CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Oil sludges are composed of hydrocarbons such as high molecular weight saturates, aromatics and asphalt compounds which have negligible solubility in water. Preliminary studies on oil sludge biodegradation reveal the process to be very slow. In order to improve the rate of degradation of hydrocarbons, pretreatment of oil sludge was carried out by using surfactant. In this research, the experiments were divided into 2 parts: solubilization and biodegradation. In the solubilization studies, the effect of a nonionic surfactant system on the solubility of hydrocarbons was examined at various surfactant concentrations and reported as %enhanced solubilization and the ratio between the amounts of solubilized carbon with the amounts of nonionic surfactant as compared with the control (no addition of surfactant). For the biodegradation of petroleum hydrocarbons in the crude oil sludge obtain from Bangchak Public Company Limited was studied by using the sequencing batch reactor (SBR) with 50 mL fill and draw operation. Firstly, the microorganism or the mixed culture of indigenous bacteria consortia originally present in the crude oil sludge was cultivated inside the bioreactors as an oil sludge degrader for 1 liter and then the biodegradation of hydrocarbon in extracted oil was studied. In the biodegradation studies, the biodegradation of hydrocarbon in the oil sludge was analyzed by Chemical Oxygen Demand (COD), Total Organic Carbon (TOC), Total Petroleum Hydrocarbon (TPH) extraction and Dry Weight Cell method.

In the solubilization studies, the result was found that the addition of surfactant greatly enhanced the solubilization of hydrocarbons in the oil sludge. The enhancement of the hydrocarbon solubilization increased with increasing surfactant concentration and reached its maximum value at a specific concentration or optimal concentration well above the critical micelle concentration of each surfactant. Nevertheless, the nonionic surfactant system provided the best optimization on the solubilization of hydrocarbons in the crude oil sludge at the concentration of 0.2%

w/v. The enhancement of the solubilization of hydrocarbons was related to their water solubility, which nonpolar solutes are generally less soluble in the surfactant micelles than polar compounds.

In the biodegradation studies, the effect of oil loading (0.5 and 1.0 kg/m^3d) was first examined with the addition of nonionic surfactant concentration 0.1%w/v were fed into the bioreactors and it was shown that at the highest biodegradation was achieved in the oil loading 1.0 kg/m^3d. Then at this oil loading rate the effect of various numbers of cycles per day (1-3 cycles per day) of the SBR operation were examined. The result showed that at 1 cycle per day of the SBR operation provided the highest percent removal when compared to other SBR operation time. However, the biodegradation efficiency of this condition was not high enough so the solubilization of hydrocarbon from extracted oil was further determined to improve the enhancement of biodegradation efficiency by changing the surfactant concentration to 0.2% w/v with fixed the optimum oil loading (1 kg/m^3d). The result showed that at 1 cycle per day of the SBR operation provided the highest biodegradation efficiency when compare to other SBR operation and surfactant concentration 0.1% w/v. This phenomenon can be elaborate that the microorganisms required to quite a long time to degrade the hydrocarbons from oil sludge and capability to solubilize hydrocarbon into the aqueous phase at optimum surfactant concentration. In the environmental concern, it was very good in treating toxic chemicals to be non-toxic chemicals but it was not quite practical in the business way because a long time biodegradation was required.

5.2 Recommendations

The temperature seems to have the effect on the rate of biodegradation. This study did not control the effect of temperature but used the room temperature as a condition. The temperature of this research might be swayed from 24 to 32 degree Celsius and it might change the biodegradation efficiency. For this reason, the bioreactor should have the temperature controller in order to control and increase the efficiency of surfactant-enhanced biodegradation of crude oil sludge in the SBR process making it more accurate than this research.