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Preparation of textile sludge-derived activated carbons via KI and KOH activation for fast and efficient removal of methylene blue

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ABSTRACT

Textile sludge is a promising precursor of activated carbon. In this work, textile sludge-based activated carbons (TSACs) were prepared at different activation temperatures (400°C–800°C) and times (0.5, 1, and 2 h) using a mixture of potassium iodide (KI) and potassium hydroxide (KOH). The impregnation ratio of KI:KOH:textile sludge was fixed at 0.7:0.3:1. The effects of activation temperature and time on the methylene blue adsorption capacity were investigated, and response surface methodology was employed to optimize the process parameters. The TSACs were characterized for physicochemical properties. Results showed that the optimum activation conditions of 700°C for 1 h yield 17.9% of TSAC with an excellent maximum methylene blue adsorption capacity of 382 mg/g. The TSAC possessed high surface area, total pore volume, and microporosity of 1,180 m^2/g, 0.776 cm^3/g, and 56.5%, respectively. The isotherm study showed that the Langmuir model gave a good fit, indicating a monolayer adsorption. The adsorption kinetics was well described by the pseudo-second-order kinetics model, signifying that chemisorption may predominate, whereas the intraparticle diffusion model suggested that the pore diffusion is not the sole rate-limiting step. This study provides further understanding on the optimization of TSAC for dye wastewater treatment.

Keywords: Activated carbon; Activation; Methylene blue; Textile sludge

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