



CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

In this work, C_8 aromatics adsorption on di-valent series cation exchanged zeolites was studied. To study the adsorption mechanism, the effects of acid-base interaction, cation size and zeolite type were considered. Cation size was varied by changing the exchangeable cation. Zeolite type was varied by varying Si/Al₂ ratio. And acidity of zeolites was varied with either changing cation or Si/Al₂ ratio. The zeolite acidity was increased with decreasing the exchanged cation size and/or increasing the Si/Al₂ ratio.

Two techniques were used for studying the adsorption mechanism. First, the Pulse Test technique involved low feed concentration. Second, the Breakthrough technique handled high feed concentration. The results from these two techniques showed the effect of feed concentration on selectivity. Selectivity that calculated from the Pulse Test and Breakthrough techniques showed the same trend but different in the magnitude. Thus, it was concluded that concentration of the feed had the effect on the adsorbate-adsorbent interaction.

For 2.0X and 2.5X zeolites, the acid-base interaction played an important role on the *p*-xylene selectivity with respect to *m*-xylene and *o*-xylene of Ba and Sr exchanged zeolites. *p*-xylene selectivity dramatically decreased as the zeolite acidity increased. However, for Sr and Ca, the effects of acid-base interaction were hardly seen. For Ca with Mg, the effects of cation size started to control the *p*-xylene selectivity with respect to *m*-xylene and *o*-xylene. *p*-xylene selectivity increased as the cation decreased. *p*-xylene selectivity with respect to ethylbenzene were governed only by the effect of acid-base interaction as the selectivity decreased continuously from Ba to Mg.

For Y zeolite, acid-base interaction did not play an important role on the *p*-xylene selectivity with respect to *m*-xylene and *o*-xylene like in the case of 2.0X and 2.5X zeolite. However, the selectivity on Y zeolite showed the same trend as in the X zeolite and can be interpreted in the same way for Sr, Ca and Mg exchanged zeolite. The effect of acid-base interaction did not affect much on *p*-xylene selectivity with respect to ethylbenzene. As the selectivity slightly decreased from BaY to MgY.

Additionally, effect of zeolite framework must be taken into consideration. It was found that with the same exchanged cation, *Y* zeolite provided lower *p*-xylene selectivity than *2.0X* and *2.5X* zeolites. Because acidity of the *Y* zeolite is relatively high, *p*-xylene, which is low basic xylene, does not prefer to adsorb on the *Y* zeolite.

Ba2.5X was the representative for studying the heat of adsorption of the C₈ aromatics on zeolite because of its high *p*-xylene selectivity. The trend of the heat of adsorption was consistent to selectivity. The higher selectivity, the higher heat of adsorption. *p*-xylene, the most adsorbed species, had the highest heat of adsorption followed by ethylbenzene, *m*-xylene and *o*-xylene, respectively.

The study on mono-valence exchanged cation zeolites, previous work, and di-valence exchanged cation zeolites, present work, showed that the adsorption mechanism is very complex. Factors that control the mechanism are acid-base interaction, exchanged cation size and zeolite type. To explain these behaviors, all factors have to be combined and taken into consideration.