ADSORPTIVE REMOVAL OF METHYLENE BLUE USING ACTIVATED CARBON DERIVED FROM BARK WASTE OF *Acacia mangium*

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ABSTRACT

This study investigates the potential of activated carbon obtained from *Acacia mangium* bark waste (BWA-AC) in removing methylene blue (MB) from aqueous solutions, tackling a significant environmental challenge associated with dye pollution. The study aims to optimise critical adsorption parameters such as adsorbent dosage, pH, contact time, temperature, and initial dye concentration to assess the effectiveness and practicability of BWA-AC as a sustainable adsorbent. The adsorption behaviour was examined by isotherm models (Langmuir, Freundlich, and Temkin) and kinetic experiments to clarify the underlying mechanisms. Results indicate that BWA-AC displays superior adsorption capability, attaining optimal removal efficiency under particular conditions. The Langmuir model signifies monolayer adsorption with elevated adsorption capacity (q_{max}), whereas the Freundlich model endorses its relevance to heterogeneous surfaces. Thermodynamic analyses indicate the spontaneous and endothermic characteristics of the adsorption process. This study emphasises the dual advantages of employing *Acacia mangium* bark waste for water purification: alleviating dye contamination and fostering sustainable waste management. The results highlight the promise of BWA-AC as an economical and sustainable option for wastewater treatment in industrial and environmental contexts. The maximum adsorption capacity achieved was 291.42 mg/g.