

CHAPTER VI

CONCLUSIONS AND RECOMMENDATION

In the present research, the hydroxylation of benzene reaction on periodic operation was used to compare effects of difference Si/Ti ratios and of pretreatment with HNO_3 solution. The conclusions emerged from all the experiments are summarized in section 6.1. In addition, recommendations for further study are given in section 6.2.

6.1 Conclusions

1. Increasing titanium content can increase the hydroxylation activity of the catalyst. However, too much titanium can lead to the formation of some inactive titanium species. The inactive titanium species is not only inactive for the hydroxylation of benzene but also blocks the active titanium species from reacting with the reactants. This results in a decrease in benzene conversion if the catalyst contains too high titanium.

2. The catalyst contains an appropriate amount of titanium (such as the catalysts Si/Ti = 32 and 40 in the present work) can achieve the same steady state conversion as of the pretreat catalyst, but will take a longer time. The pretreatment with HNO_3 solution just only speed up the time need to produce a catalyst with a stable activity.

3. The catalyst contains too high titanium (such as the sample Si/Ti = 22 in the present study) requires the pretreatment with HNO_3 solution since washing with H_2O_2 solution is not effective enough in removing the inactive titanium species.



6.2 Recommendations

From the previous conclusions, the following recommendations for further studies can be proposed.

1. Other choices of method for synthesized TS-1 catalysts including sources of Si, Ti, template and base solution should be further investigated.
2. Other acid solution for the pretreatment of TS-1 catalysts should be tried.
3. The cycle period of periodic operation should be varied by changing the cycle. Other operating parameters such as benzene concentration in the feed gas as well as the feed gas flow rate should also be manipulated to find an optimal operating condition.
4. The pretreatment should be applied to the TS-1 catalyst used in different operation system.
5. A mathematical model for this periodic system should be developed.