Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2017.20132

62 (2017) 208–220
February

Response surface methodology approach for optimization of color removal and COD reduction of methylene blue using microwave-induced NaOH activated carbon from biomass waste

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Received 26 March 2016; Accepted 31 July 2016

ABSTRACT

Coconut leaves (*Cocos nucifera. L*) biomass waste were utilized for the preparation of activated carbon by microwave-induced NaOH activation. The surface characteristics of the coconut leaves activated carbon (CLs-AC) were determined by scanning electron microscopy, Fourier transform infrared spectroscopy and pH_{PZC}. Subsequently, the CLs-AC was applied for the color removal and chemical oxygen demand (COD) reduction of methylene blue (MB) from aqueous solutions. The face-centered composite design (FCCD) and response surface methodology were used to investigate the effects of main operating variables such as initial solution pH (3–8), temperature (298–323 K), adsorbent dosage (0.2–1.50 g/L), and contact time (15–90 min), while the initial MB concentration was fixed at 100 mg/L throughout the optimization process. Maximum color removal (99.37%) and COD reduction (98.27%) for MB can be achieved by simultaneous interaction between temperature with time and adsorbent dosage with contact time. The optimum pH, temperature, adsorbent dosage and contact time were found to be 8.00, 323.00 K, 1.50 g/L and 90 min, respectively. Under optimal conditions, the adsorption equilibrium data was well fitted with the Langmuir adsorption isotherm with R^2 of 0.9907 and q_{max} at 87.72 mg/g. The adsorption kinetics was found to follow pseudo-second-order model.

Keywords: Optimization; Response surface methodology; Decolorization; Chemical oxygen demand; Adsorption; Activated carbon

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