CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The release of high level of zinc in wastewater without treatment can post a significant threat to human health and the environment. A simple and cost effective treatment procedure was proposed for the removal of heavy metals from contaminated water through the sorption on foundry sand. Sorption is a strong choice for the removal of heavy metals as it is operationally simple and can adapt to changing wastewater flow rates and compositions.

5.1 The following specific conclusions can be drawn based on the results of this investigation.

1. The changing of bed height between 14.5-25 cm was not affected to breakthrough curves very much. The capacity of foundry sand at various bed heights was not much different. At bed height 25, 21.5, 18, and 14.5 cm, the capacity was 0.61, 0.66, 0.5, and 0.48 mg of zinc/ g of foundry sand, respectively.

2. At bed height of 25 cm, flow 6 ml/min had the highest removal efficiency which was 0.61 mg/g. The other registered 0.45 and 0.48 mg/g of flow rates at 11 and 15 ml/min, respectively.

3. The initial concentration affected the breakthrough time and exhaustion time. At initial concentration 60 mg/l it had a lower breakthrough time and exhaustion time than 30 mg/l.

4. The study revealed that at an initial pH of 5 the removal efficiency was better than at a pH of 3. This is because as the pH increases, there is increasing trend in the concentration of anion on the foundry sand surface from PZC 2.9 which leads to the greater attachment of zinc ions from the solution. In contrast, at low pH competition is created between protons (H^+) and heavy metals (M^{2+}) at the binding site of mediums.

5. The mode of the column operation affects the capacity of foundry sand and breakthrough porevolume. Up-flow operation had higher removal capacity and breakthrough time than down-flow. The short circuit might have been the cause of the early breakthrough time.

6. The optimum condition from this study was at bed height 25 cm, flow rate 6 ml/min, initial concentration 60 mg/l, initial pH 5, and up-flow mode.

7. The mechanism in the column might be both ion exchange and adsorption (according to the conclusion no. 4).

8. Zinc removal capacity of foundry sand in column experiment was around 0.60-0.66 mg/g. This value is similar to the value obtained in batch experiment-0.67 mg/g.

5.2 Recommendations

1. The study of synthetic sand should be done in order to enhance the efficiency of foundry sand performance for metal removal.

2. The study of the leachability of the exhausted foundry sand by EDTA or another solution should be studied in order to find the potential of the recirculation of foundry sand for use as a new medium.

3. Before using foundry sand to remove metals in the wastewater, a study of the efficiency of competition among various kinds of heavy metal in the wastewater needs to be carried out.

4. This study can be a guideline for the scale-up system for the removal of zinc from wastewater. The size of column, however, might affect the performance of the removal. In such cases, the real size column needs to be studied in order to investigate the performance that might be difference from pilot scale.

5. After foundry sand is exhausted with zinc, it should be removed in order to prevent desorption that can occur because of the difference in concentrations of zinc in the foundry sand and zinc in the wastewater. If the zinc in the foundry sand has a higher concentration than the zinc in the wastewater it can be released into the solution again which can cause more hazardous wastewater.