

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Etherification of ethyl tertiary butyl ether (ETBE) from ethanol (EtOH) and tertiary butanol (TBA) was studied in this research. The following conclusions can be drawn from the investigation.

1. Kinetic study

1.1 Beta zeolite is an attractive catalyst for the production of ETBE from EtOH and TBA due to high selectivity and equivalent yield.

1.2 The external mass transfer resistance was neglected at the speed level higher than 540 rpm.

1.3 The Arrhenius's equation shows the reaction rate constants, k_{10} and k_{20} , as follows:

$$k_{10} = \exp(27.297 - 11233/T)$$

$$k_{20} = \exp(77.486 - 29421/T)$$

1.4 The Van't Hoff equation shows the water inhibition coefficient, K_w

$$K_w = \exp(-38.756 + 14127/T)$$

2. Reactive distillation study

2.1 The selectivity of the reactive distillation with Beta zeolite catalyst was much higher than that with Amberlyst-15 catalyst.

2.2 For batch operation, increasing heat duty increases the production rate of ETBE at the beginning, however, later it decreases as the amount of reactants in the system was smaller due to the reaction and the loss in the distillate.

2.3 For continuous operation, increasing the heat duty decreased the conversion of EtOH due to the loss of the reactants in the distillate.

2.4 There is an optimum feed flow rate for the reactive distillation operation. In this case it is $2 \text{ cm}^3/\text{min}$.

2.5 Increasing the reflux ratio results in more residence time of the reactants in the reactive distillation column and, as a result, the conversion is improved.

2.6 There is an optimum feed composition for the reactive distillation operation. In this case EtOH:TBA:H₂O is 1:1:20 mol.

Recommendations

This work studies the etherification of ethyl tertiary butyl ether from ethanol and tertiary butanol in reactive distillation catalyzed by Beta zeolite. The experimental result shows the mol fraction of distillate is about 57 mol% ETBE that it do not enough the purity. This is because the azeotropic mixture of ETBE and water thus it should be improve the purity of distillate by withdrawal amount of water with pervaporation technique.

From the experimental result shows that the etherification for synthesis of ETBE occurs in gas phase. Therefore, it will be interesting to investigate gas phase etherification of ETBE in fixed-bed reactor in the future works.