

CHAPTER V

CONCLUSION

The used PE could be converted to hydrocarbons in high yield by a one-step hydrocracking reaction over Ni(10%)-Sn(5%)-F(2%) on molecular sieve (4A-DG type) catalyst. The optimum conditions are summarized below.

catalyst type	Ni(10%)-Sn(5%)-F(2%)/MS(4A-DG) catalyst
catalyst concentration	40%wt
reaction time	4 hours
reaction temperature	390 °C
hydrogen pressure	500 psig

The percentage of oil yield was 84.0%wt which consisted of C₈-C₂₀ hydrocarbons. The properties of product are shown below.

API Gravity @ 60 °F	46.2
Specific Gravity @ 60/60 °F	0.7963
Kinetic Viscosity , cSt 40 °C	1.571
Flash Point , °C	room temperature

Pour Point , °C	-8
Distillation , °C	393
Color	6
Sulfur Content , %wt	0

For molecular sieve 3A-EPG and 13xPG types, although they provided less oil yields than 4A-DG type, the molecular weight distribution and their physical properties were the same. In conclusion, the pore sizes of molecular sieve did not influence the molecular weight distribution of hydrocarbons of the oil products.

The used catalyst should not be reused because of the declining of the catalyst 's activity. The oil product from depolymerization of used PE had a wide range of physical properties so they should be distilled before utilization.

This research had more advantages than Leesuksan 's research as shown in table 4.11. It can be seen that hydrocracking process in this research could be operated under milder condition than Leesuksan 's work. Ni catalysis had a lower price and was more available than Pt catalysis. Besides, the oil product from this study had a wide range of utilization. Therefore, this research could be an option for solving the waste plastic problem in the future.

Table 4.11 Comparison of Leesuksan 's research and this research

Items	Leesuksan 's research	this research
plastic	PE	PE
catalyst type	Pt/Sn/F on alumina	Ni/Sn/F on MS
catalyst concentration	40 %wt	40 %wt
reaction time	12 hr.	4 hr.
hydrogen pressure	600 psig	500 psig
reaction temperature	400 °C	390 °C
product	C ₁₀ - C ₁₆	C ₈ - C ₂₀
yield	94 %wt	84 %wt

Suggestion for future work

Spherical catalyst particles should be studied instead of the cylindrical catalyst pellets, because the cylindrical catalyst pellets were easily broken in reaction.

A continuous process should be studied because it can depolymerize high amounts of used PE in a short time and continuously.