Chapter I
Introduction

1.1 Rational

Nowadays, there are several hazardous chemicals which are indeed environmentally persistent. Nitrobenzene are the organic chemical compounds which consist of a benzene ring but having different functional group and have also been categorized as hazardous wastes. Today, nitrobenzene are widely used in several industries such as dye manufacturing, pesticides, rubber chemicals, and pharmaceuticals. Due to their toxicity, reduction of nitrobenzene which is believed to be a human carcinogen (NTP, 2005), the US EPA has included it in a reduced list of drinking water contaminant to be assessed for possible future regulation. At low nitrobenzene concentration, bioreactor was used successfully to remove this contaminant (Majumder and Gupta, 2003), but at high concentration, it is toxic to microorganisms and it is resistant to oxidation by biological process. Therefore, the chemical oxidation measure is needed (Bell et al., 2003).

The degradation of organic pollutants by chemical oxidation affords an alternative route to the biological processes, especially at high concentrations of toxic chemicals. The Fenton process is an advanced oxidation processes (AOP) that has been used to treat wastewaters bearing biologically refractory organic substances. This technology possesses several advantages in treating wastewaters. For example, the hydroxyl radicals rapidly generated in this process can oxidize a variety of organic chemicals (Kiwi et al., 1994, Casero et al., 1997, Kwon et al., 1999, Lu et al., 1999 and Teel et al., 2001). In addition, the oxidant is easy to handle and environmentally friendly because the final decay products (water, oxygen and ferric hydroxide) have no harmful effect. The performance of the Fenton system is understood to be governed mainly by the concentration of hydroxyl radicals produced in the reaction mixtures. Controlling the pH between 2 and 4 is a very important procedure for the

efficient treatment of wastewaters (Casero et al., 1997 and Lu et al., 1999). However, major drawback of Fenton's reaction is the production of substantial sludge required further handle and disposal. To deal with this problem, several new Fenton modifications have been develop. One of these alternatives is the use of fluidized-bed reactor in which the carriers can initiate the iron precipitation via crystallization process (Chou et al., 2004). A modification of Fenton process, the process with Fe^{2+} addition in named fluidized-bed Fenton method, in which Fe^{2+} is the homogeneous catalyst and supported carriers is the heterogeneous catalyst of H_2O_2 to oxidize organic contaminants. The Fe (III) hydrolysis product of Fenton's reaction can crystallize and grow on the surface of this carrier to reduce the precipitation of $Fe(OH)_3$ (Chou et al., 2003).

The concentration of hydroxyl radicals is affected by the background impurities present in the wastewater stream. The inorganic ions such as chloride ions are very common in most wastewaters (Lu et al., 1997). As mentioned above, chloride ions may be the final product of parent-chlorinated compounds, and it is speculated that the accumulation of chloride ions may inhibit the Fenton process to a significant degree (Pignatello.,1992). Some wastewaters, such as industrial dye manufacturing wastewater, may exhibit a high concentration of chloride salts. Therefore, since the Fenton process is considered as one of the most promising technologies in the treatment of wastewater, and since pH is a critical parameter, the effect of chloride ions on process efficiency has to be explored in greater detail.

1.2 Objectives

1. To investigate the effect of chloride ions on the oxidation of nitrobenzene by fluidized-bed Fenton process.
2. To compare the removal efficiency of nitrobenzene by Fenton and fluidize-bed Fenton processes.
3. To determine the effects of initial ferrous concentration and hydrogen peroxide dosage on the oxidation of nitrobenzene by fluidized-bed Fenton process.

4. To investigate the kinetics information on the oxidation of nitrobenzene by fluidized-bed Fenton process.

1.3 Scope of Investigation

1. Using lab scale reactor of 1.35 liters.
2. Using synthetic nitrobenzene wastewater.
3. For the fluidize-bed Fenton process, the carriers is the aluminium oxide.
4. Working at room temperature.