



CHAPTER I INTRODUCTION

Advanced oxidation process (AOP) makes use of oxidants to reduce chemical oxidation demand (COD) levels to remove organic components and to reduce color contents. This process can completely oxidize organic compounds to carbon dioxide and water. There are various oxidants employed in AOP such as hydrogen peroxide (H_2O_2) and ozone (O_3). Only one or more types of oxidants may be used in a process depending on the type of AOP. The hydroxyl radicals are generated by oxidants which can destroy organic compounds. The oxidation efficiency of hydroxyl radicals is limited by the generation rates of hydroxyl radical in a solution. AOP is suitable for small COD contents of less than 5 g/l (Mishra and Mahajani, 1995). If COD is more than 5 g/l, wet oxidation or incineration will be more suitable for wastewater treatment.

The advantage of AOP is the treatment cost and environmental friendly products. Total annual treatment cost of $\text{O}_3/\text{H}_2\text{O}_2$, a type of AOP, was 2-4 times less than the combined processes of air stripping and gas phase granular activate carbon (GAC), and less than liquid-phase GAC itself (Plant and Jeff, 1994). The overall cost of AOP treatments is comparable with those of well established technology of pollutant abatement (Andreozzi *et al.*, 1999a).

There are various advanced oxidation processes which produce hydroxyl radicals (OH^\bullet) such as Fenton reagents ($\text{Fe}^{2+}/\text{H}_2\text{O}_2$), photofenton ($\text{Fe}^{2+}/\text{H}_2\text{O}_2/\text{UV}$), O_3/UV , $\text{H}_2\text{O}_2/\text{O}_3$, etc. For Fenton reagents, hydroxyl radicals are produced by the combination of hydrogen peroxide and ferrous ion. This system is interesting because ferrous ion is very abundant and nontoxic, and hydrogen peroxide is easy to handle and environmentally safe (Andreozzi *et al.*, 1999b)). For $\text{H}_2\text{O}_2/\text{O}_3$, the addition of hydrogen peroxide enhances the decomposition of ozone, creating more formation of hydroxyl radicals.

There are many different techniques on advanced oxidation processes, which have been developed. It is a choice for the selection of treatment methods which depends on specific problems. In this research, the combination of Fenton

process and air evaporation was studied by experimentation and mathematical modeling on the removal of organic compounds present in wastewater.