ADSORPTIVE REMOVAL OF METHYLENE BLUE

BY USING ACTIVATED CARBON DERIVED FROM

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BACHELOR OF SCIENCE (Hons.)

APPLIED CHEMISTRY

AUGUST 2024

UNIVERSITI TEKNOLOGI MARA | Fakulti Sains Gunaan

SUBMISSION FOR EVALUATION
FINAL YEAR PROJECT 2 - RESEARCH PROJECT

ADSORPTIVE REMOVAL OF METHYLENE BLUE BY USING ACTIVATED CARBON DERIVED FROM WASTE COFFEE GROUNDS

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Final Year Project Proposal Submitted in
Partial Fulfilment of the Requirements for the
Degree of Bachelor of Science (Hons.) Applied Chemistry
In the Faculty of Applied Sciences
Universiti Teknologi MARA

AUGUST 2024

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ABSTRACT

Adsorptive removal of Methylene Blue

by using Activated Carbon Derived from Waste Coffee Grounds

In this study, the waste coffee grounds-derived activated carbon (CSG-AC) used was prepared via zinc chloride ($ZnCl_2$) activation. CSG-AC is used as an adsorbent to remove methylene blue (MB) from the aqueous solutions. The effects of adsorbent dosage, initial concentration, contact time, solution pH, and temperature were studied in batch experiments. The experimental data were analysed by the Langmuir, Freundlich, and Temkin adsorption isotherm models. Based on correlation coefficient results (0.9998), the Langmuir isotherm model provided the best fit for the adsorption of MB onto CSG-AC. The maximum monolayer adsorption of MB onto CSG-AC was calculated to be 176 mg/g. Kinetic parameters were evaluated based on pseudo-first-order (PFO), pseudo-second-order (PSO) and Weber-Morris intraparticle diffusion (IPD) kinetic models. The regression results showed that a PSO model is more accurately representing the adsorption kinetics. The plot of q_t versus $t^{1/2}$ for the IPD model represented multi-linearity and proved that the adsorption processes occurred in more than one step. Thermodynamic parameters were determined between temperatures of 25 to 34 °C. The $\Delta G°$ values were negative while the $\Delta H°$ values were positive and the overall adsorption process was determined as spontaneous and endothermic. While the positive value of $\Delta S°$ proposed good affinity of the MB molecules toward the CSG-AC. The results from this study suggested that CSG-AC could be a viable adsorbent in managing higher concentrations of dyes from water and wastewater.