Integrated Investigation on the Production and Fate of Organo–Cr(III) Complexes from Microbial Reduction of Chromate

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Chromium contamination exists at 13 of the 18 U.S. Department of Energy (DOE) facilities studied; microbial reduction to form insoluble trivalent Cr, Cr(III), is a potential treatment for such sites. In our prior research on Cr(VI) reduction, we discovered that soluble organo–Cr(III) complexes are likely formed and then, perhaps, further transformed to insoluble Cr(III) precipitates. The production of organo–Cr(III) complexes from chromate reduction is documented in eukaryotic systems because the stable DNA–Cr adducts are mutagenic. However, the formation of soluble organo–Cr(III) complexes from microbial reduction of chromate has only recently been discovered, bringing up the necessity for investigating the significance of the soluble complexes in Cr bioremediation. The proposed research is aimed at (1) characterizing the scope and extent of organo–Cr(III) complex formation by chromate-reducing microorganisms, (2) evaluating cellular components that can potentially form organo–Cr(III) complexes, (3) addressing the stability and biodegradability of these organo–CR(III) complexes, and (4) assessing the fate and transport of these compounds in soils. The results will provide scientific guidance on whether organo–Cr(III) should be considered during application of Cr bioremediation. The information will also help establish a more complete biogeochemical cycle for Cr, which is currently lacking organo–Cr(III) complexes.