

CHAPTER VI

CONCLUSIONS AND RECOMMENDATION

The hydroxylation of benzene reaction was used to compare the periodic operation data with steady co-current operation data on a gas and liquid flow rate basis. The effect of key parameters such as total cycle period, concentration of benzene, and weight of catalyst were investigated experimentally to demonstrate the cause-effect relationships in periodic operation. The conclusions of these investigations are shown in section 6.1. In addition, recommendations for further study are given in section 6.2.

6.1 Conclusions

1. Performance comparison for co-current operation and periodic operation showed that benzene conversions under periodic operation were higher than those under comparable co-current operation at the same basis. It is suggested that at low liquid flows (as in this experiment), the co-current operation shows nonuniform distribution of liquid and thus in liquid-poor regions in bed. Thus, the wetting influences the hydroxylation rate. The importance of periodic addition of liquid reactant is to increase the efficiency of wetting, higher liquid flow pulses during the liquid cycle period, thereby increasing the benzene conversion.
2. The effect of cycle period on periodic operation performance showed that the higher cycle period could enhance benzene conversion because of the longer contact time of the reaction.
3. The effect of concentration of benzene on periodic operation performance showed that the higher concentration of benzene could enhance benzene conversion because of the higher amount of benzene at the same period time. However, at concentration of benzene equal to 2.3 mol/m^3 , the conversion gradually increased and almost become constant. It seems to be the limitation

in increasing the conversion of benzene. Thus, we can conclude that the benzene mass transfer is the important role for this system.

4. The effect of weights of catalyst on periodic operation performance showed that the system with 1 g of catalyst had higher benzene conversion than the system with 2 g of catalyst. The liquid pockets which occurred in the bed, when increasing the catalyst weight, have the role on reactor throughput.

6.2 Recommendations

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

1. Other choice of manipulated variables such as: the flow rate; flow direction; feed composition should be carried out.
2. The other reactions that use TS-1 as the catalyst are also recommended to study in the periodic operation because its properties play roles in this operating type.
3. Comparison results between the experiment and the mathematical models are also recommended to investigate the behavior of the system.

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