

## CHAPTER V

### CONCLUSIONS AND RECOMMENDATION

The study showed that the crude palm kernel and crude coconut oil could be used as a material for producing biodiesel. The effect of the parameters for the transesterification of crude PKO and CCO was investigated. The appropriate condition for the reaction is at 6:1 methanol: oil molar ratio and 65°C. It can be inferred that the presence of fatty acid is more crucial in affecting the ester yield than the presence of water. The total amount of NaOH to be added in the transesterification of PKO and CCO is equal 0.5% (based on the weight of oil) plus the amount needed to neutralize the oil.

An initial survey of heterogeneous catalysts used in the transesterification of other ester groups was examined. It showed that high temperature and pressure should be applied when dealing with heterogeneous catalysts. The results confirmed that  $\text{CaCO}_3$ , and  $\text{ZnO}$  are active catalysts for the reaction. There were also other heterogeneous catalysts discovered to catalyze the reaction. The most active of these new catalysts was  $\text{SO}_4 \cdot \text{SnO}_2$ , followed by  $\text{ZrO}_2$ , NaX, Beta Zeolite and NaY.

Since Sulfated Stannous Oxide showed a promising result, it is suggested to try and look for the optimum condition in preparing the catalyst effective for the transesterification of vegetable oil. It is also interesting to develop a good understanding of the systems kinetics by studying a wide range of temperature and pressure to determine the best condition. Finding the efficiency of this catalyst when used in packed bed reactors is also recommended.