ADSORPTIVE REMOVAL OF METHYLENE BLUE USING ACTIVATED CARBON DERIVED FROM COCONUT SHELL

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ABSTRACT

ADSORPTIVE REMOVAL OF METHYLENE BLUE USING ACTIVATED CARBON DERIVED FROM COCONUT SHELL

In this study, coconut shell activated carbon (CS-AC) activated by zinc chloride ($ZnCl_2$), utilized as an adsorbent to remove methylene blue (MB) from aqueous solutions. The CS-AC exhibited an acidity value of 5.4 and some functional groups based on Fourier Transform Infrared Spectroscopy, (FTIR) analysis. Batch experiments were conducted to investigate the effects of the adsorption parameters, such as adsorbent dosage, initial MB concentration, contact time, initial pH, and temperature. The experimental data were analyzed using Langmuir, Freundlich and Temkin adsorption isotherm models. Based on the correlation coefficient, (R^2) results, the Langmuir isotherm model provided the best fit for the adsorption of MB onto CS-AC, with a calculated maximum monolayer adsorption capacity, q_{max} of 214.53 mg/g. Adsorption kinetics were analyzed using pseudo-first-order (PFO), pseudo-second-order (PSO), and Intraparticle diffusion (IPD) models. The R^2 results indicated that the PSO model is more accurately described the adsorption kinetics. The van't Hoffman plot (q_t versus $t^{½}$) indicated multi-linearity, involving multiple steps in the adsorption process. Thermodynamic parameters were determined over the temperature range of 25 to 34°C, resulting in $\Delta G°$ value was negative while $\Delta H°$ values was positive, indicating a spontaneous and endothermic adsorption process. The positive value of $\Delta S°$ suggested increased randomness of MB molecules towards CS-AC. The result from this study indicated that CS-AC as a good adsorbent for the removal of MB and could pave the way for more low-cost adsorbents for dye removal from water and wastewater.

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