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Plutonium complexation by phosphonate-functionalized mesoporous silica

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MCM-41-type mesoporous silica functionalized with the CMPO-based "Ac-Phos" silane has been reported in the literature (1) to show good capacity as an actinide sorbent material, with potential applications in environmental sequestration, aqueous waste separation and/or vitrification, and chemical sensing of actinides in solution. Our study explores the complexation of Pu(IV and VI) and other selected actinides and lanthanides by SBA-15 type mesoporous silica functionalized with Ac-Phos. The Pu binding kinetics and binding capacity were determined for both the Ac-Phos functionalized and unmodified SBA-15. We analyzed the binding geometry and redox behavior of Pu(VI) by X-ray absorption spectroscopy (XAS). We will discuss the synthesis and characterization of the functionalized mesoporous material, batch sorption experiments, and the detailed analyses of the actinide complexes that are formed. Structural measurements are paired with high-level quantum mechanical modeling to elucidate the binding mechanisms.

1) Y. Lin et al., Environ Sci Technol. 39 (2005) 1332-1337.

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