THE EFFECTS OF NITRATE ON URANIUM (U(VI)) REDUCTION BY *GEOBACTER METALLIREDUCENS*

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Uranium is a prevalent metal contaminant in the subsurface at many Department of Energy (DOE) sites. Many microorganisms can reduce uranium from U(VI) to U(IV), using it as a terminal electron acceptor in their respiration. These anaerobes can grow by coupling the oxidation of acetate or H_2 to the reduction of U(VI). U(VI) is highly soluble and therefore mobile in groundwater; whereas, U(IV) is highly insoluble, and will precipitate from groundwater. Reductive precipitation by subsurface bacteria may provide a cost effective form of *in situ* bioremediation of uranium contaminated aquifers[1]. Sediment incubation studies with uranium contaminated sediment have shown that U(VI) concentrations will decrease over time with the addition of acetate. Unamended and sterilized sediments show no decrease in U(VI). Thus, the loss of U(VI) may be due to the enzymatic reduction and subsequent precipitation of U(VI) to U(IV)[2]. This positive initial study necessitates further characterization of the factors influencing the reduction of U(VI) in subterranean environments.

Several hypotheses have been proposed to further characterize U(VI) reduction in sediments: 1) Nitrate (a more thermodynamically favorable terminal electron acceptor) inhibits uranium reduction due to competition for donor. 2) Re-oxidation of the U(IV) is possible with the addition of nitrate by the biotic coupling of U(IV) oxidation to nitrate reduction. In addition to testing these hypotheses in sediment, it is also important to assess their biological validity by performing analogous experiments with U(VI)-reducing bacteria[3]. Resting cell assays of the dominant anaerobic aquifer sediment organism, *Geobacter metallireducens*[4], were used to investigate the biological validity of the two hypotheses. These cell suspension experiments with *G. metallireducens* have shown the following results: Nitrate will inhibit U(VI) reduction by *G. metallireducens*. U(IV) is not re-oxidized in the presence of nitrate, nor in the presence of nitrate and cells. This contrasts with results from similar studies in sediments[5]. U(IV) is, however, oxidized in the presence of nitrite. Although *G. metallireducens* will not couple the oxidation of U(IV) to the reduction of nitrate, it will oxidize Fe(II) with the reduction of nitrate. This biotically produced Fe(III) will in turn oxidize the U(IV).

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