

CHAPTER VI

CONCLUSION AND RECOMMENDATION

The conclusions of the study of the hydrogenation of rubber seed oil are as follow:

1. The Nysel HK-4 and the G95E catalysts are suitable commercial catalysts for the hydrogenation of rubber seed oil. The Nysel HK-4 catalyst is a better commercial catalyst because it can hydrogenate rubber seed oil in the wider temperature range than the G95E catalyst and suitable for the study of the kinetics.

2. From the economic considerations and the quality of the product, the optimum operating condition for the hydrogenation of rubber seed oil by using commercial catalyst, the Nysel HK-4, is the reaction temperature of 180°C , the hydrogen pressure not less than 120 psig, the agitation speed of 700 rpm, and the catalyst concentration of 0.2% Ni in oil.

3. The catalyst loading of the precipitated in-house catalysts are 56.1%, 41.8%, and 15.2% Ni and of the impregnated in-house catalyst is 9.3% Ni. The products from the in-house catalysts, the precipitated 41.8% nickel catalyst and the impregnated 9.3% Ni nickel catalyst, are similar quality. Their hydrogenation rates are better than those of the precipitated 56.1% and 15.2% nickel catalysts. The hydrogenation by using impregnated 9.3% nickel catalyst has a higher rate than the precipitated 41.8% nickel catalyst at the beginning until 3.40 hours, then becomes slower.

4. The order of the hydrogenation of rubber seed oil is the first-order reaction and the apparent activation energy at 150 psig, 0.2% Ni in oil, and reaction temperature range from 120° to 180°C is 14.5 kcal/mole. The global reaction rate constants are proportional to the reaction temperature, hydrogen pressure, catalyst concentration, and agitation speed. The study of kinetics can not go to the kinetic regime because of the limitation of the apparatus.

5. The hydrogenation of rubber seed oil produces a wax which is composed of 89% stearic acid at the condition of 160°C, 150 psig, 0.2% Ni/oil, and 700 rpm. Stearic acid is a very valuable chemical to manufacture a lot of products. From the analysis by the IR spectrophotometer, the peaks of the cyanide, which is the substance in the oil, do not appear in the rubber seed wax. Thus, it can be said that the rubber seed wax is a non-toxic product.

The recommendations of this thesis for further research are as follow:

1. The chemical structures of the commercial catalysts, Nysel HK-4 and G95E, should be studied in order to find whether they have any promoters or the reason why they are active to the hydrogenation of rubber seed oil. The in-house catalysts should then be prepared for study the hydrogenation of rubber seed oil by incorporating positive features from commercial catalysts.

2. Other methods of the precipitated catalyst preparation and the reasons of their different activities should be further study including the methods of characterization, in particularly, the measurement of catalyst surface area so that catalyst surface activity per surface area can be measured.

3. The impregnated in-house catalyst should be prepared on various supports in order to study the effects of sintering in the hydrogenation.

4. The in-house catalyst which incorporated promoters should be prepared. The activity and the stability of the hydrogenation catalyst which are affected to a certain degree by promoters should be studied.

5. The capability of the hydrogenator in particular the maximum speed of agitator should be improved in order to be able to study the kinetics in the kinetic regime.