Contaminant organic compounds are common constituents in mixed wastes, and some of these compounds undergo microbially mediated degradation. Biodegradation reactions have direct impact on the geochemistry of the subsurface environment, yet the nature and rates of inorganic-organic interactions are largely unquantified. Further, to realistically simulate the hydrogeological environment, these reactions much be placed in dynamic hydrological context. In a series of controlled and replicated laboratory experiments, the rates of geochemical reactions driven by biodegradation will be quantified, and those rates will be used to predict transport of the organic contaminant itself and other chemical constituent with which it interacts. In flow-through columns and in supporting batch experiment, we have investigated the biodegradation of hydrocarbons, BTX, and a complexant, citrate, in systems with clean and sesquioxide-coated quartz sand present. The effect of citrate as a complexant and the impact of its biodegradation on the geochemistry of a co-contaminant metal, cobalt, is being explored. The aqueous speciation, sorption, and solubility of cobalt will be influenced by the stability of citrate. Supporting batch and column kinetics sorption experiments for the metals and heterotrophic uptake measurement for the citrate inform the interpretation of the transport experiments. Our results will enhance our understanding of the interaction between biodegradation and other geochemical reactions in contaminated aquifers.
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