CHAPTER I

INTRODUCTION

1.1 Rational

Nowadays, there are several hazardous wastes polluting in the environment. *O*-toluidine is a chemical substance that is considered to be one of the hazardous wastes. It is a light yellow liquid at ambient temperature. It is of moderate to low acute toxic and has the potential to produce minimal skin irritation and mild eye irritation. The principal signs of toxicity following acute and short-term exposure to this chemical are methaemoglobinaemia and related effects in the spleen. *O*-toluidine is used primarily in the manufacture of dye stuffs, although it is also used in the production of rubber, chemicals, and pesticides and as a curing agent for epoxy resin systems. Due to its toxicity, *o*-toluidine must be eliminated from wastewater before discharging into the natural body.

Advanced oxidation processes (AOPs) are the alternative approaches used to degrade organic pollutants by producing the highly reactive hydroxyl radical (•OH). Among various AOPs, Fenton process (H_2O_2/Fe^{2+}) has been effectively used to treat various organic contaminants. However, the drawback of Fenton process is the production of a high amount of $Fe(OH)_3$ sludge. To solve this problem, a fluidized-bed reactor is used to reduce $Fe(OH)_3$ sludge via crystallization process to form iron oxide onto the carriers. Moreover, the iron oxide synthesized in the reaction can act as a heterogeneous catalyst of the decomposition of H_2O_2. By this way, the Fe^{2+} dosage used in the Fenton system can be reduced. In order to find the effects of variable factors on the process performance and to obtain the optimum conditions for *o*-toluidine degradation, the design of experiments methodology is a promising way to use because the number of experiments can be minimized and it is the statistic-based method. Consequently, this research investigated on the removal of *o*-toluidine by fluidized-bed Fenton process by using the statistical experimental design methodology.

1.2 Objectives

1. To investigate the removal efficiency of *o*-toluidine by fluidized-bed Fenton process.
2. To find the optimum condition for *o*-toluidine degradation by fluidized-bed Fenton process.
3. To determine the effects of hydrogen peroxide dosage, initial ferrous ions concentration, and initial *o*-toluidine concentration on the *o*-toluidine removal efficiency of fluidized-bed Fenton process.
4. To investigate the oxidation kinetics of *o*-toluidine in fluidized-bed Fenton process.

1.3 Hypothesis

1. pH, hydrogen peroxide, and ferrous ions concentration have impacts on *o*-toluidine degradation in fluidized-bed Fenton process.
2. Statistical experimental design is an accurate tool for optimization with minimal experiments.

1.4 Scope of the research

1. Using a 1.35 liter lab-scale fluidized-bed reactor.
2. Using the synthetic *o*-toluidine wastewater.
3. For the fluidized-bed Fenton process, the carrier was silica dioxide (SiO_2).
4. Working at room conditions.

1.5 Expected Results

1. Effectiveness of *o*-toluidine removal by fluidized-bed Fenton process.
2. Effect of pH, hydrogen peroxide, and ferrous ions concentrations on *o*-toluidine degradation in fluidized-bed Fenton process.
3. The kinetic equation for *o*-toluidine degradation by fluidized-bed Fenton process.