

In situ analysis of biogeochemical arsenic transformations

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The reactivity and transport of arsenic (As) in the environment is controlled to a large extent by its speciation. Oxidation of arsenite (As^{III}) is rapidly catalyzed by certain bacteria and soil minerals, producing the less toxic and less mobile arsenate (As^{V}) species. Rapid-scan attenuated total reflectance (ATR) Fourier transform infrared (FTIR) spectroscopy has been used to collect *in situ* kinetic data for oxidation of As^{III} to As^{V} . Using a rapid-scan technique, IR spectra are collected every 2.55 seconds (24 scans, 8cm^{-1} resolution). Through observation and analysis of IR bands corresponding to arsenate (As^{V}), rapid chemically-controlled As^{III} oxidation is observed via Mn-oxide minerals. Also, the data reveal oxidation of As^{III} is followed by rapid binding of As^{V} to Mn-oxides, at least in part, through surface bound Mn^{II} . The binding of As^{V} , and Mn^{II} , leads to surface passivation of the mineral phase and prevents further oxidation from occurring. Analysis of first-order rate kinetics revealed 95% transformation of As^{III} to As^{V} in < 3 min ($t_{1/2} < 1$ min). Research is ongoing to examine reaction rates and effect on cell surface composition during bacterially catalyzed As^{III} oxidation by the As-oxidizing bacteria *Alcaligenes faecalis* and *Pseudomonas fluorescens*.

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