CHAPTER V

CONCLUSION

A novel method has been developed in this work for the synthesis of microporous nanoparticle zeolite beta via transformation of mesoporous SBA-15 in the presence of tetraehtylammonium hydroxide and aluminum isopropoxide under autogenous pressure at 135°C. The transformation products were characterized using XRD, SEM, ^{27}Al-MAS-NMR, nitrogen adsorption, NH_3-TPD and XRF techniques. The transformation process can be explained that SBA-15 firstly decomposed in an alkaline solution of TEAOH and transformed into a crystalline phase of α-quartz within 6 h and then subsequently to zeolite beta with maximum crystallinity after 24 h but the highest yield of 42.4 % after 48 h. The calcined samples of zeolite beta prepared from SBA-15 has the drastic change in particle size in the range from 116-147 nm upon varying the crystallization period, but the crystallite size and BET specific area are not significantly. Then, the TEAOH/SiO_2 ratios were varied from 0.10 to 0.39. The TEAOH/SiO_2 ratio of 0.26 gives the highest yield of zeolite beta with larger average particle size of 215 nm. The SBA-15/AIP ratios were varied in a range from 10 to 90. It is found that the SBA-15/AIP ratio as low as 10, the failure of formation of zeolite beta is owing to amount of organic template under the synthesis condition, acting as the skeleton for inorganic ions to adhere is not enough for all ions especially aluminum ionic species to form aluminosilicate building blocks. It is obvious that the SBA-15/AIP ratio of 30 provided with the sample with highest external surface area. The SBA-15/AIP ratio of 90 shows the mesoporous behavior along with the microporous character at very low relative pressure. It is concluded by combining XRD, SEM and nitrogen adsorption isotherm that the product obtained from the reactant mixture with the SBA-15/AIP ratio of 90 is not normal zeolite beta but contains the mesopores which does not belong to SBA-15. We believe that it is a hybrid sample of mesoporous zeolite beta. The total acidity of the zeolite samples is inversely proportional to the SBA-15/AIP ratio used in the synthesis course. As usual, the lower the SBA-15/AIP ratio, the higher the acidity is.

The nanoparticle zeolite beta was found vary active in cracking of PP waste to liquid fuel. The cracking of PP takes place more difficultly than that of HDPE. The plastic conversions and the yields of products fractions obviously depend on the reaction temperatures, the SBA-15/AIP ratios and the plastic to catalyst ratios. The product selectivity is affected by those factors. The gas products obtained by PP and HDPE cracking are mainly propene, *i*-butene and C_5^+ while those from catalytic cracking of PP-derived crude oil are propane, *n*-butane, *i*-butene and C_5^+. The liquid products obtained by cracking of both types of plastic are mainly in the boiling point ranging from C_6 to C_9 and for PP-derived crude oil C_9 is mainly obtained. The used catalyst can be regenerated easily by calcination and its activity remains comparable to the fresh catalyst.

The suggestions for future work

1. To prepare hybrid zeolite beta with SBA-15 for using as a catalyst for another reaction (alkylation, isomerization, reforming)
2. To investigate the type of hydrocarbon components in liquid fraction product such as aromatic compound and C_{14}^+ by GC-MS.
3. To investigate the efficiency of zeolite beta for catalytic cracking of mixed plastic containing LDPE, PP, PS.
4. To reduce the reaction temperature less than 300°C for catalytic cracking of PP-derived crude oil.
5. To optimize the continuous pyrolysis process for increasing the gasoline product.