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ADSORPTIVE REMOVAL OF ERIOCHROME BLACK T (EBT) FROM AQUEOUS SOLUTION USING GRANULAR ACTIVATED CARBON DERIVED FROM COCONUT SHELL

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This Final Year Project Report entitled **"Adsorptive Removal of Eriochrome Black T (EBT) from Aqueous Solution Using Granular Activated Carbon Derived from Coconut Shell"** was submitted by Syed Muhammad Amir Hamzah bin Syed Ismail in partial fulfilment of the requirement for the Degree of Bachelor of Sciences (Hons.) Applied Science, in the Faculty of Applied Sciences and was approved by:

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ABSTRACT

ADSORPTIVE REMOVAL OF ERIOCHROME BLACK T (EBT) FROM AQUEOUS SOLUTION USING GRANULAR ACTIVATED CARBON DERIVED FROM COCONUT SHELL

The discharge of synthetic dyes such as Eriochrome Black T (EBT) into aquatic environments poses serious environmental concerns due to their persistence, toxicity, and resistance to biodegradation. This study investigates the adsorptive removal of EBT from aqueous solution using granular activated carbon (GAC) derived from coconut shell as a low-cost and sustainable adsorbent. Batch adsorption experiments were conducted to evaluate the effects of adsorbent dosage, initial dye concentration, contact time, solution pH, and temperature on adsorption performance. The adsorption kinetics were optimal characterized by the pseudo-second-order model, with a good correlation value ($R^2 = 0.9143$) and an equilibrium adsorption capacity (q_e) of 40 mg/g, signifying that chemisorption was the best mechanism in the adsorption process. The equilibrium data conformed closely to the Freundlich isotherm model ($R^2 = 0.9143$), indicating heterogeneous surface adsorption. Thermodynamic study indicated Gibbs free energy changes ($\Delta G°$) of −0.36, −0.11, and 0.09 kJ/mol at 25, 30, and 35 °C, respectively, signifying that the adsorption process was spontaneous at lower temperatures. The positive enthalpy change ($\Delta H° = +7.35$ kJ/mol) affirmed the endothermic characteristic of adsorption, whilst the positive entropy change ($\Delta S° = +24.24$ J/mol·K) indicated enhanced disorder at the solid–solution interface during adsorption. The findings indicate that coconut shell-derived granular activated carbon is an efficient and sustainable adsorbent for the elimination of Eriochrome Black T from aqueous solutions. This study offers significant insights into the adsorption mechanism and endorses the prospective use of agricultural waste-derived activated carbon for dye elimination in wastewater treatment systems.