CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The objectives of this thesis work were to (1) establish a start up system, (2) investigate the optimum condition on the treatment of zinc (Zn) by the use of sulfate reducing bacteria (SRB), and (3) investigate the factors that inhibit the reaction. Based on the results of this research, the following conclusion may be drawn:

5.1 Conclusion

1. The results from the experiment on the startup and operation can be concluded that, both of the reactors were able to produce a suitable condition for the SRB reduce sulfate to sulfide. This was confirmed by the indicator parameters examined on the COD, neutral pH, and ORP values toward the end of the experiment.

2. The conditions that the experiment achieved when both of the reactor A and B reached the steady state were in the range of: -100.2mV to -124.9mV for ORP, 6.95 to 7.15 for pH, 10.55 to 27.59 mg/L for sulfide and 5350 to 6110 mg/L for COD. As there were fulfill requirement on the optimum conditions for the SRB to be able to treat zinc are anaerobic environment with a redox potential of lower than - 100 mV and a pH of higher than 5.5 (Lyew et al., 1994, Garcia et al., 2001).

3. The amount of sulfide and toxicity to the SRB in the reactor could be possibly limiting in the treatment of zinc in the wastewater. After of the first addition of zinc with the concentrations of 50 ppm, the results showed that there was no production of sulfide in reactor A. The SRB was possibly weakened after the first addition of zinc at 50 ppm by the toxicity cause by the zinc added since there was no further conversion between the oxidation of sulfate to sulfide.

4. After the third addition of 50 ppm of zinc, the reactor B showed the same failure trend as for reactor A when it reached its limit after the second addition of 50 ppm of zinc. The reactor B was possible to last longer in the treatment of zinc.

5. Reactor B was much better in treatment of zinc when compared to reactor A; the possible reasons were, 1) in reactor B was filled with the filtered leachate from the anaerobic digested sludge, 2) more sulfate reducing microorganism from the filter leachate, which help in oxidizing sulfate to sulfide and further precipitated as Zinc-sulfide (ZnS).

6. The efficiency of zinc treatment after the first addition of zinc in reactor A was 93.43% or 2.474 mg of zinc. The efficiency of zinc treatment after the second addition of zinc in reactor A was 54.78% or 5.85 mg of zinc.

7. The efficiency of zinc treatment after the first addition of zinc in reactor B was 92.72% or 2.574 mg of zinc. The efficiency of zinc treatment after the second addition of zinc in reactor B was 90.72% or 9.82 mg of zinc. The efficiency of zinc treatment after the third addition of zinc in reactor B was 48.62% or 6.838 mg of zinc.

8. The treatment of zinc per volume of reactor A and B were 5.212 mg of total zinc per liter of liquid volume and 10.367 mg of total zinc per liter of liquid volume, respectively.

9. The limiting condition in the reactor A and B can only be confirmed by the no change in the zinc concentration. Other factors could not be a good indicator to inform when the reactor reach it limit, due to the low mixing in the reactor.

10. The use of filtered leachate from the sludge of wastewater provides more favorable environmental conditions for microbiological growth and proliferation for the SRB, including attenuation of co-disposed heavy metals.

5.2 Recommendation for future work

1. In real site, there are a large number of various heavy metals in landfill and wastewater. Consequently, determining on other heavy metals competition in the metal sulfide precipitation is crucial.

2. Test on the SRB consortium available in the reactor and how much sulfate was oxidized to sulfide by the SRB in details for more valuable information.

3. Test an effect on the treatment of zinc and other heavy metal to the elevation of the reactor, to inform on the treatment efficiency to the height.

4. Toxicity test on the SRB to the concentration of zinc.

5. Test on the treatment of heavy metal after loading of wastewater in the plugged or fully mixed flow.

6. The data obtained from this study were results of lab-scale laboratory work with constant operational conditions. To confirm the results obtained, a full-scale study is recommended.

7. Test on the treatment of zinc was not cause by the adsorption onto the mixture matrix wood chip and stone.

8. Since the work reported here did not attempt to investigate the underlying mechanisms, the possible explanations given are conjecture. There could be complicated mechanisms for attenuation of heavy metals; therefore, future studies are needed to investigate to the relationships among pathway and removal mechanisms.