

Possible Pathways and Microorganisms Associated with Biodegradation of Chlorinated Ethanes

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Chlorinated ethanes, represented by 1,1,1-trichloroethane and 1,2-dichloroethane etc., are the toxic, volatile organic compounds (VOCs) that are specified as contaminants by the Japanese Soil Contamination Countermeasures Act. Due to the number of the sites contaminated with chlorinated ethanes are much less than that of the sites contaminated with chlorinated ethenes represented by tetrachloroethene (PCE), trichloroethene (TCE) and their biodegradation products such as cis-1,2-dichloroethene and vinyl chloride, the studies and information on degradation of chlorinated ethanes are very limited in Japan compared with those on chlorinated ethenes.

Based on systematic literature surveys, we summarize possible pathways and microorganisms that can be involved in biodegradation of chlorinated ethanes, especially under anaerobic conditions because such conditions generally exist in the deep subsurface environment. Besides the biotic degradations, abiotic degradations were also investigated for complementarity. A variety of mechanisms such as hydrolysis, dehydrohalogenation, reductive dichlorination and co-metabolism can be involved in degradation of 1,1,1-trichloroethane, and reductive dichlorination, anaerobic oxidation and catabolic reaction can be involved in degradation of 1,2-dichloroethane. Degradation rates can be affected by many factors including the contaminant itself and temperature. The rates may vary over several orders of magnitude under different conditions and/or in different sites. To predict the time required for a bioremediation of a specific contaminated site, detailed investigations on chemical, biological and hydrogeological conditions are fundamentally necessary.

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