HRC TECHNICAL BULLETIN # 1.1.2

Hydrogen Release Compound HRC®

Biological Reductive Dechlorination of CAHs

Reductive dechlorination is the most prominent mechanism by which chlorinated aliphatic hydrocarbons (CAHs) are biologically degraded under anaerobic conditions. CAHs, commonly used as degreasing solvents (see TB 1.1.1), are hydrocarbons whose hydrogen atoms have been replaced, or substituted, with chlorine atoms. It is in this chlorinated state that these hydrocarbons are considered toxic in groundwater. In order to remedy this problem the chlorine atoms must be removed.

Reductive dechlorination is the process by which anaerobic microorganisms substitute hydrogen (H_+) for chlorine on CAHs. Hydrogen, resulting from the breakdown of HRC, acts as a source of electrons which provide the reducing conditions necessary for dechlorination of CAHs, as shown in the Figure 1.

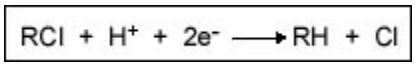

Figure 1

Through this process, CAHs can be degraded to form vinyl chloride, and even ethene, as depicted in Figure 2.

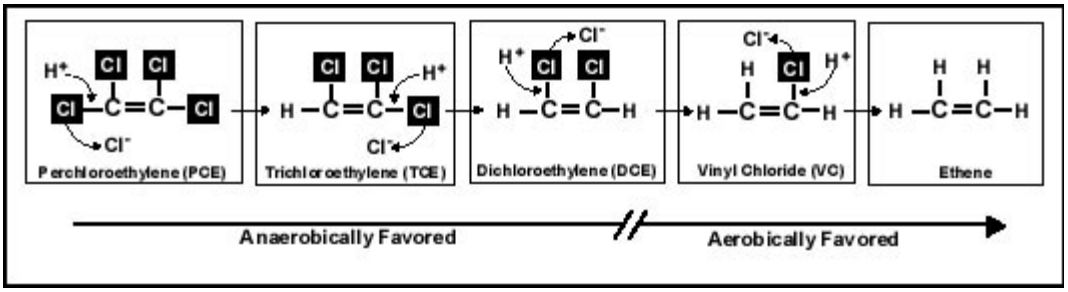

Figure 2

While the degradation rates of PCE and TCE are highest under anaerobic conditions, vinyl chloride will degrade up to four times faster under aerobic conditions (Figure 2). Therefore, optimal results for CAH remediation with HRC may be achieved by combined treatment with Oxygen Release Compound (ORC®) to enhance aerobic bioremediation of vinyl choride.

NOTE: For a complete discussion on reductive dechlorination of CAHs, see the RABITT document (1).

References:

1. Morse, J.M. and B.C. Alleman; Gossett, J.M. and S.H. Zinder; Sewell, G.W.; Vogel, C.M. 1997. A Treatability Test for Evaluating the Potential Applicability of the Reductive Anaerobic Biological In Situ Treatment Technology (RABITT) to Remediate Chloroethenes. ESTCP Technical Protocol.

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