# Biotransformation of γ-hexachlorocyclohexane (lindane) to Non-Toxic End Products by Sequential Treatment with Mixed Anaerobic Microbial Cultures

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**Background/Objectives.** Lindane, the γ isomer of hexachloroyclohexane (HCH), is a persistent organic pollutant and known carcinogen. Soil and sediment contamination with HCH isomers is a worldwide problem since they were extensively used as pesticides. A *Dehalobacter*-containing enrichment culture (GT2) capable of transforming lindane to monochlorobenzene (MCB) and benzene was derived from contaminated sediment from the French West Indies. Although the anaerobic transformation of lindane occurs steadily in this culture, MCB and benzene are not desirable end products. The reductive dechlorination of MCB to benzene and the anaerobic biodegradation of benzene were previously demonstrated using anaerobic mixed microbial cultures. We hypothesize that the complete biotransformation of lindane to non-toxic end products can be achieved by sequential treatment with specialized anaerobic microbial cultures.

**Approach/Activities.** In this study, we set out to demonstrate the complete anaerobic biotransformation of lindane by performing a three-phase lab-scale study. In phase I, lindane was transformed to MCB and benzene by GT2. In phase II, MCB was transformed to benzene by a *Dehalobacter*-containing mixed microbial culture (KG2). A combination of analytical and molecular techniques (qPCR and 16S rRNA amplicon sequencing) has been used to demonstrate that *Dehalobacter* populations in these microbial cultures grow via organohalide respiration with lindane and MCB. During phase III, benzene will be anaerobically biodegraded to methane and $CO_2$ by a benzene-degrading microbial culture (DGG).

**Results/Lessons Learned.** This study demonstrates that lindane can be anaerobically biotransformed by specialized *Dehalobacter*-containing microbial enrichment cultures. To achieve complete mineralization at contaminated sites, a combination of existing and novel technologies will be required in order to account for the differences in the biodegradability and chemical properties of the parent compound and its by-products. Sequential treatment and monitoring will be required to accommodate the complex spatial and temporal nature of HCH biotransformation.