CHAPTER VI
CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

In this work, the influences of pore size of HZSM-5(moderate pore size, 5.3x5.6, and 5.1x5.5 Å), HBeta (large pore size, 7.6x6.4, and 5.5x5.5 Å) and HY(large pore size, 7.4 Å) modified with P-,Sb-, and Bi- oxide promoters, and the effects of channel structures of HZSM-5(zigzag channel structure) and HZSM-11(straight channel structure) modified with P-,Sb-, and Bi- oxides on the catalytic dehydration of bio-ethanol to liquid hydrocarbons were investigated.

The production of petroleum cuts (i.e. gasoline kerosene gas oil) was found governed by the pore size of the zeolite. Large petroleum cuts tend to be produced by a large pore size zeolite, but the contents were also limited by some factors such as channel structure, cage size, and contact time. Moderate pore size zeolite (HZ5) tends to have the highest activity by exhibiting the largest oil yields. Propane, C9 and C10+ aromatics are produced by HZ5 mostly; on the other hand, ethylene, ethane, benzene, and toluene were produced by HBeta and HY. P-oxide modified HZ5,HY, and HBeta participated in the enhancements of ethylene, oxygenates, and C10+ aromatics. P/HZ5 exhibited the significant yield of phenol and its derivatives. Sb- and Bi- oxides seemed to improve the oil yields; moreover, C9 and C10+ aromatics in extracted oil were also improved.

The channel structure of zeolites also influenced to the catalytic activity of the zeolite. HZ11 (75), with a straight channel structure, seemed to have low activity, and produced a low content of oil product. However, propylene and BTEX were produced in significant amounts. On the other hand, HZ5(80) produced the greater oil yields than HZ11(75). C9, and C10+ aromatics were the main components in oils by using HZ5(80). Petroleum fractions were limited for gasoline and kerosene by using HZ11(75) and HZ5(80). P-oxides modified HZ5(80) and HZ11(75) participated in ethylene, oxygenate and C10+ aromatic improvements. BTEX selectivity was improved by using Sb/HZ11(75) and Bi/HZ11(75); however, *p*-xylene selectivity was increased by using Sb/HZ5(80) and Bi/HZ5(80). Bismuth oxide had more pronouncing effects on oil yield improvement than the zeolite with Sb-oxide promoter.

6.2 Recommendations

According to the results, it can be noticed that the differences in pore size, channel structure, and acid properties, influenced to phenol and its derivative production. Moreover, SiO_2/Al_2O_3 ratio was also the parameter that affected to phenol production noticing from the second scope of work that P/HZ(80) showed the absence of phenol. Nearly 100% of ethylene produced in this process is attractive to be applied in a commercial plant. So, one step synthesis of phenol and its derivatives by using P/HZ5 is worth to further investigation.