



CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Semi-batch Fenton process ($\text{H}_2\text{O}_2/\text{Fe}^{2+}$) was studied. Air was used to improve efficiency of system. The simulated wastewater composed of ethanol and isopropanol was used to investigate in these studies under various conditions. The parameters, which were air flow rate, the concentration of hydrogen peroxide and ferrous sulfate, were varied. The experimental data were used to study Fenton process, and to develop model for Fenton and Fenton/Air process. From the experimental results, conclusions were drawn as follows:

1. The higher air flow rate and the higher the concentration of hydrogen peroxide were applied to the systems, the more %TOC remaining, %ethanol and % isopropanol decreased. Hydrogen peroxide was converted to hydroxyl radicals which can destroy organic compounds.

2. When the amount of ferrous sulfate increased, %TOC remaining, %ethanol and % isopropanol decreased. If ferrous sulfate amount was higher than 0.0075 g for Fenton process and 0.003 g for Fenton/Air process, %TOC remaining, %ethanol and % isopropanol for both processed increased more. Ferrous sulfate would possibly precipitate at high concentration during the processes.

3. Air can improve the efficiency of system. When air was fed into the system, % TOC remaining, %ethanol and % isopropanol reduced more than the system without air.

4. For Fenton process, the rate expression shown below was proposed. It was first order with respect to concentration of the contaminants and hydroxyl radicals.

$$d[\text{ethanaol}]/dt = k_{10}[\text{ethanol}]^{0.61}[\text{isopropanol}][\text{OH}^{\bullet}]^{1.15}$$

$$d[\text{isopropanol}]/dt = k_{10}[\text{ethanol}]^{0.61}[\text{isopropanol}][\text{OH}^{\bullet}]^{1.15}$$

$$\text{where } k_{10} = 1.68 \cdot 10^9 \text{ M}^{-2}\text{s}^{-1}$$

From the model, the concentration of ethanol and isopropanol closely fitted with the experimental data.

5. For Fenton/Air process, when chemical oxidation and evaporation were combined, the concentration of ethanol and isopropanol did not fit with the experimental data. The enormous over-prediction of the experiment data by the model occurs from evaporation. The assumption of model use equilibrium y_i which is greater than y_i from experiment.

5.2 Recommendations

1. The other type of Advanced oxidation process (AOP) such as Fenton/UV should be studied and compared with Fenton process.

2. The mathematical modeling for Fenton/Air should be developed especially evaporation equation.