Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2017.21429

92 (2017) 116–127
October

Removal of trihalomethane precursors from water using activated carbon obtained from oak wood residue: kinetic and isotherm investigation of adsorption process

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Received 2 February 2017; Accepted 16 September 2017

ABSTRACT

A novel adsorbent, activated carbon prepared from oak wood residue (ACOWR) was applied to eliminate trihalomethanes (THMs) precursors in an improved adsorption process. The prepared adsorbent was characterized by the Brunauer–Emmett–Teller and Barrett–Joyner–Halenda surface area measurement, Fourier transform infrared spectroscopic and scanning electron microscopic analyses. Moreover, the impacts of parameters including pH value, initial total organic carbon (TOC) concentration, contact time and adsorbent dose on TOC and UV_{254} removal from water were surveyed. Both TOC adsorption efficiency and UV_{254} removal remained approximately constant within the pH range of around 3–8. At the optimal adsorption conditions: pH = 6.5 and contact time = 120 min, approximately 53% and 62% removal efficiencies were obtained, respectively, for TOC and UV_{254} removal using the adsorbent dose of 2.5 g L^{-1} and initial TOC concentration of 10 mg L^{-1}. Experimental data were fitted with different isotherms and kinetic models. The results showed that the adsorption data were fitted well to the Freundlich isotherm equations, indicating that THMs precursors' uptake was mainly directed by a heterogeneous physical adsorption. Also, the kinetic data were best fitted to the pseudo-second-order and intraparticle diffusion kinetic models. The results also showed that the preparation of the ACOWR is easy and can be employed as an adsorbent for the effective removal of THM precursors from aqueous environments.

Keywords: Oak wood activated carbon; Trihalomethane precursors; Adsorption kinetics; Adsorption isotherms

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