Dynamic adsorption of methylene blue by melon peel in fixed-bed columns

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ABSTRACT

The dynamic adsorption of methylene blue (MB) by melon peel (MP) was studied in packed bed columns. The values of column parameters were predicted as a function of flow rate and initial dye concentration. On evaluating the breakthrough curves, the adsorption isotherms of MB by MP were experimentally determined in batch conditions. The Langmuir model was found to fit the adsorption isotherm data well with a maximum adsorption capacity of 333.33 mg/g at 25˚C. A series of column tests using MP as a low-cost adsorbent were performed to determine the breakthrough curves with varying initial dye concentrations and flow rates. High bed height, low flow rate and high initial dye concentration were found to be the better conditions for maximum dye adsorption. To predict the breakthrough curves and to determine the characteristic parameters of the column useful for process design, four kinetic models namely Bohart and Adams, Clark, Wolborska, and Yoon and Nelson were applied to experimental data. All models were found suitable for describing the whole, or a definite part of the dynamic behavior of the column, with respect to flow rate and initial dye concentration. The initial segment of the breakthrough curve was not well fitted by the Wolborska model, while the whole breakthrough curve was well predicted by the Bohart and Adams, Clark, and the Yoon and Nelson models. The findings revealed that MP has a high adsorption potential, and it could be used to treat dye-containing effluents.

Keywords: Methylene blue; Dynamic adsorption; Fixed bed; Melon peel; Modeling

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