

**Bioaugmentation of butane-utilizing microorganisms to promote cometabolism of 1,1,1-trichloroethane in groundwater microcosms**

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**BIODEGRADATION**

12 (1): 11-22 2001

**Abstract:**

The transformation of 1,1,1-trichloroethane (1,1,1-TCA) in bioaugmented and non-augmented microcosms was evaluated. The microcosms contained groundwater and aquifer materials from a test site at Moffett Field, Sunnyvale, CA. The initial inoculum for bioaugmentation was a butane-utilizing enrichment from the subsurface of the Hanford DOE site. The non-augmented microcosm required 80 days of incubation before butane-utilization was observed while the augmented microcosms required 3 days. Initially the augmented microcosms were effective in transforming 1,1,1-TCA, but their transformation ability decreased after prolonged incubation. The non-augmented microcosms initially showed limited 1,1,1-TCA transformation but improved with time. After 440 days, both the non-augmented and augmented microcosms had similar transformation yields (0.04 mg 1,1,1-TCA/mg butane) and had similar microbial composition (DNA fingerprints). Subsequent microcosms, when bioaugmented with a Hanford enrichment that was repeatedly grown in 100% mineral media, did not effectively grow or transform 1,1,1-TCA under groundwater nutrient conditions. Microcosm tests to study the effect of mineral media on transformation ability were performed with the Hanford enrichment. Microcosms with 50% mineral media in groundwater most effectively utilized butane and transformed 1,1,1-TCA, while microcosms with groundwater only and microcosms with 5% mineral media in groundwater lost their 1,1,1-TCA transformation ability. DNA fingerprinting indicated shifts in the microbial composition with the different mineral media combinations. Successful bioaugmentation was achieved by enriching butane-utilizers from Moffett Field microcosms that were effective in groundwater with no mineral media added. The results suggest that successful in-situ bioaugmentation might be achieved through the addition of enriched cultures that perform well under subsurface nutrient conditions.