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An Investigation on the Applications of Eucalyptus Bark Powder for the Removal Methylene Blue from Aqueous Solution

Dr.Wondalem Misganaw

Assistant Professor at Ethiopian Defence University, College of Engineering

Background: Textile, dyeing, and printing industries consume a large amount of water and different types of chemicals in their processes. Of the several dyes utilized in textile processing industries, methylene blue (MB) is widely used as the colouring agent. The removal of methylene blue (MB) from water bodies is necessary to meet regulated concentrations in order to protect human health and the environment and has been a subject of extensive academic and industrial research.

Objective: The main goal of this research was to evaluate the adsorption equilibrium isotherms, thermodynamic, kinetic, and mass transfer parameters for the removal of methylene blue from aqueous solution using Eucalyptus Bark Powder as an adsorbent.

Methods: In this work, eucalyptus bark powder was utilized as a low cost adsorbent for the removal methylene blue from aqueous solution. Batch adsorption studies were conducted and the effect of operating parameters such as adsorption dosage, pH, initial dye concentration, temperature, and contact time on the removal efficiency of Methylene blue (MB) were investigated. Adsorption equilibrium isotherm models were used to calculate the adsorption parameters and to evaluate the potential applicability of Eucalyptus Bark Powder for the removal of methylene blue from water. Thermodynamic parameters were calculated using thermodynamic equilibrium constants derived from various constants to reveal the feasibility and to understand the mechanism of the adsorption process. Kinetics aspects were studied to evaluate the rate of adsorption process. Mass transfer parameters were evaluated to predict the controlling step in the adsorption process.

Results: The maximum removal of MB was found at 2.5 g adsorbent dosage, 120 min contact time, pH of 8, Temperature of 303 K, and initial dye concentration of 200 mg/L. At optimum operating conditions, the experimental results of methylene blue removal efficiency was 92.5 %. The maximum theoretical adsorption capacity of methylene blue on the surface of chitosan/bentonite biocomposite was found to be 65.4 mg/g. Equilibrium studies were carried out in the temperature range of 283 to 313 K and found that the Freundlich isotherm fitted well to the experimental data with the highest correlation coefficient (R²) and least chi-square (χ^2) values for all the adsorbents used.

Conclusion: The results revealed that eucalyptus bark powder was effective and a low cost adsorbent removal methylene blue from aqueous solution

Biography

Dr. Wondalem Misganaw has completed his PhD in Chemical Engineering from Indian Institute of Technology Delhi in 2017. Currently, he is Assistant Professor at Ethiopian Defence University, College of Engineering. He has published more than 7 papers in a peer reviewed journals and presented his research findings in more than 4 International conferences. His research interest is smart materials for environmental applications
wondalem2004@gmail.com

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