CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The adsorption behaviors of *m*- and *p*-CNB were studied on the FAU zeolites with alkaline earth exchanged cations under the static condition at the temperature of 30°C. In the single component adsorption study, the Langmuir's equation could be used for describing the adsorption isotherms of both CNBs. *m*-CNB is selectively adsorbed by the FAU zeolites more than *p*-CNB due to the higher of basicity of *m*-CNB. The adsorption capacities of CNBs increase with the increase in the acid strength of the adsorbent. The Y zeolites have a higher adsorption capacity than the X zeolites, and CaY gives the highest adsorption capacities of both *m*- and *p*-CNB. The results were also compared with the adsorption behavior of CNBs on the FAU zeolite with alkaline exchanged cations. The results of both types of cations substantiate that the adsorption behaviors of *m*- and *p*-CNB on both FAU zeolites partly depend on the acid-base interaction.

For the binary competitive adsorption study, the individual adsorption isotherms of *m*- and *p*-CNB in the binary system are slightly different from those of *m*- and *p*-CNB in the single adsorption. However, the total adsorption isotherms of both CNBs could be described by the Langmuir model. The adsorption capacities of *m*- and *p*-CNB also increase with the acid strength of the zeolites except MgX and MgY because of the effect of the competitive adsorption of *m*- and *p*-CNB. Most of the zeolites preferably adsorb *m*-CNB more than *p*-CNB due to the higher basicity of *m*-CNB except SrX. CaY gives the highest *m*-/ *p*-CNB selectivity, followed by MgY, BaY, and SrY gives the lowest selectivity. However, the acid strength does not affect greatly on the selectivity because the selectivity does not increase much with the increase in the acid strength of both X and Y zeolites with the different exchanged cations. For the CNBs adsorption on the zeolites with the alkaline exchanged ion, the adsorption capacities of CNBs increase consequently with the acid strength of the zeolites. The adsorption selectivity of the zeolite with mono-valence exchanged ion shows a non-ideal behavior. The selectivity depends on the composition in the fluid phase. It decreases with the increase in the *m*-CNB equilibrium concentration. Moreover, the selectivity of the zeolites with the alkaline exchanged cations relies significantly on the acid strength of the adsorbent. NaY is the most appropriate adsorbent among the zeolite with the alkaline exchanged cations.

NaX, NaY, CaX, and CaY were used in the crystallization of CNBs. The zeolites could shift the precipitate composition to be rich in *p*-CNB with the purity as high as 85–94 wt% for the precipitate near the zeolite. The effects of the adsorption and the composition gradient were proved to have no influence during the experiment. The purity of the *p*-CNB in the precipitates partly depends on the position of the precipitate and type of the zeolite. NaY gives the highest purity of *p*-CNB in the precipitates.

5.2 Recommendations

Based on what has been discovered in this study, the following recommendations are suggested:

1) The effect of the position and number of grains of the zeolites on the precipitate composition should be studied.
2) The stability of the zeolites on the crystallization should be noticed.
3) The temperature gradient of the mixture at the position along the radius of the crystallizer should be investigated.