CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The overall objective of this research was to remove two types of oil which were diesel and motor oil from substrate using the surfactant gradient approach. Furthermore, the specific application was to investigate phase behavior of systems enabled to form microemulsion with diesel and motor oil and to apply the gradient approach from the selected surfactant system for diesel and motor oil removal in a column study using an electrolyte gradient.

From the phase behavior study results, the mixed surfactant system of 0.2 wt% Alfoterra 145-4PO and 0.5 wt% AOT was selected for study further in a column to remove mixed diesel and motor oil from Ottawa sand because the system is able to form microemulsion with both diesel and motor oil. The mixed surfactant system gave the lowest optimum salinity of diesel and motor oil at 1 wt% NaCl and 5 wt% NaCl, respectively.

The results from the column study shows that surfactant gradient system using an electrolyte gradient perform better on diesel and motor oil removal with as compared to the single flushing with only surfactant solution. Moreover, using surfactant gradient system can enhance diesel and motor oil solubilization while prevent the diesel and motor oil mobilization. As a result, the surfactant gradient system can be used to remove both diesel and motor oil at the same time.

5.2 Recommendations

Based on the present results, the following recommendations are suggested for future studies:

1. Other surfactant systems should be further studied for select the best surfactant system to remove different type of contaminated oils in the substrate such as combination of some LNAPLs or DNAPLs in the same site. Moreover, maximizing contamination

solubilization and economics considerations should be concerned for minimizing surfactant losses.

2. The phase behavior and column study should be further applied with the used oil which containing the wear metals or other heavy metals (i.e., cadmium, zinc, mercury, and lead) to determination the appropriate system for removal of contaminated oils at the field contaminated site. However, management of used oil and surfactant solution should be concerned to reused or recycled for cost saving and energy recovery. For example, the recovery of surfactant used in gradient system should be further studied.

3. The study on surfactant gradient approach should be extended to other media into the column that simulate the real soil or using real soil as a heterogeneous soil from any contaminated sites that could vary in characteristic such as organic matters and heavy metals for application at the field contaminated site. However, this approach would be worked to remove several types of oil with the similar structure contaminated in the same site. Furthermore, the surfactant gradient approach may be introduced to soil washing process.

4. The column study should be further studied to determine the highest efficiency for removal both types of oils by varying the flow rate and the ratio of surfactant solution at different stages of surfactant gradient approach.