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Insight into efficient co-removal of Se(IV) and Cr(VI) by magnetic mesoporous carbon microspheres: Performance and mechanism

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ABSTRACT

In this study, carbon microspheres (CMSs) and magnetic carbon microspheres (MCMSs) were synthesized and applied to remove Se(IV) and Cr(VI) in Se(IV), Cr(VI), and Se(IV)-Cr(VI) coexisting systems, respectively. Transmission electron microscopy (TEM), Fourier transform infrared spectroscopy (FTIR), Vibrating-sample magnetometry (VSM), and X–ray diffraction (XRD) were employed to investigate the physical properties, compositions, and structures of CMSs and MCMSs. X-ray photoelectron spectroscopy (XPS) was employed to reveal the removal mechanism of Se(IV) and Cr(VI) with MCMSs. Under optimum conditions, 100% Se(IV) and 100% Cr(VI) can be removed by MCMSs in 120 min from Se(IV)-Cr(VI) coexisting system containing initial concentration of 10.0 mg/L Se(IV) and 10.0 mg/L Cr(VI). Cr(VI) was removed due to the hydrogen bonding interaction between Cr(VI) and carboxylate groups and redox reaction of Cr(VI) with alcoholic hydroxyl groups on CMSs. Besides, the Fe_3O_4 nanoscale particles on the surface of CMSs can form outer-sphere complexes with Cr(VI) and reduce Cr(VI) to Cr(III).

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