247e Treatment of Nitroaromatic Contaminated Groundwater with Zero-Valent Metals and Advanced Oxidation Techniques

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Many nitroaromatic compounds (NACs) are considered toxic and potential carcinogens. Years of improper wastewater techniques at United States Department of Defense ammunition plants have led to NACs groundwater contamination in these facilities. Specific NACs include 2,4,6-trinitrotoluene, 2,4-dinitrotoluene (2,4-DNT), 2,6-dinitrotoluene, and nitrobenzene. At some sites the contaminated groundwater poses a threat to domestic drinking water sources. Presently, the chemical and biological processes applied for treating waters contaminated with these compounds generate persistent by-products that are still of environmental concern. These persistent compounds can be degraded by applying more aggressive reaction conditions or different treatment technologies in series, increasing significantly the capital and operating cost of treating the water. A one step technology capable of efficiently and cost effectively degrading water contaminants is necessary to promptly return billions of gallons of this essential resource to farmers, private companies, and the public. The purpose of this study is to develop an integrated reductive/oxidative process for treating NACs contaminated waters. The process consists of the combination of zero-valent manganese or iron and a hydroxyl radical based treatment technique. Corrosion promoters are added to the contaminated water to minimize passivation of the metallic species. Water contaminated with 2,4-DNT was treated with the integrated process using a recirculated batch reactor. It was demonstrated that addition of corrosion promoters to the contaminated water enhances the rate of reaction of 2,4-DNT with zero-valent iron or manganese. The results show that manganese and iron have different selectivity for the reduction by-products. Ozone or hydroxyl radicals generated combining ozone and ultraviolet light oxidized these products. The degree of mineralization was measured analyzing the samples for total organic carbon and nitrates. These results will be presented along with proposed reaction and corrosion mechanisms, and developed rate expressions.