Preparation and evaluation of kinetics and thermodynamics studies of lead adsorption onto chemically modified banana peels


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ABSTRACT

The use of alternative materials for environmental decontamination has been intensively studied. In this study, the capacity of banana peels treated with sodium hydroxide (NaOH), hydrochloric acid (HCl), and phosphoric acid (H₃PO₄) to adsorb Pb (II) was evaluated. The physical and chemical changes on the banana peels after chemical treatment were evaluated by infrared spectroscopy and scanning electron microscopy. Batch adsorption experiments were carried out as a function of pH, time, metal concentration, and temperature; desorption tests were also performed. Pb (II) concentrations were determined by flame atomic absorption spectrometry. An increase in the adsorption capacity of the modified and natural peels was observed in the pH range of 3–5, and pH 5 was adopted for further experiments. The adsorption system reached equilibrium in 300 min, and its kinetics followed the pseudo-second-order equation. From adsorption isotherms, it was observed considerable enhancement on adsorption capacity of banana peels, especially with treated with NaOH. Besides, the negative Gibbs free energy variation values showed that the Pb (II) adsorption was spontaneous. Moreover, the improvement in the Pb (II) desorption for the modified peels was observed, indicating that the proposed material can be reutilized.

Keywords: Adsorption; Banana peels; Lead (II)