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13. ABSTRACT (Maximum 200 Words) Recent laboratory and field experiments have shown that some halogenated hydrocarbons undergo rapid reductive dehalogenation with zero-valent iron and the application of this process is being developed for <i>in-situ</i> remediation of contaminated groundwater. However, Iron can also reduce other organic substances and is commonly used to synthesize reduction products nitro compounds. 19980817 140				
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ABIOTIC REMEDIATION OF NITRO-AROMATIC
GROUNDWATER CONTAMINANTS BY ZERO-VALENT IRON

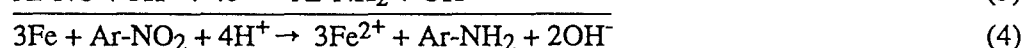
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Recent laboratory and field experiments have shown that some halogenated hydrocarbons undergo rapid reductive dehalogenation with zero-valent iron (O'Hannesin and Gillham, 1992; Matheson and Tratnyek, 1993), and the application of this process is being developed for in-situ remediation of contaminated groundwater (Gillham et al., 1993). However, Iron can also reduce other organic substances and is commonly used to synthesize reduction products nitro compounds (Hudlicky, 1984).

In this study, we have investigated nitro reduction by granular iron in model systems similar to those in which dehalogenation experiment have been and are being performed. Many important environmental contaminants are nitro compounds, including some munitions (TNT, RDX), pesticides (parathion, DNOC, trifluralin), nitrosamines (NDMA), nitro-PAHs, and industrial feedstock chemicals (nitrobenzene, p-nitrophenol etc.). Nitro reduction of these contaminants may prove to be another useful application of remediation technologies based on granular iron.

Experiments with nitrobenzene as model substrate show rapid reduction by iron, with nitrosobenzene as intermediate and aniline as final product. The reduction of nitrobenzene to aniline in the model system appeared to proceed in two sequential transformation steps: (i) nitrobenzene to nitrosobenzene, followed by (ii) nitrosobenzene to aniline. The disappearance of nitrobenzene was almost complete in a few hours in our batch systems, and the nitro, nitroso and amino compounds account for 90% of the initial substrate added (Figure 1). The overall transformation reaction for nitrobenzene reduction in the model system may be represented as:



The transformation of nitrobenzene to nitrosobenzene (Equation 2) was found to be first-order in substrate concentration (Figure 2), and the rate of reaction (k_{obs}) was dependent upon the amount of iron, extent of cleaning of the iron-surface, and degree of mixing. Laboratory investigations are in progress to determine the effect of substrate concentration, pH, and commonly dissolved natural inorganic solutes in the groundwater, including the carbonate, sulfate and sulfide, on the kinetics of reactions and product distribution.