CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The investigated catalysts (Na_2CO_3, NaOH, CaO, BaO, and MgO) show different activities for the etherification of glycerol at 240 °C and with 2 wt% loading of each types of catalyst. Conversion of glycerol increases with increasing catalyst basicity. The conversion increases in the order: NaOH>Na_2CO_3>BaO>CaO>MgO. Temperature varied from 220 to 250 °C affects the rate of reaction of glycerol to dliglycerol and to other polyglycerols but has no influence on the diglycerol selectivity. The kinetics of reaction of BaO and CaO were also investigated in order to find the reaction rate. The reaction order was found to be first order. The activation energies for the etherification of glycerol using BaO and CaO were 142.6 and 162.3 kJ/mol, respectively. CaO which has satisfied conversion and has commercial advantages was selected to study in pilot scale. A 20 kilogram pilot scale batch reactor was designed and constructed for testing and optimizing the operating conditions. The pilot scale studies use 2 wt% loading of CaO at 240°C. It was observed that tend of concentration for each component is similar to the previous studies. At 6 h of reaction time, the glycerol conversion is about 39 % and diglycerol concentration is 30 %, the rest is triglycerol.

5.2 Recommendation

For further development of this research, I do recommend that the synthesis of diglycerol can be done by using the shape selectivity catalyst which can select the linear diglycerol from the other isomers. Moreover, this research could analyze the diglycerol oligomers e.g. linear, cyclic and branch diglycerol. The recover and reuse of the catalysts should be further studied.