CHAPTER V
CONCLUSIONS

The production of biosurfactant by a crude oil-contaminated soil isolated *Pseudomonas aeruginosa* SP 4 in two identical units of sequencing batch reactors (SBRs) under aseptic conditions has been found to be affected by nutrient sources, oil loading rates (OLRs), and cycle times. The reactor temperature was maintained at 37°C throughout the experiments by circulating water through bioreactor jacket. The working and draining volume in the SBRs were respectively 1,500 and 500 ml. The sedimentation, decanting, and feeding step used for all experiments were 50, 5, 5 min, respectively. A carbon source used was palm oil owing to its low price and currently available in Thailand. It also increases the economic value of the agricultural product.

Two nutrient sources, i.e. fish steaming waste (FSW) and mineral medium, were assayed based on the surface tension reduction, and COD and oil removal. FSW could not directly serve as a nutrient source for biosurfactant production without dilution. This was attributed to a COD removal as low as 29% and aggressive foam formation in the SBR. However, diluted FSW (1:60 times diluted) is competitive with mineral medium as a nutrient source, because a similar surface tension reduction was obtained with both diluted FSW and mineral medium. The C:N and C:P ratios in the mineral medium were respectively adjusted to maintain at 16 and 14, which are the optimum ratios for maximum rhamnolipid production (Guerra-Santos *et al.*, 1984).

Consequently, the variation in OLRs with mineral medium showed that an OLR of 2 kg/m^3d was found to be the optimal OLR for biosurfactant production. The surface tension dropped from 67.6 to 28.1 mN/m at an OLR of 2 kg/m^3d, corresponding to the highest COD removal of 88% and oil removal of 94%. Additionally, an OLR of 2 kg/m^3d gave the lowest cell wash-out. All OLRs achieved 53% surface tension reduction, as well as 72% oil removal and 50% COD removal. From aeration time profile during a steady state cycle, the SBRs for all OLRs tested produced noticeably similar aeration time profile and a minimum surface tension was reached at aeration time in the range of 6 to 10 h.

After optimizing the oil loading rate, further study was the effect of cycle time on biosurfactant production by using the same oil concentration (0.6%w/v). Increasing the cycle time from 1 to 3 days was not significantly influence the COD removal, whereas an oil removal slightly increased. However, the surface tension reduction decreased with increasing the cycle time. As expected, the SBRs operation with 3-d cycle caused the deficient in a carbon source, corresponding to a lower MLSS in the SBR. Hence, it can be concluded that an OLR of 2 kg/m^3d with mineral medium under operating at 1-d cycle was found to be the optimum conditions for biosurfactant production.

An interesting feature for future investigation is the effect of cycle time on biosurfactant production at the optimized OLR of 2 kg/m^3d in order to completion of study.