CHAPTER I
INTRODUCTION

C_8 aromatics are ones of the most important raw materials in petrochemical industries. Although there are four isomers of C_8 aromatics, *p*-xylene, *m*-xylene, *o*-xylene, and ethylbenzene, *p*-xylene is the most important one as it is the raw material for purified terephthalic acid (PTA) and polyester fiber.

Even though several separation processes exist, physical properties of the C_8 aromatics have ruled out some of the processes. For example, the close boiling point of the aromatics makes distillation and crystallization processes ineffective and uneconomical. Moreover, the crystallization process may suffer from the eutectic problem between *p*-xylene and *m*-xylene. However, the most attractive industrial technique for the separation of *p*-xylene is selective adsorption using a zeolite adsorbent. One of the most successful commercial processes is the Parex process by UOP LLC. The widely used adsorbents are faujasite type zeolite, particularly *X* or *Y* zeolite exchanged with barium or potassium cation with toluene or PDEB (para-diethylbenzene) as a desorbent and operated in the liquid phase.

Many studies have focused on the selectivity of the adsorbent, zeolite, in order to efficiently separate the C_8 aromatics. Attempts have also been made to correlate or predict such the data. But most of the experimental data are for one or two components in the gas phase without the presence of a desorbent as used in the industrial process. Moreover, the process is operated in the liquid phase rather than in the vapor phase. Because the adsorbate and desorbent are present at the same time, it is, therefore, essential to consider adsorptions of both adsorbate and desorbent on the adsorbent. As a result, more understanding of the liquid phase adsorption of the C_8 aromatics and the role of the desorbent are still needed. Particularly, measurements of the

adsorption equilibrium of binary system between one C_8 aromatic and desorbent are of great importance and can provide a database from which a correlation or mathematical model can be obtained.

In this work, liquid phase adsorption of four isomers of C_8 aromatics (*p*-xylene, *m*-xylene, *o*-xylene, and ethylbenzene) with toluene as a desorbent on *KY* and *KBaX* zeolites at constant temperature was studied. Effects of initial concentration, operating temperature, and water content in the zeolites on the adsorption of each C_8 aromatic were investigated. Multi-component pulse tests on *KY* zeolite were also conducted. An adsorption model was applied to fit the single component data. Moreover, comparisons between the single component data and the multi-component pulse test data were made.