CHAPTER I

INTRODUCTION

1.1 General

Nowadays, heavy metals cause serious environmental problems. They can contaminate surface water, ground water, and soil. Human health and the environment receives effects from the contaminant. Most of heavy metals are from two major sources. The first is from industries such as metal processing, metal finishing, and plating. The other is from mining process (Veeken et al., 2002). Common heavy metals in industrial wastewater and acid mine drainage are iron, zinc, nickel, copper, cadmium and chromium (Foucher et al., 2001).

In contrast to organic pollutants, metals in wastewaters cannot be mineralized but they can only be eliminated by concentration or conversion to a chemically inert state.

Numerous treatment technologies exist for the removal of heavy metals from natural waters and wastewaters which include precipitation, coagulation–flocculation, ion exchange, solvent extraction, complexation, adsorption, filtration, and membrane processes (Veeken et al., 2002).

In most cases, precipitation processes are applied to the treatment of acidic heavy metals contained in the water. As a neutralizing agent, lime is often used. However, large amounts of sludge contaminated by heavy metals are formed; the disposal of the sludge is costly. More complicated technologies like evaporation, ion exchange, or membrane processes usually are not suitable because of high capital and operation costs and the large volumes to be treated. Passive systems, like constructed wetlands, are cheaper method for mine water treatment. However, possibilities of controlling the processes are poor. Furthermore, large area is necessary for the treatment (Glombitza et al., 2000).

The sulfide precipitation was a very interesting method. It had many advantages. It was applied to treat wastewater with high efficiency removal heavy metal. It was less problematic interference of chelating agent in the wastewater. It was possible to remove selected metal, and low hydraulic retention time (HRT) from fast reaction rate. Metal sulfides exhibited good thickening, and dewatering characteristics. Sulfide precipitated was processed by existing smelters for metal recovery (Veeken et al., 2002).

The precipitation process was employed by various sulfide sources. The generation of sulfide by sulfate reducing bacteria was an interesting option, especially when sulfate source was present as it was transformed to sulfide by sulfate reducing bacteria (SRB). So, Biogenic sulfide precipitation has been studied for treatment of industrial wastewater and acid mine drainage (Veeken et al., 2002).

This was adapted for developing the available wastewater treatment plant for example the large amount of heavy metal in the wastewater caused problem to industrial wastewater treatment system. The heavy metal in the wastewater could not be removed effectively in the anaerobic process. After anaerobic process, the large amount of heavy metal inhibited bacteria when the wastewater came into the aerobic process. The aerobic process failed by this effect. This study could solve this problem.

These are the reasons to study sulfide precipitation in anaerobic batch reactor. This study focuses on removing of heavy metal by sulfide precipitation in completely-mixed anaerobic reactor.

1.2 Objectives of the study

The main objective of this study is to investigate the optimum condition for removal of heavy metals from wastewater with sulfide precipitation.

The specific objectives are:

1. To determine the optimum condition for sulfide precipitation.

2. To determine the maximum concentration and/or content of Zn to be removed in the completely-mixed anaerobic system.

1.3 Scopes of the study

1. Literature related to heavy metals in waste water and sulfide precipitation by sulfide reducing bacteria was reviewed. The information was gathered from related proceedings, journals, theses, dissertations, and websites.
2. The carbon source (saw dust) and the seed (sludge form Nongkam wastewater treatment plant) were studied on basic properties such as BOD and COD.
3. The bench scale reactor was constructed and operated under completely-mixed anaerobic condition.
4. The wastewater contaminated Zn was synthesized and prepared.
5. The synthesized wastewater was injected into the reactor when it became stable.
6. The results (ORP, pH, S^{2-}, SO_4^{2-}, etc.) were analyzed when the reactor finished operation.