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Adsorption Study of Methylene Blue Dye on Clay in Aqueous Solution

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ABSTRACT

Removal of Methylene Blue (MB) from aqueous solution by adsorbing it on Montmorillonite was investigated by batch method. The studies were conducted at 25°C and included the effects of pH and initial concentration of Methylene Blue. The adsorption of (MB), whose isotherms are modeled according to Langmuir and Freundlich, were studied at a variety of physical and chemical conditions. The data fitted very well with Freundlich isotherm. The maximum capacity of MB adsorbed on Natural and Activated Clay at equilibrium (Qe) (78 mg g^{-1} and 75.7 mg g^{-1}) with a fixed adsorbent dose of 0.5 g L^{-1} was observed at MB concentration of 30 mg L^{-1}, 293° K, pH 7.5 and 270 min equilibrium time and maximum monolayer adsorption capacity was found to be 36 mg of the dye per gram of clay. The data were also analyzed in terms of their kinetic behavior and was found to obey the pseudo second order equation. In addition, various thermodynamic parameters, such as standard Gibbs free energy (ΔG°), standard enthalpy (ΔH°), standard entropy (ΔS°), and the activation energy (Ea) were calculated. The adsorption process of MB dye onto clay was found to be spontaneous and endothermic process.

Keywords: Methylene blue; Sorption isotherms; Kinetics; thermodynamics; Adsorption.