CHAPTER V

CONCLUSION

In this research, used polystyrene was transformed to hydrocarbons in high yield by cracking under hydrogen or nitrogen pressure with various processing conditions, i.e. catalyst type, catalyst concentration, pressure, reaction temperature and reaction time. The optimum conditions are summarized below.

Under hydrogen pressure

Catalyst type	: Fe(5%)-Sn(5%)-F(2%) on molecular sieve
Catalyst concentration	: 15% by weight
Initial hydrogen pressure	: 400 psig
Reaction temperature	: 350 °C
Reaction time	: 90 minutes

Under this optimum condition, the average yield was 76.36%. The product was consisted of C_8 paraffin, C_6-C_{11} aromatics and polynaphthene. The major component in the product was ethylbenzene. Toluene and xylene were the second and the third major components, respectively. The catalyst, Fe(5%)-Sn (5%)-F(2%) on molecular sieve, was reusable. The percentage yields of the fresh, the 1st regenerated and the 2nd regenerated catalysts were 76.36, 70.79 and 68.39 and ethylbenzene was still found to be the major component.

Under nitrogen pressure:

Catalyst type	: Fe(5%)-Sn(5%)-F(2%) on molecular sieve
Catalyst concentration	: 15% by weight
Initial nitrogen pressure	: 300 psig
Reaction temperature	: 350 °C
Reaction time	: 90 minutes

Under this optimum condition, the average yield was 75.48%. The product was consisted of C_7-C_8 paraffins, C_7 naphthene, C_6-C_{11} aromatics and polynaphthene. Ethylbenzene was the main component. Toluene and iso-propylbenzene were the second and the third major components, respectively. When the catalyst, Fe(5%)-Sn(5%)-F(2%) on molecular sieve, was reused, toluene was found to be the main component instead because the catalyst surface was attached by coke. It reduced pore size of molecular sieve and changed the product selectivity of the catalyst.

The products were obtained by one-step cracking process under mild conditions. Due to the similar percentage yield of hydrocracking and cracking under nitrogen pressure, cracking under nitrogen pressure process can depolymerize polystyrene to ethylbenzene in lower cost and more safety than hydrocracking process.