Biosorption of neptunium (IV) and neptunium (V) on soil bacteria

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Background

There is a growing recognition of the important role that biological interactions have in defining the speciation of multivalent actinides in the subsurface. An important, but often-overlooked interaction, is the sorptive interaction between actinide species and the many functional groups that populate the bacterial surfaces. These interactions, especially in the very low actinide concentrations typical of subsurface contaminations, are likely to predominate over bio-uptake and bio-reduction.

Biosorption of Np(IV) and Np(V)

Herein we report the results of oxidation–specific sorption studies for Np(IV) and Np(V) species with two soil bacteria: *Pseudomonas fluorescens* and *Shewanella alga strain BrY*. Sorption was determined as a function of pH and biomass for metabolically active cells, dead cells, and cellular material. This sorption was correlated, by modeling, with the carboxylate, amine, and phosphate functional groups on the bacterial cell surface. Absorption spectrometry was used to monitor the aqueous speciation of the neptunium complexes. XANES analysis of the bio-sorbed neptunium was used to confirm the oxidation state of the absorbed species to distinguish between sorption and bio-reduction. These results support our hypothesis that bio-sorption is a likely interaction under many expected subsurface contamination scenarios.