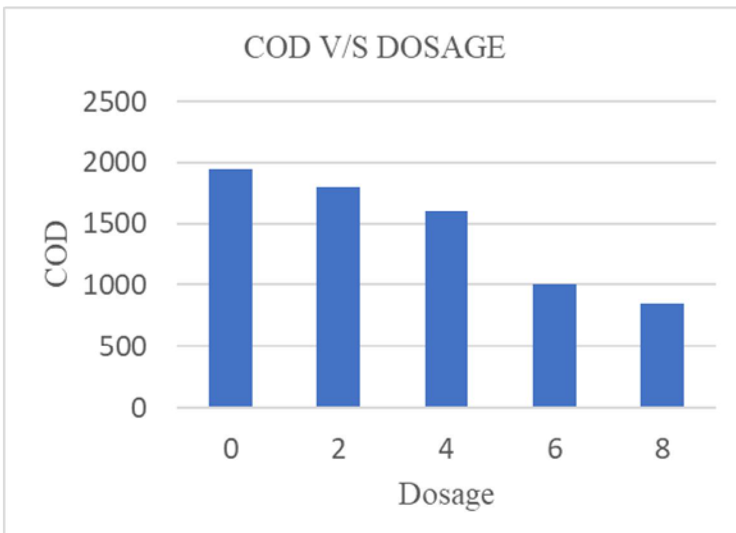

FIG 4 variation of COD with varying dosage

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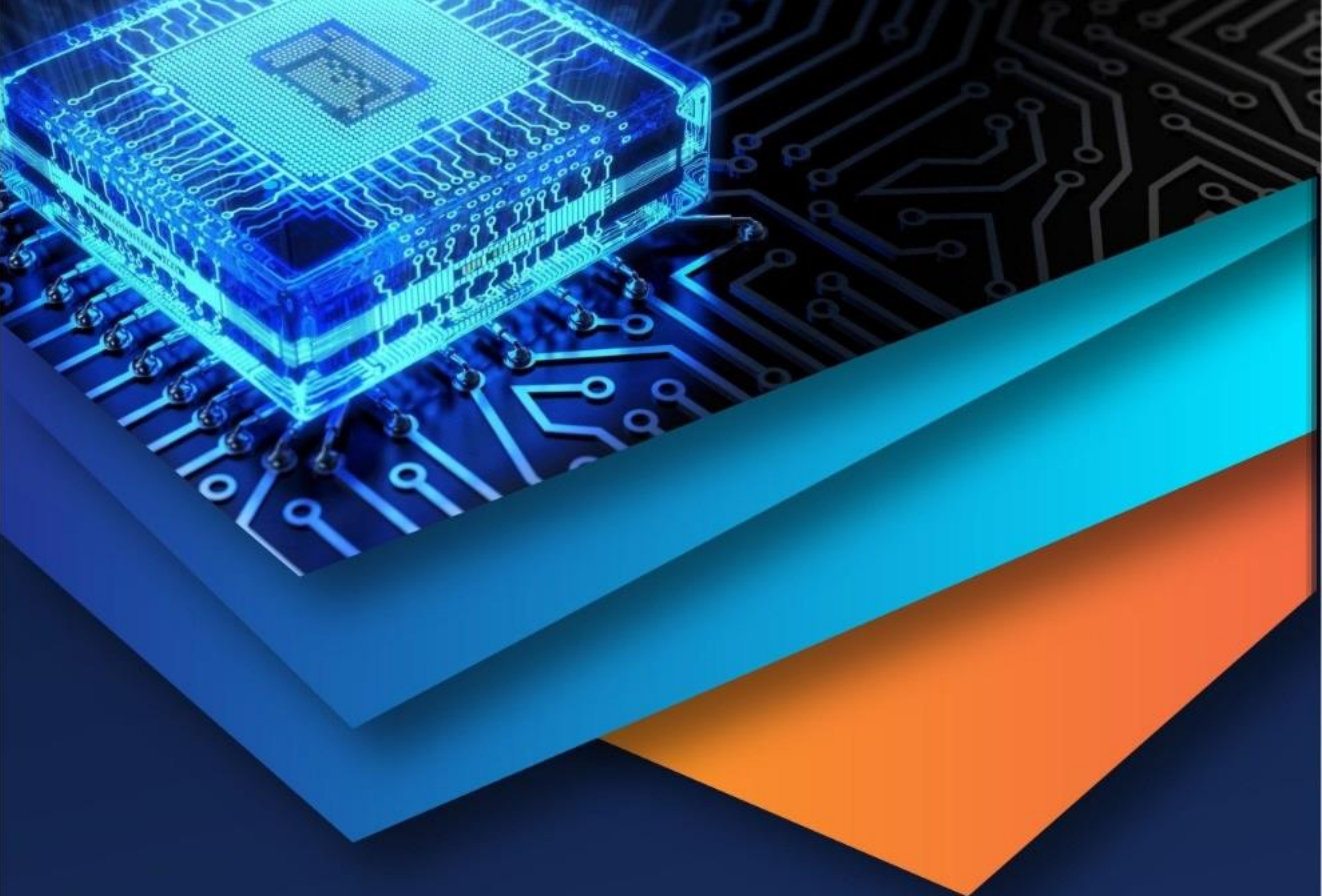

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