HYDROGEN RELEASE COMPOUND

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; therefore, 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. As HRC is broken down, hydrogen is released, providing a source of electrons and thereby inducing a reducing environment which is necessary for the dechlorination of CAHs, as shown in Figure 1 below:

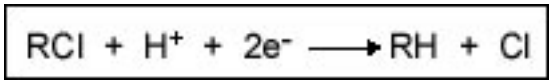

Figure 1

In this process, CAHs are degraded, forming vinyl chloride and even ethene, as outlined in Figure 2.

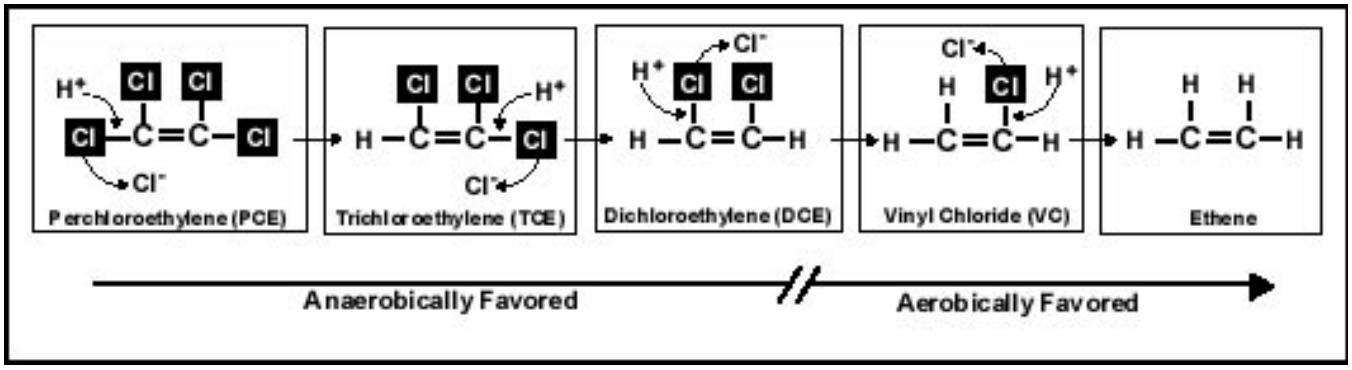

Figure 2

While the degradation rates of PCE and TCE are highest under anaerobic conditions, vinyl chloride degrades 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.