

Accumulation of heavy element - siderophore complexes by bacteria

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Naturally occurring chelating agents, such as siderophores, form complexes with actinides and may enhance their mobility in the environment. Adsorption and/or biodegradation of chelated actinides by microorganisms are important processes which regulate their mobility in the natural environment.

We investigated the interaction and fate of Eu(III)-, Ce(IV)-, Hf(IV)-, and Pu(IV)-desferrioxamine B (DFO) complexes by aerobic bacterium, *Pseudomonas fluorescens* (ATCC 55241) in order to elucidate stability of DFO complexes. Potentiometric titration of Fe(III)-, Eu(III)-, and Hf(IV)-DFO complexes revealed that each metal bonded with three hydroxamate groups of DFO at neutral pH. Stability of Hf(IV)-DFO complex was strong and was same as Fe(III)-DFO complex, while Eu(III)-DFO complex was less stable than Fe(III) - DFO complex. When 16 micromol of 1:1 Eu(III)-, and Ce(IV)-DFO complexes were incubated with *P. fluorescens* in 0.1 M Tris-HCl buffer (pH = 7.3), the metals were removed from solution, with no change in DFO concentration in solution. With decreasing metal/DFO molar ratio from 1 to 0.01, the accumulation of Eu and Ce by *P. fluorescens* decreased. X-ray absorption near edge structure (XANES) spectroscopy showed Ce associated with the bacteria was reduced from tetravalent to trivalent state. In contrast, Fe(III)-, Hf(IV)-, and Pu(IV)-DFO complexes were recalcitrant and not accumulated by bacteria.

These results indicate trivalent heavy element -DFO complexes dissociated in the presence of cells and was readily biosorbed, whereas tetravalent heavy element - DFO complexes are stable and can be mobile in geosphere.