Effectiveness and mechanisms of mercury sorption by biochars from invasive Brazilian pepper at different temperatures

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Abstract

Characteristics and mechanisms of mercury sorption by biochars from Brazilian pepper (BP; *Schinus terebinthifolius*) through pyrolysis at different temperature (300, 450, and 600˚C) were investigated. The surface characteristics of BP biochars before and after Hg(II) sorption were examined with scanning electron microscopy-equipped with energy dispersive X-ray spectroscopy and Fourier transform infrared spectroscopy. The sorption process can be described by the pseudo-second order equation and Langmuir equation. The kinetic data suggested that Hg sorption was rapid initially and reaching equilibrium after 24 h. All biochars were effective in Hg sorption, with maximum sorption capacity being 28.6-41.0 mg/g and the sorption capacity decreasing as temperature increased. FTIR and modification results showed that carboxylic and amine groups were responsible for Hg sorption. Release of Ca^{2+}, K^{+} and Na^{+} cations confirmed the role of ion exchange for Hg(II) removal by BP biochars. Our results suggest that BP biochars can be used as an alternative sorbent to remove Hg from wastewater.

Keywords: Brazilian pepper, mercury, biochar, kinetics, isotherm, mechanism