

Synergistic Effects of Utilizing Abiotic and Biotic Degradation Pathways Simultaneously for Chlorinated Solvents Remediation

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Despite being used for over 20 years, *in situ* bioremediation of chlorinated solvents is still not fully understood, which has potentially limited harnessing the full capabilities of this remediation technique. Knowledge gaps often stem from the lack of comprehension for the importance of biotic interactions with abiotic processes. While the majority of completed work to-date has assessed both the biotic and abiotic degradation of chlorinated solvents in isolation via dechlorinating microbes and reactive iron sulfide minerals, respectively, limited research investigates the combination of abiotic and biotic degradation processes. In this study, the conditions used to create an environment for both degradation mechanisms to ensue include sulfate concentrations up to 5 mM, ferric iron coated sand (1.5% iron by weight), oxidation reduction potential (ORP) below -150 mV, circumneutral pH, 5 mM acetate and lactate as electron donors for microbial processes, and 50 mg PCE/L. By allowing both degradation pathways to occur simultaneously, this work seeks to determine if faster rates and more complete dechlorination (i.e., to ethene) can be obtained over using either degradation pathway individually. To do this, as a first step, batch reactors are being used to validate if iron reducing bacteria, sulfate reducing bacteria, and dechlorinating bacteria cultures can reduce their respective compounds under the given conditions. To extend the realism to a dynamic system with flow, three up-scaled 1-D column experiments are used to measure rates of dechlorination due to 1) a dechlorinating microbial consortia; 2) biotically formed reactive iron sulfide minerals; 3) a combination of the two degradation methods. This research could lead to an enhanced understanding of dechlorinating processes. Results from these experiments will indicate if environments exist where both methods of dechlorination should be considered for remediation purposes.

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