# Microbial metabolite promoted dissolution and transformation of mixed chromium(III)-iron(III) (oxy)hydroxides

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Because of its utility in many industrial processes, chromium (Cr) has become the second most common metal contaminant in the United States. The two most common oxidation states of chromium in nature are Cr(III), which is highly immobile, and Cr(VI), which is highly mobile and toxic. In both natural and engineered environments, the most common remediation of Cr(VI) is through reduction, which results in chromium sequestration in the low solubility mixed Cr(III)-Fe(III) (oxy)hydroxide phases. Consequently, the stability of these minerals must be examined to assess the fate of chromium in the subsurface. We investigated the stability of Cr(III)-Fe(III)-(oxy)hydroxides with a range of compositions in the presence of common microbial metabolites: siderophores, which are Fe(III) chelating ligands, and small organic acids. In the presence of a representative siderophore, desferrioxamine B (DFOB), Fe was preferentially released relative to Cr from all (oxy)hydroxide solid phases. The small organic acid, oxalate, acted synergistically with DFOB to increase the rate of metal release. Upon reaction, the remaining solids became enriched in Cr relative to Fe (i.e. increased Cr/Fe ratio), leading to increased solubility relative to the initial solid phases. Thus, the presence of microbial exudates can promote the release of Cr(III) from remediation products via both ligand complexation and increased solid solubility, producing dissolved ligand-complexed or free Cr(III) ions. These dissolved phases are more susceptible than the solid phase to subsequent re-oxidation to Cr(VI) and the occurrence of recontamination. Results from this study will provide insights regarding the long term transport and fate of Cr in the natural environment in the presence of microbial activities. Ongoing work is addressing the use of Cr isotope systematics as a quantitative means of assessing the long term transport and fate of chromium in the natural environment in the presence of microbial activities