Removal of m-phenylene diamine by adsorption onto activated carbon: kinetics, equilibrium and process design

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ABSTRACT

The adsorption behavior of m-phenylene diamine (m-PDA) from aqueous solution onto activated carbon was investigated under various experimental conditions, such as contact time, adsorbate concentration, and temperature. Maximum adsorption capacity for m-PDA was found to be 33.17 mg g^{-1} at pH 7.0 and temperature 303 K. The adsorption kinetics data were best described by the pseudo-second-order rate equation and the equilibrium was achieved after 120 min. The m-PDA adsorption was governed by film diffusion process. Besides, equilibrium data were very well represented by the Redlich–Peterson model. A model for prediction of the dose of adsorbent required to achieve a range of m-PDA removals for a given number of adsorption–desorption cycles has been developed and validated based on the Langmuir isotherm. Thermodynamic parameters indicated the spontaneous, endothermic, and increased random nature of m-PDA adsorption. The amide, carboxylic acid, and nitro groups of the activated carbon were involved in chemical interaction with the m-PDA molecules. Results suggested that the activated carbon has good potential for remediation of m-PDA contaminated waters.

Keywords: Activated carbon; Adsorption; m-phenylene diamine; Kinetics; Thermodynamics

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