Optimization of the column studies into the adsorption of basic dye using tartaric acid-treated bagasse

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ABSTRACT

Previous batch studies have shown that acid treated bagasse is a potentially useful adsorbent for treating dye wastewaters. The present paper examines the use of tartaric acid-modified bagasse for the continuous adsorption of methylene blue (MB) dye in columns. The adsorbent was characterized using Fourier transform infrared spectroscopy and scanning electron microscopy. A $2^3$ full factorial design analysis was carried out to screen the significant parameters that affecting the adsorption of MB dye onto tartaric acid-modified bagasse, namely initial MB concentration (100–300 mg/L), column bed height (40–80 mm), and feed flow rate (5–15 mL/min). The adsorption process was optimized using response surface methodology -central composite design with the help of Minitab® 14 software. Maximum decolorization (99.42%) and chemical oxygen demand reduction (88.40%) could be achieved at 200 mg/L inlet MB dye concentration with 78 mm bed height and 3.5 mL/min of feed flow rate. Thomas and Yoon–Nelson models were in good agreement with the experimental results ($r^2 > 0.91$).

Keywords: Bagasse; Methylene blue; Continuous adsorption; Optimization; Modeling

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