

Iron and arsenic co-precipitates: complex interfaces

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The transformations affecting As mobility at the redox interface are mainly mediated by microorganisms involved in the redox cycling of Fe, Mn, and As. The dynamics of these populations, often forming biofilms, depend on the chemico-physic environment, and are still poorly understood. The study of natural systems may be challenging and may provide site-specific results. Synthetic simplified models, conversely, might overlook the effects of some components of complex systems, such as organo-mineral phases at the solid-liquid interface. Combining both approaches could improve the interpretation of complex phenomena.

The As release from co-precipitates naturally formed in Bangladesh was compared with that from synthetic Fe-As precipitates. Iron oxy(hydr)oxides were the main component of all materials, but the natural ones also contained carbonates, phosphates and microbial organic matter. The As release varied with the composition, concentration and pH of the solution. Both synthetic and natural co-precipitates released less than 2% of the total As content with diluted organic and inorganic P-extractants while, at higher concentration the natural co-precipitate released much more As than the synthetic ones. The oxidation of the organic matter in the natural co-precipitates significantly affected As extractability. Kinetics of As release from synthetic Fe-As-polygalacturonate precipitates evidenced the hindrance of the organic coverage. Organic interface can be determinant in regulating As mobility at the solid-liquid interface.

Remediation of salt and chlorinated organic contaminated fine textured soils and ground water

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Soil and ground water are commonly contaminated by industrial activities. The contamination poses a risk to human and environmental health and prevents productive land use. Contaminant mixtures make remediation complex due to the differing behaviors of various compounds. The University of Alberta's Ellerslie Waste Management Facility was used to process laboratory waste from 1972 to 2007 and is contaminated with salts and chlorinated organic compounds. This research is focused on characterization and remediation of the site. Ground water has been monitored for over 26 years providing an extensive data set. Analytical parameters include pH, electrical conductivity, major ions, volatile organic compounds and metals. The data are being analyzed to determine trends indicating contaminant movement or degradation. A laboratory scale experiment is being carried out to examine the potential of indigenous soil microorganisms to anaerobically biodegrade trichloromethane, one of the most common chlorinated organic contaminants on site. Treatments are acetate, canola oil, nitrate and sulfate. The acetate and canola oil serve as carbon sources to support reductive dechlorination. The nitrate and sulfate provide terminal electron acceptors for different redox conditions. Preliminary results indicate that salt and chlorinated organic contamination is spatially concentrated in and down gradient of a former waste water pond which is known to have leaked in the early 1980s. Microorganisms from the site are active and may be able to biodegrade trichloromethane. Results from this research will be essential to managing and remediating the site so that the land can be returned to the Crown and safely used for other purposes.