CHAPTER I

INTRODUCTION

1.1 Research background and motivation

Persulfate is one of the oxidants that has been used to degrade organic contaminants (Liang et al., 2003). Being a strong oxidizer, either persulfate-ultraviolet or heated-persulfate oxidation has been used as a standard method for TOC analysis in water and wastewater (Clesceri et al., 1998). Furthermore, persulfate is a potential alternative oxidant compared with other chemical oxidants. Despite the fact that other oxidants such as Fenton's reagent, potassium permanganate, and ozone have commonly been used for degrading organic contaminants, they have some limitations. Hydrogen peroxide in Fenton's reaction and ozone are highly unstable. Fenton's reaction requires pH to be less than 6. Potassium permanganate can slightly degrade saturated hydrocarbon such as 1,1,1-trichloroethane. Potassium permanganate and ozone have less redox potential than sulfate radicals of persulfate (1.68V and 2.07V, respectively, versus 2.6V). On the other hand, persulfate salt is stable at or under 25 C, has a high water solubility and has a harmless by-product after the oxidation, which is sulfate. Additionally, when activated by heat, metal catalysts or UV light, persulfate anion can be transformed to the sulfate free radical with a high redox potential of 2.6V(Liang et al., 2003; Huang et al., 2002b).

Trichloroethylene (TCE) has been used as a component of industrial cleaning solution and as a universal degreasing agent. Hence, it is one of the most frequently detected volatile organic chemicals in groundwater in the United States (Fisher et al., 1987 as cited in US EPA, 1992). The contaminant has adverse effects on public health. Furthermore, TCE was classified as a potential human carcinogen by US EPA (1998) as cited in Liang et al. (2003). Therefore, TCE was selected as a target contaminant in this study due to widespread use and highly adverse effects.

Since persulfate is one of the most interesting alternatives for destroying the organic contaminants which are not readily biodegradable, this study is conducted for determining the feasibility of using persulfate oxidation to degrade TCE. The purpose of this research is to compare the performance of heat and UV activated persulfate oxidations for the degradation of TCE. The optimal persulfate/TCE molar ratio of each method and effects of concentration of TCE on the performance of the degradation will be determined so that they can be used as basic information for further studies involving remediation technique at contaminated sites.

1.2 Objectives

The main objective of this study is to compare the performance of thermal and UV activated persulfate oxidations for the degradation of trichloroethylene. The specific objectives are:

1. To determine the effect of concentration of persulfate on the performance of the degradation.
2. To investigate the effect of concentration of TCE on the performance of the degradation.
3. To study the batch kinetics of the degradation.
4. To identify the major degradation by-products.