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Molecular approach to evaluate biostimulation of 1,2-dibromoethane in contaminated groundwater

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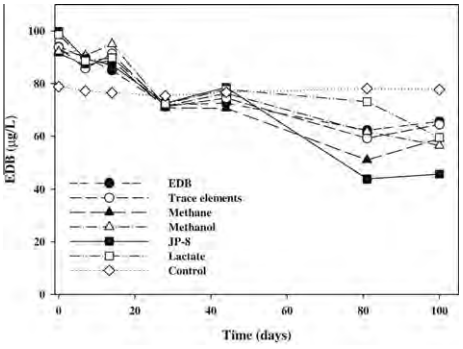
HIGHLIGHTS

- This study investigated the potential for biostimulation of 1,2-dibromoethane in contaminated groundwater using a molecular approach.
- Microcosm experiments diligently mimicked in situ conditions.
- The addition of jet fuel (50 mg/l) yielded the highest biodegradation of EDB.
- Jet fuel addition led to highest bacterial numbers compared with other amendments.
- Members of genera associated with monooxygenase dominated all microcosms.
- Gene abundances for monoxygenase were significantly higher in jet fuel treatments.

GRAPHICAL ABSTRACT



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ABSTRACT

This study investigated the effect of co-substrate amendments on EDB biodegradation under aerobic conditions. Microcosms were established using contaminated soil and groundwater samples and maintained under in situ conditions to determine EDB degradation rates, and the diversity and abundance of EDB degrading indigenous bacteria. After 100 days of incubation, between 25% and 56% of the initial EDB was degraded in the microcosms, with added jet fuel providing highest degradation rates ($2.97 \pm 0.49\ yr^{-1}$). In all microcosms, the quantity of dehalogenase genes did not change significantly, while the number of BTEX monooxygenase and phenol hydroxylase genes increased with jet fuel amendments. These results indicate that EDB was not degraded by prior dehalogenation, but rather by cometabolism with adapted indigenous microorganisms. This is also reflected in the history of the plume, which originated from an aviation gasoline pipeline leak. This study suggests that biostimulation of EDB is possible at aerobic groundwater sites.

1. Introduction

The compound 1,2-dibromoethane, also known as ethylene dibromide (EDB), was primarily used as a lead scavenger in anti-knock gasoline mixtures, particularly in aviation fuels

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