Kinetic studies and equilibrium isotherm analyses for the adsorption of Methyl Orange by coal fly ash from aqueous solution

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ABSTRACT

The coal fly ash waste generated from thermal power plant has been used as low cost adsorbent for the removal of methyl orange (MO) from the aqueous solution. In the batch experiments, the effect of various parameters was studied such as contact time, pH, adsorbent dosage, dye concentration and temperature. The adsorption of MO on the fly ash at different temperatures follows the pseudo second order kinetics. Freundlich, Langmuir, Redlich–Peterson (R–P), Temkin and Dubnin–Radushkevich isotherm models using nonlinear regression technique for the adsorption of MO were analyzed. R–P and Langmuir isotherms were found to be suitable to represent the data for adsorption. Error analysis shows that the Langmuir isotherm best fits the adsorption data at various temperatures. Isotherms have also been used to obtain thermodynamic parameters such as free energy, enthalpy and entropy. The adsorption of MO was exothermic in nature (ΔH: –38.16 to –36.41 kJmol^{-1}) with increasing temperature over range of 303–333 K.

Keywords: Methyl orange; Fly ash; Adsorption; Kinetics; Isotherms; Thermodynamic parameters