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Novel three-dimensional chitosan-carbon nanotube–PVA nanocomposite hydrogel for removal of Cr^{6+} from wastewater

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ABSTRACT

A novel hybrid nanocomposite adsorbent was prepared by encapsulation of multi-walled carbon nano-tubes within polyvinyl alcohol/chitosan hydrogel (Cs/MWCNT/PVA) and cross-linked with glutaraldehyde. The chemical reactions between the components affected the position and intensities of the infrared bands. This nanocomposite has excellent Cr^{6+} ions adsorption efficiency. The optimal conditions of the process as a function of the solution pH, contact time, ionic strength, and sorbent weight were investigated. The batch equilibrium experiments revealed that the most suitable pH for chromium adsorption was at 1.5. The maximum adsorption capacity for the hydrogel was 217.4 mg g^{-1} as estimated by the Langmuir model. Other isotherm models, such as Freundlich and Temkin, were used to analyze the experimental data and the models' parameters were evaluated. The pseudo-first and second-order, Elovich, intraparticle diffusion, and film diffusion kinetic models were also investigated. The obtained results enabled to estimate the possibility to use the Cs/MWCNT/PVA hydrogel in the removal of Cr^{6+} ions from wastewater by adsorption.

Keywords: Cr^{6+} ions removal; Nanocomposite; Three-dimensional hydrogel; MWCNT; Chitosan

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