

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

- 5.1.1 Biodiesel could be produced by non-catalytic esterification of fatty acid from palm oil supercritical methanol. The reaction product contains only methyl ester and water. Since no soap was produced and no neutralization was needed, the separation process became much simpler compared with the usual alkali or acid catalyzed process.
- 5.1.2 The most suitable condition for transesterification reaction by supercritical methanol was 1:6 at 300 °C and 30 min in which 94 % methyl ester was produced.
- 5.1.3 Water has an effect on the methyl ester yield as it hydrolyzed methyl ester back to fatty acid, and the decrease in the yield increased with water content and reaction time.
- 5.1.4 Esterification in supercritical methanol requires lower operating conditions (molar ratio and reaction time) compared with supercritical methyl transesterification.

5.2 Recommendations

- 5.2.1 In the present work, there was an equipment limit which could achieve the maximum temperature of only 300 °C. Use of a reactor made of inconel alloy rather than stainless steel would allow higher reaction temperature, which allows investigation of the reaction at wider temperature range.
- 5.2.2 Based on the esterification results in this study, care should be given to remove water from the raw material and the final product to prevent hydrolysis. Alternatively, to minimize hydrolysis, the reaction time should be kept to the minimum, which can possibly be achieved by preheating the reactants to the desired temperature *a priori*.

- 5.2.3 Reaction kinetics could be determined for supercritical methyl esterification of fatty acids to methyl ester, which would be useful for the design and cost evaluation of the large scale process.