

Effect of Operational Parameters for Removal of Fluorescein Sodium Dyes by Bentonite

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Abstract: *The removal of synthetic dyes from industrial wastewater has become a critical environmental concern due to their toxic and non-biodegradable nature. This study investigates the parameters governing the adsorption of Fluorescein Sodium dye onto bentonite clay. Batch adsorption experiments were conducted at varying temperatures (298, 308, 318, and 328 K), initial dye concentrations (10-100 mg/L), contact times (30-240 minutes), and pH values (2-10). The maximum adsorption capacity was found to be 85.2 mg/g at 298 K at pH 6. Thermodynamic parameters including Gibbs free energy change (ΔG°), enthalpy change (ΔH°), and entropy change (ΔS°) were calculated using Van't Hoff equation. The negative ΔG° values (-15.8 to -18.7 kJ/mol) confirmed the spontaneous nature of the adsorption process. The positive ΔH° value (+12.4 kJ/mol) indicated endothermic adsorption, while positive ΔS° (+95.2 J/mol·K) suggested increased randomness at the solid-liquid interface. Kinetic studies revealed that the adsorption followed pseudo-second-order kinetics, and equilibrium data fitted well with Langmuir isotherm model. The results demonstrate that bentonite is an effective and environmentally friendly adsorbent for Fluorescein Sodium dye removal from aqueous solutions.*

Keywords: Operational Parameters; Adsorption; Bentonite; Fluorescein Sodium; Water treatment

