

Preparation, characterization, and adsorption performance of activated rice straw as a bioadsorbent for Cr(VI) removal from aqueous solution using a batch method

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ABSTRACT

This research investigated the adsorption of Cr(VI) using HNO₃ 0,01 M-activated rice straw in a batch system. Some parameters such as pH, initial Cr(VI) concentration, and contact times were examined. The optimum conditions were achieved at the pH 3, initial Cr(VI) concentration 800 mg/L in 15 min with adsorption capacity 60.204 mg/g. It was found that the adsorption of Cr(VI) onto activated rice straw was followed the Freundlich isotherm model ($R^2 = 0.9957$) and pseudo-second-order model ($R^2 = 0.9995$) indicating that adsorption chemically occurred and multilayer. Whereas the thermodynamic study revealed that Cr(VI) adsorption onto activated rice straw was exothermic ($\Delta H^\circ = -8.658$ kJ/mol) non-spontaneous reaction ($\Delta G^\circ =$ positive) with liquid/solid interface disorder ($\Delta S^\circ = -65,297$ J/mol). The physicochemical characterization of the bioadsorbent showed a wavenumber shifting of some functional groups. The percentage of Cr(VI) in bioadsorbent increased and the surface morphology of the bioadsorbent was smoother after adsorption occurred. Thus, this locally abundant rice straw could be used as a bioadsorbent for Cr(VI) removal.

Keywords: Activated rice straw; Adsorption; Batch method; Cr(VI); Isotherms; Kinetics

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