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EFFICIENCY OF REDUCTIVE DECHLORINATION OF TRICHLOROETHYLENE AND *CIS*-1, 2-DICHLOROETHYLENE BY IRON FILLING

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ABSTRACT

This study aimed to evaluate the possibility of using iron filling from machine shops as a low-cost reactive medium for treating groundwater contaminated by trichloroethylene (TCE) and *cis*-1,2-dichloroethylene (*cis*-DCE). The efficiency of reductive dechlorination of trichloroethylene and *cis*-1,2-dichloroethylene (*cis*-DCE) by iron filling were further studied in different concentrations at pH 5. The initial TCE and *cis*-DCE concentrations ranged from 1 to 1000 mg/L. The results showed that the degradation rates of these contaminants were rapid at low concentration and relatively slow at high concentration. At day 7, the removal was 100% with the initial TCE concentrations of 1 and 10 mg/L and with the initial DCE concentrations of 1, 10, 25, 50 and 100 mg/L. The observed pseudo-first order rate constants for TCE and DCE degradations were 0.29 to 0.94 day⁻¹ and 0.33 to 1.39 day⁻¹, respectively. The result showed that the rate constant of *cis*-DCE was higher than TCE. The major products in the dechlorination of TCE were ethylene and chloride. The concentrations of *cis*-DCE and vinyl chloride (VC) were detected in small amounts in the reductive dechlorination of TCE at day 7. In addition, with the high concentration of initial *cis*-DCE and TCE of 1000 mg/L, the VC accumulated in the system with concentration of 28.0 and 3.47 mg/L found at day 7, respectively. The increase of chloride in the aqueous solution indicated that the degradation of contaminants was the result of its reductive dechlorination which occurred by transferring electrons from the surface of metallic iron to the contaminants. These results elucidated that iron fillings from machine shops could served as an alternative reactive medium for the remediation of groundwater contaminated with chlorinated contaminants.

Keywords: Trichloroethylene, TCE, *cis*-DCE, Iron filling, Reductive dechlorination.

1. INTRODUCTION

Chlorinated solvents are common contaminants in the aquifer and soil. They are susceptible to reductive dechlorination in reducing environments (Lee and Batchelor, 2004). Trichloroethylene (TCE) is a chlorinated solvent that is widely used as an industrial solvent and degreaser (Schnabel et al., 1996). It is considered as environmentally hazardous because of its toxicity and persistence in the environment. It affects the human liver and kidney and is