CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This study provides the GHG emission and environmental impacts of palm oil based microemulsion biofuel production by means of the life cycle assessment (LCA) approach. The production of microemulsion biofuel data was collected from laboratory research works and secondary data sources based on its functional unit, one ton of microemulsion biofuel production. The life cycle environmental impact assessment (LCIA) evaluated in this study were GHG emission, acidification, eutrophication, ozone layer depletion, abiotic depletion, photochemical oxidation, land use, human toxicity, fresh water aquatic, marine aquatic and terrestrial ecotoxicity. Four different scenarios such as Scenario I (base case), Scenario II (biobased case), Scenario III (butanol blend case) and Scenario IV (RBDPO case) were created by varying the formulation of microemulsion biofuel production.

When GHG emissions from all four Scenarios were compared, formulation with RBDPO (Scenario IV) contributed only 1,017 kg CO_2 eq. per ton of ME biofuel production. From this result, the appropriate ME biofuel formulation with crude palm oil (RBDPO) can be achieved with 30 percent lower GHG emission than Scenario I (base case) which contributed 1,447 kg CO_2 eq. per ton of ME biofuel.

According to impact assessment methods' results, the highest contribution of Scenario IV (RBDPO case) was observed in only 24 percent contribution to the photochemical oxidation impact category and there was zero percent contribution to terrestrial ecotoxicity .In this study, major cause of terrestrial ecotoxicity potential was due to the usage of bioethanol and biodiesel in the formulation of Scenario II. When all environmental impact categories of four Scenarios were compared, Scenario II (biobase case), especially from utilization of bioethanol in the ME biofuel formulation contributed significant impacts on some impact categories than other Scenario I, III and IV. These impact categories were fresh water aquatic ecotoxicity, terrestrial ecotoxicity and eutrophication.

Based on the life cycle analysis results, appropriate raw material selection could parameter to optimize its emissions. Life cycle analysis revealed significant environmental hotspots of product, process or service to develop the environmental performance in real life by managing the processes carried out in the boundary of assessment.

5.2 Recommendations

Although the use of crude palm oil (RBDPO) in microemulsion (ME) biofuel formulation contributes lower emission than other Scenarios, viscosity of ME biofuel is still higher than neat diesel. More research on formulation of ME biofuel production with RBDPO or other environmental friendly feedstock should be conducted in the future. Moreover, if possible, life cycle inventory data should be directly collected from real plant. So, it might be good enough for real situation. Furthermore, emission factors used in most of the calculations of this study were based on Ecoinvent database. Therefore, it is hardly suitable to apply in Thailand. It might be a next step to do more researches related to Thailand's conditions in order to precisely evaluate the GHG emission and environmental impacts regardless of any processes, services or activities in the future.