



Kinetics of the batch adsorption of methylene blue from aqueous solutions onto rice husk: effect of acid-modified process and dye concentration

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ABSTRACT

In this study, adsorption of methylene blue (MB) dye onto clean rice husks (CRH) and acid-modified CRH was investigated with respect to the contact time, MB concentrations, acid concentrations and acid types used in the acid modification processes. The results indicate that the acid modification process reduces the MB sorption efficiency from 98% for CRH to 67% for NRH (nitric acid treated rice husk), 59% for HRH (hydrochloric acid treated rice husk) and 55% for SRH (sulfuric acid treated rice husk). In order to investigate the adsorption mechanisms, four kinetic models, i.e., pseudo-first-order, pseudo-second-order, Elovich and intraparticle diffusion models were fit to the experimental results. The characteristic parameters and correlation coefficients for each kinetic model were determined. The fits of the kinetic results from the kinetic equations were compared with the experimental data. The results indicate that the acid modification process changes the MB adsorption mechanism. Langmuir, Freundlich, Temkin, Redlich-Peterson (RP), and Langmuir-Freundlich (LF) isotherm models were also employed to analyze the equilibrium data, and the correlations of the experimental data to the isotherms was examined. The LF isotherm was found to best represent the data for MB adsorption onto CRH. The separation factor revealed the favorable nature of the isotherm to the MB-CRH system.

Keywords: Acid-modified; Methylene blue; Adsorption; Kinetics; Equilibrium isotherms; Rice Husk
