

## CHAPTER V

### CONCLUSIONS AND RECOMMENDATIONS

#### 5.1 Conclusions

The conversion of biomass-derived alcohols were investigated over HZSM-5 catalysts. The aromatics selectivity decreased in the following order: *n*-butanol > *n*-propanol > ethanol > methanol. These results exhibited to show that longer chain alcohols produce more aromatic hydrocarbons than shorter chain alcohols. Over the properly alkali-treated HZSM-5 zeolites, the reaction activity was enhancing. Both the micropores and mesopores of the catalyst can be improved; the former ensures the shape-selectivity, while the latter maintains the shorter path length thus reducing the channel blockage. The coke produced, soft and hard coke in the reaction procedure tends to deposit in the mesopores of the zeolites. For the aromatization reaction of *n*-butanol at 450 °C, the optimized conditions for alkali treatment of HZSM-5 zeolite (Si/Al (30)) was with NaOH concentration of 0.3 M, at 75 °C and treatment time of 2 h. The silylation process was investigated over HZSM-5 modified via silylation (CLD) with loading TEOS. The *p*-xylene selectivity in xylenes was enhanced with loading TEOS. For the effect of CLD cycle number, the two-cycle of TEOS deposition showed higher *p*-xylene selectivity in xylenes than one cycle of TEOS deposition with the same amount of TEOS. It can be concluded that, multi-cycle deposition not only increased the amount of silica deposited on external surface HZSM-5 zeolite but also improved the uniformity of the silica layer.

## 5.2 Recommendations

Although, the alkali treatment should be studied the effects of different alkali solutions such as  $\text{Na}_2\text{CO}_3$  and  $\text{CaCO}_3$ . The HZSM-5 catalyst performance in the dehydration and aromatization. Silylation can improve the *p*-xylene selectivity but the yield of xylenes and aromatics are decreases. So, the metal should be added to help the support HZSM-5.