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

Luying Xun[1,5], Geoffrey J. Puzon[1,5], Sue Clark[2,5], Zhicheng Zhang[2,5], Brent Peyton[3,5], Ranjeet Tokala[3,5], and David Yonge[4,5]

[1]Departments of Molecular Biosciences, [2]Chemistry, [3]Chemical Engineering, [4]Environmental and Civil Engineering, and [5]Center for Multiphase Environmental Research, Washington State University, Pullman, WA

Chromium contamination exists at several Department of Energy facilities; microbial reduction to form insoluble trivalent Cr [Cr(III)] is a potential treatment for such sites. We have discovered that some soluble organo-Cr(III) complexes are likely formed and then further transformed to insoluble Cr(III) precipitates. The production of organo-Cr(III) complexes from chromate reduction is well documented in Cr toxicity studies in humans. However, the formation of soluble organo-Cr(III) complexes from microbial reduction of chromate has only recently been discovered. Here we present more evidence on the formation and mineralization of organo-Cr(III) complexes. First, production of soluble organo-Cr(III) complexes by selected microorganisms has been observed. Second, we have observed the production of organo-Cr(III) complexes during chromate reduction in the presence of microbial cellular components. Third, a bacterium capable of mineralizing an organo-Cr(III) complex has been isolated. Fourth, the transport and fate of organo-Cr(III) complexes in soils have been investigated. Some results have been published. Our data thus far point to a likely extensive formation of various organo-Cr(III) complexes during bioreduction of chromate. Further studies will help establish a more complete biogeochemical cycle for Cr, including organo-Cr(III) complexes as an integral link. The information should also provide guidance on whether organo-Cr(III) complex formation should be considered during application of Cr bioremediation.