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Magnetic cork as adsorbent to remove hexavalent chromium from aqueous solution

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Abstract-

Chromium contamination of water is a severe environmental problem due to the potential carcinogenicity of Cr(VI). In this work, magnetic cork powder was used as a porous material, and its removal efficiency for Cr(VI) was compared to that of natural cork powder through two mechanisms: adsorption and reduction. Adsorption isotherms and adsorption kinetics were utilized to calculate the reaction rate using a pseudo-first-order model, pseudo-second-order model, and intraparticle diffusion. After adsorption, the powder was characterized by scanning electronic microscopy with energy-dispersive X-ray analysis (EDAX), Fourier transform infrared spectroscopy, X-ray diffraction, and X-ray photoelectron spectroscopy (XPS). EDAX allowed to see a mapping distribution of Fe and Cr, and XPS revealed the presence of Cr2O3 and Cr(OH)3, confirming the reduction of Cr(VI) to Cr(III). All the Cr was efficiently reduced and adsorbed onto the surface of the magnetic cork at 20 °C, 27 °C, and 50 °C within 120 min with stirring. The relative efficiencies to the total milligrams of added adsorbent were 98, 98.6, and 99.7 mg, respectively. This is comparable to the adsorption on the natural cork surface at the same temperatures, which measured 97.8, 98.5, and 99.6 mg, respectively, of 100 mg/L Cr(VI) solution. Furthermore, the magnetic cork offers the advantage of being removable by applying a magnetic field.

Index Terms- Magnetic cork · Industrial waste reuse · Hexavalent chromium adsorption · Ultraviolet–visible spectroscopy

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