CHAPTER I
INTRODUCTION

Chloronitrobenzenes, or CNBs, are isomeric substances that are widely used as intermediate materials in the azo and sulfur dye industries and also used in the synthesis of pesticides, fungicides, pharmaceuticals, and rubber chemicals. CNBs can be produced via two conventional processes. Those are nitration of chlorobenzene and chlorination of nitrobenzene. The obtained products depend on the chosen process. The separation of isomeric mixtures is of considerable importance in most areas of industry because of their similar physical and chemical properties. Most isomeric mixtures are difficult to separate and usually an elaborate and expensive technique is needed. There are many commercial processes that have been developed for CNB separation, *e.g.* distillation, crystallization, and adsorption.

Adsorption and crystallization are considered to be commercially attractive since they offer potentially low-energy separation compared with distillation and latent heats of fusion are generally much lower than latent heats of vaporization (Mullin, 2001). However, its drawback is still available. Crystallization does not provide a possible means for complete separation of components into their pure forms because of the presence of the eutectic point. At this point, the mixed crystal is formed with the fixed composition resulting in the low purity of the product. To avoid reaching to the eutectic point, Dunn (1968) studied the separation of CNB isomers by crystallization combined with fractionation. The mixture was cooled to around 14°C, the eutectic temperature of binary *o*- and *p*-CNB mixture. *p*-CNB was crystallized and filtrated from the mother liquor with 99% purity and 32% yield, while 99% purity and 40% yield of *o*-CNB was obtained after passing the filtrate to the distillation fractionation and crystallization zone. The advantage of this work was recovery *o*- and *p*-CNB in high purity from the mixture by using distillation fractionation instead of eutectic depressants, which is often difficult to remove and results in impure products, to take the mixture to the other side of the normal eutectic point.

In 2007, Lerdsakulthong studied the static adsorption behavior of *m*- and *p*-CNB mixtures on FAU zeolites, X and Y zeolites, with alkaline ion exchanges. The

results revealed that the Y zeolites preferentially adsorb *m*-CNB more than *p*-CNB due to the higher molecular dipole moment of *m*-CNB. The total adsorption capacities and selectivity increased for both X and Y zeolites with the decrease in the size of the cation due to the higher acid strength of the adsorbents.

In this study, the crystallization was combined with the adsorption by using FAU zeolites with alkali earth exchanged cations. Their adsorption with *m*- and *p*-CNB was first studied in the static condition. The result comparison was made for both adsorption capacity and selectivity. Furthermore, selected zeolites were then used in the crystallization to study their effect on the precipitate composition.