Iron Chloride for Degrading Tce

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Abstract:

In this study, commercially available iron chloride was used for the dechlorination of trichloroethylene (TCE) up to 50 mg/l. The amount of iron chloride was varied up to 200 g/l and it degraded 50 mg/l TCE within an hour.

Introduction:

Trichloroethylene (TCE) is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers. Drinking or breathing high levels of trichloroethylene may cause nervous system effects, liver and lung damage, abnormal heartbeat, coma, and possibly death. Because of their immiscibility, lower solubility, relatively slow rates of dissolution, high density, and capillary forces arising from interfacial tension between the TCE and water, it is extremely difficult to remedy TCE. The presence of TCE represents a significant threat to soil and groundwater resources. Recent research is focused on the development of situ methods for destroying TCE in ground waters and surface waters. The EPA has set a maximum contaminant level for trichloroethylene in drinking water at 0.005 milligrams per liter (0.005 mg/L) or 5 parts of TCE per billion parts water.

Objective:

The overall objective of this study was to investigate the potential of using iron chloride to rapidly degrade TCE.

Testing program:

Experiments were conducted in continuously agitated reactors to determine the reduction of TCE using iron chloride. Dechlorination of 10 mg/l, 20 mg/l and 50-mg/l TCE concentrations were investigated. The concentration of TCE was analyzed using SHIMADZU GC-14A gas chromatograph. The amount of iron chloride was varied based on the concentration of TCE to be reduced.

Reduction of TCE:

The degradation of TCE by using iron chloride is shown in Fig 1. As shown in the figure complete degradation of 10 mg/l, 20 mg/l and 50 mg/l was achieved within an hour when the concentration of iron chloride was 40 g/l, 100 g/l and 200 g/l respectively. The amount of TCE degraded when different concentrations of iron chloride were used is shown in Fig 2. The degree of degradation increased linearly with iron chloride concentration for the range of variables investigated.

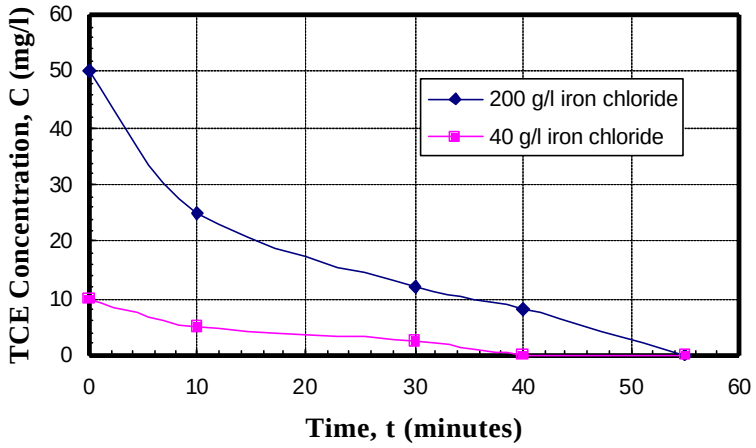

Figure 1: Degradation Kinetics of TCE using Iron Chloride

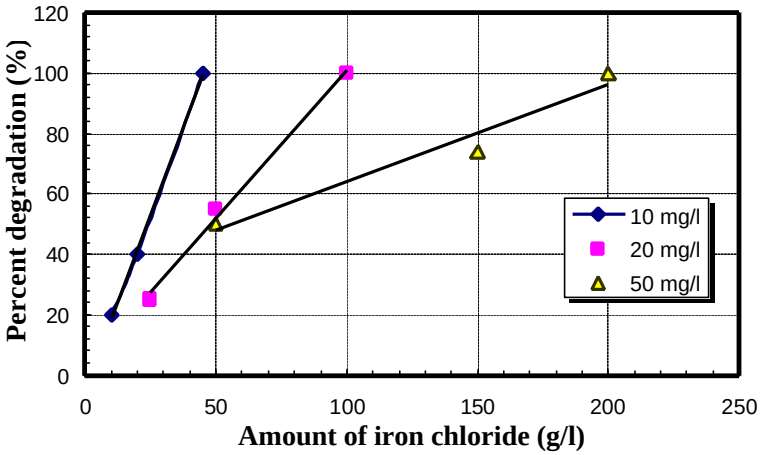

Figure 2. Degree of Degradation of TCE with Varying Amount of Iron Chloride

Conclusion:

Iron chloride was effective in completely degrading TCE. The amount of iron chloride needed to degrade 10 mg/l of TCE within an hour was 40 g/l.

Acknowledgement:

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References:

1) Mackay, D.M; Cherry, J.A, "Groundwater contamination: pump and treat remediation," 1989, 23, 630.