



Equilibrium modeling and thermodynamic parameters for adsorption of cationic dyes onto Yemen natural clay

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ABSTRACT

The equilibrium modeling for adsorption of cationic dye Methylene Blue (MB) onto Yemen natural clay at different temperatures, particle size and solution pH was studied. The adsorption capacity was found to be increase with increasing temperature and pH and decreased with increasing particle size. The maximum adsorption capacity was 500.0 (mg g⁻¹) at $T = 25^{\circ}\text{C}$, $d_p = 250\text{--}355\ \mu\text{m}$ and $\text{pH} = 12$. The data are successfully tested by Langmuir, Freundlich, Temkin and Redlich–Peterson models. It was found that the Redlich–Peterson isotherm best fit the experimental data over the whole concentration range. Thermodynamic parameters such as standard Gibbs free energy (ΔG°), standard enthalpy (ΔH°), and standard entropy (ΔS°) were calculated. The thermodynamic parameters of methylene blue/clay system indicated spontaneous and endothermic nature of the adsorption process. The results demonstrate that Yemen natural clay is very effective in the removal of MB from aqueous solution and can be used as alternative of high cost commercial adsorbents.

Keywords: Equilibrium adsorption; pH; Modeling; Thermodynamic parameters; Methylene Blue; Yemen natural clay

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