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The Analysis of Microbial Communities in Soil and Sediment During the Anaerobic Degradation of BTEX and MTBE under Various Electron Acceptors

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ABSTRACT

Petroleum hydrocarbon contamination of soil as a result of leaks from underground storage and other petroleum industrial facilities is a widespread problem. BTEX and MTBE are far more soluble than other petroleum hydrocarbons and travel at essentially the same velocity as groundwater. In this study, the anaerobic biodegradation of the contaminants in soil and sediment was conducted under various kinds of the electron acceptors, such as nitrate, iron (III), and sulfate. The microbial communities in soil and sediment were enriched for 65 days by supplying BTEX and MTBE as the contaminants and by adding nitrate, sulfate, or iron (III) as the electron donors, respectively. The biodegradation rates in the anaerobic conditions increased with the addition of the electron acceptors. The microbial consumption of the contaminants was proportional to that of the electron acceptors. The analysis of microbial communities using PCR-DGGE showed that the microorganisms capable to utilize an electron acceptor and to degrade the contaminants were the dominant communities. The degradation activities of the dominant communities affected the degradation rates.

Key words: BTEX, MTBE, Anaerobic biodegradation, Electron acceptor, PCR-DGGE

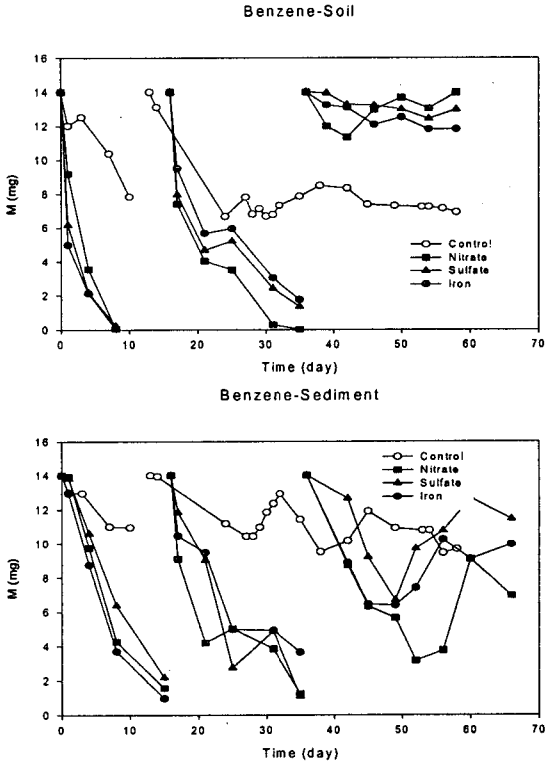

Fig. 1. Mass change of benzene in soil and sediment with nitrate, iron, and sulfate.

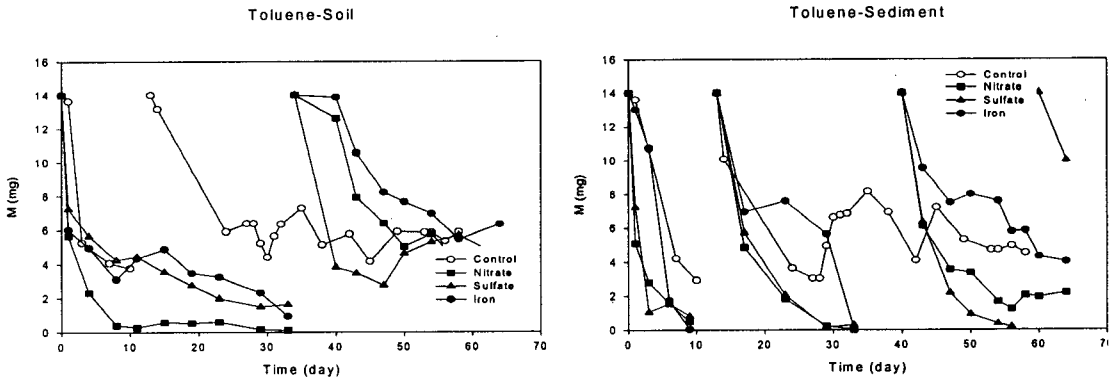

Fig. 2. Mass change of toluene in soil and sediment with nitrate, iron and sulfate.

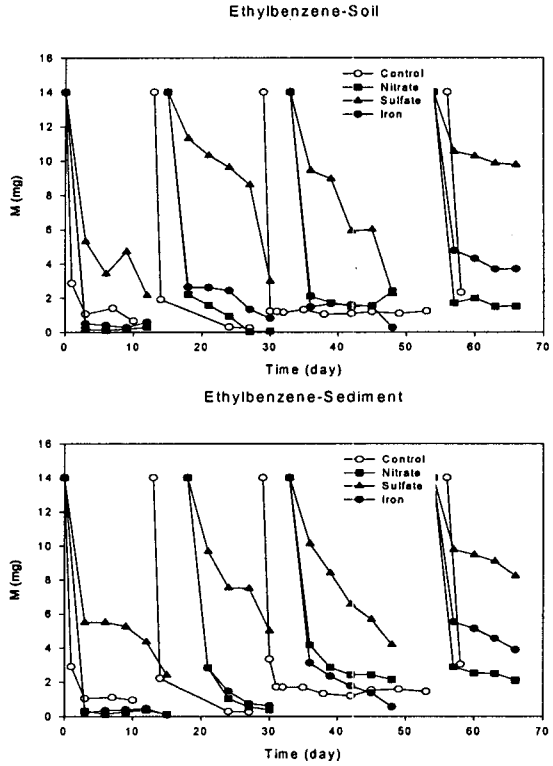

Fig. 3. Mass change of ethylbenzene in soil and sediment with nitrate, iron and sulfate

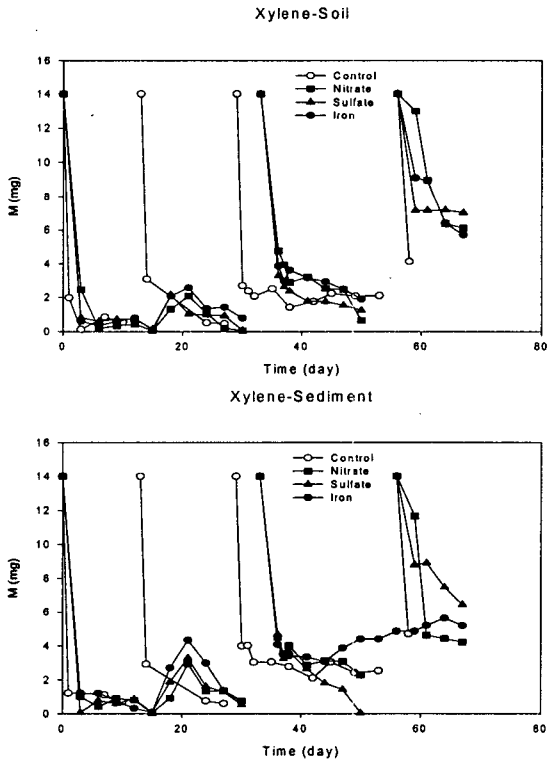

Fig. 4. Mass change of xylene in soil and sediment with nitrate, iron and sulfate.

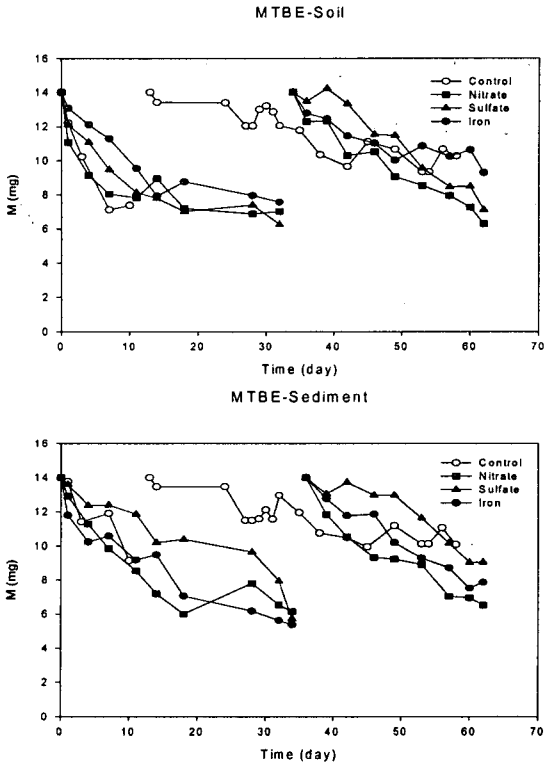

Fig. 5. Mass change of mtbe in soil and sediment with nitrate, iron and sulfate