

Pb(II) ions sequestration from aqueous solutions by canola stalk: isotherms and kinetics studies

Hanie Hashtroudi, Mehdi Khiadani*, Guangzhi Sun

School of Engineering, Joondalup Campus, Edith Cowan University, 270 Joondalup Drive, Joondalup, Perth, WA 6027, Australia, Tel. +61863045825; Fax: +61863045811; emails: Hhashtro@our.ecu.edu.au (H. Hashtroudi), M.khiadani@ecu.edu.au (M. Khiadani), G.sun@ecu.edu.au (G. Sun)

Received 25 October 2017; Accepted 22 April

ABSTRACT

This study reports on batch adsorption experiments aimed at sequestration of Pb(II) ions from synthetic wastewater at low concentrations onto canola stalk. The surface of the canola stalk was analysed using Fourier transform infrared spectroscopy, scanning electron microscopy, and energy dispersive X-ray spectroscopy systems. The sorption efficiency of the canola stalk for the elimination of lead ions was investigated for a range of pHs, contact times, concentration of lead ions and canola stalk dosages. The experimental data were evaluated applying the Freundlich, Langmuir, Harkins-Jura, Redlich–Peterson and Halsey isotherm equations. The results fitted excellently into the Freundlich and Halsey isotherm models. The Freundlich maximum multilayer sorption capacity was obtained to be 10.923 mg/g. The dynamic mechanism of lead adsorption was investigated over time using pseudo-second-order, pseudo-first-order, Elovich, fractional power and intraparticle diffusion kinetic models. The kinetic study indicated the adsorption data best fitted into the pseudo-second-order equation. The final results demonstrated the effective and fast sorption performance of canola stalk as a low cost and natural adsorbent to treat lead-contaminated wastewater.

Keywords: Agricultural waste; Canola stalk; Isotherms; Kinetics; Pb(II) adsorption

* Corresponding author.