Ethanol improves bioreduction of uranium by altering microbial community

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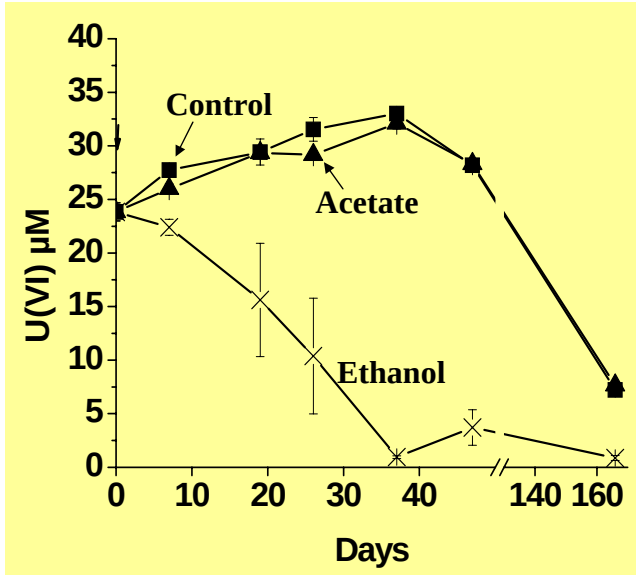
- Understanding of synergisms of geochemistry and electron donor amendment choices is critical in designing strategies for bioremediation of U(VI)-contaminated groundwater and sediments
- This study investigated the effect of electron donors (ethanol and acetate) and geochemistry (bicarbonate and sulfate) on microbial community changes that influence the rates of biological reduction of U(VI)
- Microcosm studies show that ethanol amendment biologically reduced U(VI) at significantly higher rates than acetate; and relatively low concentrations of bicarbonate and sulfate are also favored for increased U(VI) reduction and precipitation
- Both acetate and ethanol increased the Geobacteraceae population at the low bicarbonate concentrations. Species in the Geothrix genus and Betaproteobacteria are dominant at high bicarbonate concentrations and likely responsible for U(VI) reduction under such conditions



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Uranium (U) is an important radionuclide of concern. Microcosm studies were performed to investigate the effect of ethanol and acetate on uranium(VI) biological reduction and microbial community changes under various geochemical conditions. Each microcosm contained an uranium-contaminated sediment (up to 2.8 g U/kg) suspended in buffers with bicarbonate at concentrations of either 1 mM or 40 mM, and sulfate at either 1.1 or 3.2 mM, respectively. Ethanol or acetate was used as an electron donor.

Results show that the ethanol amendment yielded in significantly higher U(VI) reduction rates than acetate. A low bicarbonate concentration (1 mM) was favored for U(VI) bioreduction in sediments. The high concentrations of bicarbonate (40 mM) and sulfate (3.2 mM) decreased the reduction rates of U(VI). Microbial communities were dominated by species from the *Geothrix* genus and *Proteobacteria* phylum in all microcosms. However, species in the *Geobacteraceae* family capable of reducing U(VI) were significantly enriched by ethanol and acetate in low bicarbonate buffer. Ethanol increased the population of unclassified *Desulfuromonales*, while acetate increased the population of *Desulfovibrio.* Additionally, in the high bicarbonate buffer, species in the *Geobacteraceae* family were not enriched, but the *Geothrix* and the unclassified *Betaproteobacteria* species were. This study concludes that (1) ethanol could be a better electron donor than acetate for reducing U(VI), and (2) electron donor and groundwater bicarbonate can alter microbial communities responsible for U(VI) reduction.

REFERENCE: Luo, W.; Zhou, J.; Wu, W.; Yan, T.; Criddle, C.; Jardine, P. M.; Gu, B. 2007. Electron donor effects on bioreduction rates of uranium and microbial community under varying bicarbonate and sulfate conditions. *Appl. Microbiol. Biotech. 77, 713-721.*