Synthesis and environmental applications of cellulose/ZrO2 nanohybrid as a selective adsorbent for nickel ion

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Abstract

Cellulos/ZrO2 nanohybrid has been synthesized by simple growth of ZrO2 on cellulose matrix and characterized by X-ray diffraction (XRD), field emission scanning electron microscopy (FESEM), Fourier transforms infrared spectroscopy (FTIR) and X-ray photoelectron spectroscopy (XPS). Interestingly, FESEM showed nanoparticles with an average size of 50 nm. The analytical potential of the newly prepared nanohybrid was studied for a selective extraction of nickel prior to its determination by inductively coupled plasma-optical emission spectrometry. The selectivity of nanohybrid was investigated toward eight metal ions, including Cd2+, Co2+, Cr3+, Cu2+, Fe3+, Ni2+, Zn2+ and Zr4+. Data obtained from the selectivity study showed that nanohybrid was the most selective toward Ni2+. The uptake capacity for Ni2+ was experimentally calculated and found to be 79 mg g(-1). Moreover, adsorption isotherm data of Ni2+ on nanohybrid was well fit with the Langmuir adsorption isotherm, strongly supporting that the adsorption process was mainly monolayer on homogeneous adsorbent surfaces. Finally, data of Ni2+ adsorption on nanohybrid as a function of contact time displayed that equilibrium kinetics are very fast. (C) 2013 Elsevier Ltd. All rights reserved.

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