



CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Hydrogenolysis of ethylbenzene was used to preliminary study hydrogenolysis reaction before applying the proper condition to the hydrogenolysis of *p*-MEB. The synthesized Ni/Al₂O₃, Mo/Al₂O₃, NiMo/Al₂O₃, and the commercial NiMo/Al₂O₃ catalysts were tested for their catalytic activity and selectivity. It was found that among the four different catalysts, the commercial NiMo/Al₂O₃ catalyst gave the highest toluene selectivity from hydrogenolysis of ethylbenzene while the synthesized Ni/Al₂O₃ gave the highest ethylbenzene conversion under the same conditions. The result evidenced that different catalysts resulted in different reaction pathways. The effect of temperature demonstrated that the higher temperature the lower toluene selectivity due to the sequential hydrogenolysis. At a given temperature, as LHSV was increased, the selectivity of toluene was increased because stepwise hydrogenolysis was inhibited. Regarding the effect of H₂/feed ratio, the higher H₂/EB ratio the higher toluene selectivity since the presence of hydrogen caused the competitive adsorption between ethylbenzene and H₂ on the metallic sites. The optimum conditions obtained from hydrogenolysis of ethylbenzene to toluene over the commercial NiMo/Al₂O₃ was at 400°C, 50 psi, H₂/feed of 8, and LHSV of 2 h⁻¹ while LHSV of 14 h⁻¹ was the optimum for the synthesized Ni/Al₂O₃ catalyst which were selected to apply further for hydrogenolysis of *p*-MEB. The hydrogenolysis *p*-MEB over the commercial NiMo/Al₂O₃ illustrated that *p*-MEB was hydrogenolyzed into *p*-xylene, toluene, and ethylbenzene, with the major product of *p*-xylene. It was observed that a primary hydrogenolysis of *p*-MEB resulted in *p*-xylene as a major product. Toluene was produce via secondary hydrogenolysis and deethylation of *p*-MEB. Ethylbenzene was also observed in small amount, from dealkylation of methyl groups attached to the aromatic rings. However, the significant amount of *p*-xylene indicated that primary hydrogenolysis of *p*-MEB to *p*-xylene was the most favorable reaction over the commercial NiMo/Al₂O₃ catalyst. In contrast to the results obtained from the synthesized

Ni/Al₂O₃ catalyst, toluene was formed as the major product instead of *p*-xylene. Moreover, benzene was also detected as a product. It is indicated that not only primary and secondary hydrogenolysis, but tertiary hydrogenolysis was also observed over the synthesized Ni/Al₂O₃ catalyst.

5.2 Recommendations

For this present work, the conversion of *p*-MEB obtained from the commercial NiMo/Al₂O₃ catalyst is still low, the increase in *p*-MEB conversion without losing *p*-xylene selectivity should be further studied by increasing the content of Ni composition in the catalyst.