

Onmanee Nimmalaikaew 2006: Remediation of Fuel Hydrocarbons in Saturated Zone Using Chemical Oxidation. Master of Engineering (Environmental Engineering), Major Field: Environmental Engineering, Department of Environmental Engineering. Thesis Advisor: Assistant Professor Cheema Chomsurin, Ph.D. 106 pages.
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Chemical oxidation using potassium permanganate as an oxidizer destroyed toluene source zone in both laboratory experiments and pilot tests with saturated sand column. Precipitation of manganese oxides which were produced from the reaction, caused a reduction of porosity and permeability. Also, soil plugging can cause reduction in oxidation efficiency. From the study, potassium permanganate removed toluene more than 99.88% and water permeability reduced about 10 times in 6 hours, another word, after flushing with the oxidizer for 7.11 times the pore volume (PV). This could lead to flow bypassing and the pressure loss in the system. The purpose of this study was to test the efficiency of removing solid manganese oxide by citric acid.

Removing manganese oxide and restoring the water permeability using citric acid (4 mM) by dissolution revealed that the dissolution rate was 0.1 mg/l•min. The dissolution rates increased with increasing concentrations of citric acid. Optimum acid concentration with high efficiency to treat the clogging problem was 2.0 M or more.

In column experiments, cycles of potassium permanganate/citric acid flooding continued until almost all of the pure phase toluene was removed. The experiment was carried out about 7520 minutes (148.43 PV) in the attempt to completely remove 15 ml of pure phase toluene. By means of dissolve toluene less than 1 mg/l which passed Thailand's groundwater standard quality, there were 18 cycles of flushing without problem of plugging and flow bypassing. The removal efficiency was 99.88% of dissolved toluene (compared with water solubility). Also, from mass balance calculation, 92.04 % of pure phase toluene was removed.

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Thesis Advisor's signature

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