

CHAPTER V

CONCLUSION

The used PP from battery cases could be transformed to hydrocarbon oil in high yield by a one-step hydrocracking reaction. Because the oil products from hydrocracking over Ni(5%)-Sn(5%)-F(2%)/MS catalyst had a more specific molecular weight distribution and higher percentage of oil product than using Ni(5%)-Sn(5%)-F(2%)/Al₂O₃ catalyst, the optimum condition was studied using molecular sieve as support. The optimum condition from this study is as summarized below.

catalyst type	Ni(5%)-Sn(5%)-F (2%) on MS catalyst
catalyst concentration	40%wt
reaction time	6 hours
reaction temperature	360°C
hydrogen pressure	500 psig

Under these optimum conditions, the percentage of oil yield was 86.0 %wt. and the products were C₈-C₁₆ hydrocarbons. The properties of the optimum product, shown below, indicate that it is suitable for use as diesel fuel except for the rather low flash point.

API Gravity @ 60°F	43.8
Calculate Cetane Index	57.2
Flash Point, °C	40

Distillation 90% rec., °C	348.1
Color	<0.5
Sulfur Content, %wt	0.01
Lead Content, g/l	0.00
Kinematic Viscosity, cSt	1.8

This one-step hydrocracking process can be operated under mild conditions and give high oil yield, comparing with the previous works [7-10]. The hydrogen sulfide gas was not used and the PP content did not limited, in contrast to the previous works [7]. The used catalyst, composed of Nickel, Tin and Fluoride on Molecular sieve, has a low price and is available. The catalyst could be reused three times without significant loss of activity, comparing with the previous works [12-13]. The oil product from this study had good physical properties (high calculated cetane index) with the absence of sulfur and lead. Therefore, this research is a model for recycling plastic waste to solve the waste plastic problem and reduce the consumption of natural fuel.

Suggestion for future work

Spherical catalyst particles should be studied instead of the cylindrical catalyst pellets that were easily broken. In addition, spherical catalysts have a higher surface area than cylindrical catalyst.

The effect of pore volume of supports and support types on hydrocracking reaction should be studied because they influence the catalyst activity and the product composition.

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