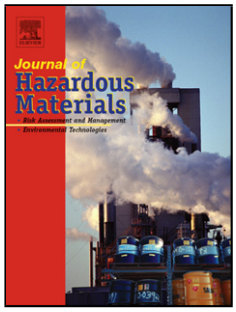

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Nano-Cerium Vanadate: A Novel Inorganic Ion Exchanger for Removal of *Americium* and *Uranium* from Simulated Aqueous Nuclear Waste

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Highlights

- Template free, low temperature synthesis of $CeVO_4$ nanopowders.
- Thermodynamically and kinetically favourable uptake of Am(III) and U(VI) exhibited.
- K_d and ΔG^O values for Am(III) and U(VI) uptake in pH 1-6 are reported.
- Interdiffusion coefficients and zeta potential values in pH 1-6 are reported.

Possible application in low level aqueous nuclear waste remediation.

Abstract

Cerium vanadate nanopowders were synthesized by a facile low temperature co-precipitation method. The product was characterized by X- ray diffraction and transmission electron microscopy and found to consist of ~ 25 nm spherical nanoparticles. The efficiency of these nanopowders for uptake of alpha-emitting radionuclides ^{233}U (4.82 MeV α) and ^{241}Am (5.49 MeV α, 60 KeV γ) has been investigated. Thermodynamically and kinetically favorable uptake of these radionuclides resulted in their complete removal within 3 hours from aqueous acidic feed solutions. The uptake capacity was observed to increase with increase in pH as the zeta potential value decreased with the increase in pH but effect of ionic strength was insignificant. Little influence of the ions like Sr^{2+}, Ru^{3+}, Fe^{3+} etc in the uptake process indicated $CeVO_4$ nanopowders to be amenable for practical applications. The isotherms indicated predominant uptake of the radioactive metal ions in the solid phase of the