

CHAPTER V

COOCLUSIONS AND RECOMMENDATIONS

Propylene producing from light naphtha (C_4 - C_6 hydrocarbon) cracking over ZSM-5 zeolite strongly depends on reaction temperature, retention time, catalyst acidity and also type of feedstock. Propylene productions prefer to lower temperature (below 600°C) because at higher temperature effect of thermal cracking plays more important role results on higher ethylene producing. The retention time is the one important parameter for cracking process. The longer retention time let the olefin in feeds and/or products can be oligomerized while the shorter retention time let the feed flush out of reactor before cracked. The optimum retention time for light naphtha cracking in this experiment is 0.34 seconds. Acidity of the catalysts directly related with the Si/Al ratio of the zeolite. The ZSM-5 with Si/Al = 20 give the best result in propylene production on all feed which are 36.41, 34.41, 24.42, and 28.09 wt% for mixed C_4 , non-BD C_4 , mixed C_5 and mixed C_6 respectively. However, the ZSM-5 with Si/Al = 398 has less acidity for light naphtha cracking. The temperature programmed desorption (TPD) of isopropylamine is performed to determined the acidity of the ZSM-5. The ZSM-5 with Si/Al = 20 and 40 have the equal acidity in strong acid site while the 40 ZSM-5 has higher acidity in weak acid site.

The stability is performed to test the life of catalyst in operating condition. Normally, the loss in activity of the zeolite in cracking process comes from coke formation. The ZSM-5 with Si/Al = 190 has the longest time on stream which are 76, 68 and 40 hours for non-BD C_4 , mixed C_5 and mixed C_6 stability test. It can be summarized that the more acidity in the catalysts results in easier coke formation. The coking tendencies during cracking of light naphtha over ZSM-5 are found to be in the following descending order: mixed C_4 > mixed C_6 > mixed C_5 > non-BD C_4 . These orders come from the effect of coke precursors that is aromatics generate more coke than do on naphthenes, olefins and paraffins (Brillis and Manos, 2003). The larger portion of coke precursors in feed and/or product results on the faster coke formation.

The regeneration of the catalyst can be examined by the TPO results. Coke formation in ZSM-5 catalysts is hard to regenerated because the coke is burned at

high temperature that are about 710, 640 and 740°C for non-BD C₄, mixed C₅ and mixed C₆ respectively.

The main problems for this works are short catalysts lifetime and high regeneration temperature. These problems may reduce by eliminating coke precursor in feed stock for the future works. Aromatic, naphtene and di-olefin in feed stock are very active for coke forming then the reducing of these coke precursors results on longer lifetime of the catalysts.

The next important study is the life cycle time of the catalyst. The catalyst need to test for number of life cycle time by bringing the after regeneration catalysts to test for activity and stability again.