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Evaluation of modified peanut shell in the removal of Cr(VI) from aqueous solution

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ABSTRACT

The use of agricultural wastes as low-cost and effective adsorbents is a promising path toward pollution reduction. This study aimed to investigate the adsorption ability of Cr(VI) by citric acid modified peanut shell (CPS). The adsorption equilibrium, kinetics, and thermodynamics were evaluated. The pseudo-first-order and pseudo-second-order models can be used to describe the uptake of Cr(VI) by CPS. The isotherm adsorption behavior was fully fitted with the Langmuir and Freundlich isotherm models, and the maximum adsorption capacity presented by the Langmuir model was 15.63 mg·g^{-1}. Thermodynamic studies showed that the adsorption of Cr(VI) on CPS was an endothermic process. Negative values of $\Delta G°$ (between –7.28 and –6.60 kJ·mol^{-1}) demonstrated that the adsorption process occurred spontaneously at all temperatures evaluated. Fourier-transform infrared spectroscopy, X-ray diffraction, carboxyl group content, and zeta potential measurements were used to clarify the structure of the adsorbent before and after modification and to discuss the possible adsorption mechanism. The scale-up design operation has been studied to show the cost-effective nature. The current work indicates that peanut shell treated with citric acid can be employed as a low-cost and potential adsorbent for removing Cr(VI) from aqueous solutions.

Keywords: Modified peanut shell; Citric acid; Chromium; Adsorption

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