The adsorption study of methylene blue from aqueous solution using synthetic zeolite as highly potential adsorbent from water sludge

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Abstract: The synthesis of zeolite as ion exchange material, adsorbents and catalyst for industrial applications is very importance. The aim of this work is to synthesis zeolite as synthetic dye adsorbent from water sludge. The adsorption performance of synthetic zeolite for methylene blue removal was examined using a batch method. Optimum parameters for adsorption including adsorbent dosage and adsorption time were investigated. Adsorption isotherm and thermodynamic parameters were studied. The obtained results indicated that at initial dye concentration at 300 mg/L, optimum dosage of adsorbent is 14 g/L and optimum adsorption time is 60 minutes with 90% of dye adsorption. The adsorption isotherm of methylene blue onto zeolite agrees well with the Langmuir isotherm and kinetic process corresponded well to pseudo-second order model. Moreover, thermodynamic properties of the adsorption, entropy $\Delta S^\circ$, enthalpy $\Delta H^\circ$ and Gibb’s free energy $\Delta G^\circ$ (were determined to be 7.44 KJ mol⁻¹, -2.78 KJ mol⁻¹ and -5.00 (303K) KJ mol⁻¹. These results indicate that the synthesis of zeolite is a promising and low-cost adsorbent for removing methylene blue dye from wastewater due to the high adsorption capacity.

Keywords: Zeolite; Methylene Blue dye; Sludge; Adsorption; Thermodynamic parameter; Isotherm