CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Microemulsion phase systems consisted of crude palm oil and surfactant solution. The middle phase microemulsion of all surfactant systems were not clearly seen by visual observation and laser light because crude palm oil contains complex ingredients. IFT measurement as a function of salt and surfactant concentration was investigated in order to estimate optimum formulation. The anionic surfactants with adding PO groups could produce low CMC and ultralow IFT without avoiding water-soluble due to high HLB value whereas nonionic surfactant could not achieve ultralow IFT due to its structure and limited temperature. Additionally, a larger area per molecule of eight PO groups causing increase the hydrophobic interaction helps offset the lower packing density as a result of lower salt and surfactant concentration used. Due to the unique structure of $C_{12,13}H_{25,27}$–$(PO)_8$–SO_4Na system, it provided the highest of total oil extraction efficiency (25%) at optimum condition including salt (2.5 wt%) and surfactant concentration (1 wt%), contact time (20 min) and solid to liquid ratio (2/15). The oil extraction parameter also affected on total oil extraction efficiency. Although the microemusion based method was not as much fraction of oil extracted as that of the efficiency from hexane method due to poor interaction between surfactant and crystalline structure of solid fats adsorbed on SBE's surface, this purposed technique offered better quality in terms of free fatty acid composition. These extracted oils could be converted to methyl ester as biodiesel or an alternative approach for β-carotene extraction. However, aqueous microemulsion based method is worth considering as alternative for replacement of solvent technique due to reduction of organic solvent and non-toxic substance in process and less pollutant emission in the other word it is a clean technology.

5.2 Recommendations

5.2.1 Addition of Co-surfactant

As crude palm oil contains high triglyceride molecule, a single surfactant system is difficult to interact with oil for microemulsion formation. In order to increase performance of surfactant systems, the mixed surfactant systems could be an alternative option by addition of co-surfactant such as short chain with alcohol molecule.

5.2.2 Temperature in Extraction

In practical application, the use of energy or heat for extraction process associated with the cost of the production. As oil adsorbed on SBE was extracted at room temperature (low melting point), the microemulsion based method provided low performance compared to hexane extraction. Thus, condition extraction (temperature) could be adapted to higher melting point to enhance the extraction efficiency.

5.2.2 Analysis of Surfactant Content in Extracted Oil

Surfactant content in extracted oil needs to be further investigated to confirm that absence surfactant or small amount of surfactant dissolve in extracted oil during extraction process.