Reductive Dechlorination and Desorption of Hydrophobic Contaminants in Non-aqueous Media

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Abstract. Chlorinated hydrocarbons like carbon tetrachloride, chlorobenzenes and polychlorinated biphenyls (PCBs) continue to be a significant threat to aquatic ecosystems and human health. Traditional remediation technologies focus on treating these hydrophobic contaminants in the aqueous phase, where the lowest percentage of the contaminant mass is located and where zero-valent iron or other reducing agents are inefficient due to the reduction of water. This study investigates the potential of degrading hydrophobic chlorinated contaminants in non-aqueous phases with the objectives (1) to increase contaminant desorption and thus availability and (2) to increase reductant efficiency for contaminant degradation reactions. Cyclic voltammetry and bulk electrolysis experiments were used to determine reduction potentials and kinetics for dechlorination reactions within non-aqueous solvents of varying polarity. Partitioning of chlorinated contaminants into these same non-aqueous solvents was investigated to reveal optimal solvent properties for desorption. Further batch studies of dechlorination reactions using zero-valent metals in mixed non-aqueous solvent systems further characterized the thermodynamic and kinetic parameters of these reactions. This study is aimed at the development of a novel remediation approach for hydrophobic chlorinated contaminants where availability, degradation and sequestration can be optimized via application of immiscible, non-aqueous treatment media.