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Removal of methylene blue from aqueous solution by walnut carbon: optimization using response surface methodology

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ABSTRACT

In this study, carbon was easily made from walnut wood as a low-cost and non-toxic natural adsorbent. It was used to remove methylene blue rapidly from aqueous solutions. This adsorbent was re-used after heating. Boehm titration method, BET surface area measurement, FTIR, and pH determination at zero point of charge (pH_{ZPC}) were used to characterize this adsorbent. Response surface methodology was used to reduce the number of experiments and to optimize the experimental factors such as pH of solution, contact time, initial dye concentration, and adsorbent dosage. The optimal conditions for the dye removal were found to be 10, 2.0 min, 9.00 mg/L, and 0.250 g for pH, contact time, initial dye concentration, and adsorbent dosage, respectively. The rapid adsorption of the MB dye is an advantage of this adsorbent. Various isotherm models were used to fit the experimental equilibrium data. The results showed the suitability and applicability of Langmuir model. Kinetic models such as pseudo-first-order, pseudo-second-order, Elovich, and intraparticle diffusion models indicated that the second-order equation model controls the kinetic of the adsorption process.

Keywords: Adsorption; Methylene blue; Carbon; Kinetic; Thermodynamic; Walnut wood

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