CHAPTER V

CONCLUSION AND SUGGESTION

5.1 Conclusion

The present study on the kinetic of effect of parameters for synthesis the styrenic beads has reached its basic goals in providing fundamental results. The beads in this study can be used to absorb organic solvents at a solubility parameter value of around 18.6 $(MPa)^{1/2}$. The findings can be concluded as follows:

5.1.1 Parameter studies and their signification

ANOVA analysis show the solution that the swelling ratio depends on the amounts of toluene, styrene and divinylbenzene, not that of poly(vinyl alcohol).

5.1.2 Kinetics study of styrene-divinylbenzene copolymer

5.1.2.1 The effect of the initiator concentration, the result shows that conversion increases with the increasing initiator concentration.

5.1.2.2 The effect of the temperature, the result shows that conversion increases with the increasing reaction temperature.

5.1.2.3 The effect of the agitation, the result shows that conversion does not give a difference with the agitation.

5.1.2.4 The effect of the crosslinking, agent concentration, the result shows that conversion does not give a difference with the crosslinking, monomer concentration.

5.1.2.5 The effect of the diluent concentration, the result shows that conversion decreases with the increasing diluent concentration.

5.1.3 Swelling properties

The effect of the diluent concentration, the swelling increased when the diluent concentration was increased.

The overall conversion increased the bead formation; and swelling ratio decreases depending on reaction time.

5.1.4 Morphology of the surface of copolymer

The particles of styrene-divinylbenzene copolymers are agglomerated by microspheres on surface. Each reaction parameter was studied in the following sections:

5.1.4.1 For the effect of the initiator concentration, the increase of the initiator concentration increases the surface of beads due to agglomeration of microspheres.

5.1.4.2 For the effect of the temperature, the increase of the temperature increases the surface of beads due to agglomeration of microspheres. When the reaction times increases, the surface of beads are agglomerated from microspheres to macrospheres

5.1.4.3 For the effect of the agitation, The copolymers prepared with lower agitation rates have the large particle sizes with dimples or circular dents. .

5.1.4.4 For the effect of the crosslinking, agent concentration, the increase of the amount of crosslinking agent concentration produced beads which surfaces showed a tendency to be smooth

5.1.4.5 For the effect of the diluent concentration, the diluent concentration decreases, microspheres on surface are more separated. When the reaction times increase, the surfaces of beads are increased by the agglomeration of microspheres

5.1.5 Coefficients of partial correlation of parameter studies

Overall conversion was related with the concentration of initiator, polymerization temperature and diluent concentration.

5.1.6 Glass transition temperature

The T_g values of styrene-divinylbenzene copolymers are about 106-110°C.

5.1.7 Production of styrene-divinylbenzene copolymers in pilot scale

Styrene-divinylbenzene copolymers can be syntheszed as beads in a pilot scale.

5.1.8 Absorption –desorption and diffusion coefficient

The initial stage of sorption was about 30 min and the swollen bead reached a stationary state in equilibrium with the surrounding solvent within 60 min The diffusion coefficient of copolymer was 1.39×10^{-5} - 1.49×10^{-5} cm^2/sec. When a swollen bead was placed on the filter paper, the solvent diffused in to the filter paper. The initial stage of desorption was about 10 min, and then the swollen bead lost all solvent within 40 min after the start of desorption process.

5.1.9 Rate equation

The complete simple rate equation of reaction was

$$-r \alpha C_{Sty}^{1.9} \; C_{DVB}^{1.8} \; C_{EVB}^{1.8}$$

5.2 Suggestion

To improve kinetics of beads of styrene-divinylbenzene copolymers, future work should be carried out as follows.

5.2.1 Analysis by gel permeation chromatograph (GPC) for evaluation of the branching degree increases with molecular weight, within sample.

5.2.2 Adding diluents such as heptane as poor solvent, into the monomer phase for copolymerization. During the formation of the copolymer beads, which intermediate pore sizes can be obtained using mixtures of good and poor solvents.