

SPECIMEN FORMAT FOR THESES OF MONTH

Faculty : **Science**

Department : **Chemistry**

Branch/ Area: : **Environmental chemistry**

Sub Subject Heading: : **Adsorption**

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Title of the thesis : Adsorption of Selected Textile Dyes onto Chemically Activated Carbon Adsorbents Prepared Using Waste *Biomass Bauhinia racemosa* Fruit pods

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(ii) In roman Scrip

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Designation of Supervisor : M.Sc., M.Phil., Ph.D

Centre/department/school in which research was conducted : Chemistry

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Abstract within 300 words:

Environmental pollution is one of the greatest problems that the world is facing today. The textile dyeing and finishing industry has created huge pollution problem as it is one of the most chemically intensive industries on earth and major polluter of fresh water. Among the various water treatment methods, adsorption process is considered to be a very effective technique in terms of simplicity of design, ease of operation and lower cost. Thus the work is aimed to study the Adsorption of Selected Textile Dyes onto Chemically Activated Carbon Adsorbents Prepared Using Waste Biomass *Bauhinia racemosa* fruit pods. The eco-friendly activated carbon was prepared from waste bio-mass Ripened *Bauhinia racemosa* fruit pods by sulphuric acid activation (BR-SAC) and phosphoric acid activation process (BR-PAC). The feasibility of the removal of Crystal Violet (CV), Acid Blue 110 (AB 110), Reactive Black 5 (RB 5) and Congo Red (CR) dyes were carried out by batch mode adsorption experiments using the prepared adsorbents by changing the parameters such as Initial dye concentration, Dosage of adsorbent, pH and Temperature.

The kinetics of adsorption of CV, AB110, RB5 and CR dyes were studied using Lagergren pseudo-first order, Elovich and Intraparticle diffusion rate equations. The adsorption data fitted with two well known adsorption isotherms Langmuir and Freundlich to determine adsorption equilibrium. Thermodynamic parameters such as Gibbs free energy change (ΔG), the enthalpy change (ΔH) and the entropy change (ΔS) for the adsorption of CV, AB 110, RB 5 and CR dyes from aqueous solution onto BR-SAC and BR-PAC adsorbents were determined. The surface morphology of both the adsorbents (BR-SAC and BR-PAC) have been visualized by using Field Emission Scanning Electron Microscope (FESEM) before and after adsorption of the dyes. The BET Surface areas of the adsorbents BR-SAC, BR-PAC and CAC are 288.700 m²/g 1083.440 m²/g, 1137.962 m²/g respectively Dye removal efficiency of the adsorbent BR-PAC was higher than the adsorbent BR-SAC and close to commercial activated carbon(CAC), well reflected by the surface areas of the adsorbents used in this study. Physico – chemical parameters of dyeing industry effluent samples before and after treatment with BR-PAC adsorbent revealed that BR-PAC treated effluents were closely in accordance with BIS permissible limits. The FTIR spectrum of the adsorbent indicated multiple possibilities for physical bond formation between the adsorbate and adsorbent.

Major objectives :

- To prepare and characterise the carbon adsorbent from the fruit pods of *Bauhinia racemosa* by sulphuric acid activation and phosphoric acid activation processes.
- To determine the feasibility of the removal of CV, AB110, RB5 and CR dyes by batch mode adsorption studies using the adsorbent prepared by changing the factors that significantly influence the performance of adsorption like Initial dye concentration, Dosage of adsorbent, pH and Temperature.
- To examine the Lagergren, Intraparticle diffusion and Elovich rate equations for the adsorption of dyes used in this study.
- To calculate the thermodynamic parameters for the adsorption of CV, AB110, RB5 and CR dyes and interpret the results in terms of Langmuir and Freundlich adsorption isotherms.
- To compare the adsorption capacities of sulphuric acid and phosphoric acid activated carbons with commercial activated carbon and evaluate the adsorption efficiency of *Bauhinia racemosa* – sulphuric acid activated and *Bauhinia racemosa* – phosphoric acid activated carbons on the application of treatment of industrial waste water containing the dyes used in this study.

Hypothesis:

Bauhinia racemosa – sulphuric acid activated and *Bauhinia racemosa* – phosphoric acid activated carbons can be effectively used as low cost eco friendly alternative adsorbents on the application of treatment of industrial waste water containing the dyes Crystal Violet, Acid Blue 110, Reactive Black 5 and Congo Red .

Methodology : Adsorption technique - utilization of natural wastes as adsorbents after carbonization and activation.

Findings: Interpretation and analysis of experimental data of the prepared eco - friendly activated carbon adsorbents BR-SAC and BR-PAC clearly indicated that the dye removal efficiency of the adsorbent BR-PAC was higher and very much closer to the removal efficiency of commercial activated carbon. This may be owing to the greater surface area of BR-PAC adsorbent (BET Surface area of BR-PAC 1083.440 m²/g, BR-SAC 288.700 m²/g and CAC 1137.962 m²/g). The measured water pollution parameters of the BR-PAC treated effluents coincides with the Bureau of Indian standards (BIS) permissible limits. Thus this adsorbent can be used for dye loaded effluent treatment process.

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