Evaluation of batch and continuous adsorption kinetic models of cadmium from aqueous solutions using sugarcane straw nano-structure absorbent

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ABSTRACT

The purpose of this study was to analyze batch and column adsorption kinetics equations of cadmium from aqueous solutions using sugarcane straw nano-structure absorbent. In the batch experiments, adsorption kinetics was investigated. In the column experiments, a fixed-bed column with 84 cm height (27 cm for free board) and 3.4 cm internal diameter was used. Adsorption column performance for 5, 10 and 20 mg/L cadmium ion, for 0.05 L/min continuous flow rate from up to down and 27 cm bed height was used. Experiments were conducted at the pH = 5 and laboratory temperature condition. Second order kinetics model with $R^2 = 0.974$ and RMSE = 0.002 had the highest correlation with laboratory data. The maximum adsorption capacity of second order kinetics model (1.11 mg/g) was exactly equal to maximum actual adsorption capacity. Continuous test results showed that with increasing concentrations of 5 to 20 mg/L cadmium, the maximum adsorption capacity increased from 0.91 to 2.08 mg/g and the adsorption efficiency decreased from 48.8 to 30.32. The model of Thomas and Yon- Nelson with the correlation coefficient up to 0.95 were more consistent with laboratory data of fixed bed columns compared to Bohart-Adams, and Dose Response models.

Keywords: Sugarcane straw; Cadmium; Continuous and batch system; Kinetic model

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