CHAPTER I
INTRODUCTION

Separation of isomeric mixtures is of significant importance in most areas of industry because of their similar physical and chemical properties. Most isomeric mixtures are difficult to separate and usually end up requiring an elaborate and expensive technique. Chloronitrobenzenes (CNBs) are one of isomeric substance examples that is industrially important. CNBs consist of *m*-, *o*- and *p*-CNB and are mostly used as basic chemical intermediates in the manufacture of azo and sulphur dyes industries and also used in the synthesis of pesticides, fungicides, pharmaceuticals, and rubber chemicals (Silva *et al.,* 2008). CNBs are produced commercially by chlorination of nitrobenzene and nitration of chlorobenzene. The components of each isomer product depend upon the process that is chosen in the production. There are many commercial processes that have been developed for CNB separation such as fractionation, crystallization, and adsorption. Crystallization is considered to be commercially attractive since it offers potentially low-energy separation compared with distillation because latent heats of fusion are generally much lower than latent heats of vaporization (Mullin, 2001). However, its drawback is that it does not provide a possible means for complete separation because of the presence of the eutectic point.

Funakoshi *et al.* (2001) studied influences of seed crystals on agglomeration phenomena and product purity of *m*-CNB crystals in batch crystallization. It was found that the agglomeration occurred when the number of seed crystals was larger and its size was smaller because of the secondary nucleation. Pattanapaiboonkul (2009) studied the influence of feed compositions on precipitate composition and crystallization temperature. The crystallization of *m*- and *p*-CNB at the eutectic composition provided precipitates with the CNB composition. Above the eutectic composition, the crystals were rich in *m*-CNB. Below the eutectic composition, the crystals were rich in *p*-CNB. Yairit (2010) studied the effects of number of a zeolite and showed that the feed solution with 5 grains of the zeolites had high *p*-CNB compositions than that from 10 grains of the zeolites. Thiensuwan (2012) studied the effects of feed compositions on the *m*- and *p*-CNB crystallization. The phase diagram of *m*- and *p*-CNB with and without the KY zeolite was constructed. The result after adding the zeolite in the feed with the eutectic composition showed the change from the amorphous solid formation to the crystal formation with the crystal composition rich in *p*-CNB. Jukkaew (2013) studied the effect of zeolites and amorphous materials on the phase diagram of chloronitrobenzenes. The effects of the KY zeolite, BaX zeolite, NaX zeolite, activated carbon, and silica gel on the binary phase diagram of *m*-CNB and *p*-CNB were constructed. The presence of the solid material can be summarized that the added material may act as impurity in the form of seeding and change the boundary between the stable zone and metastable zone.

The objective of this work was thus to study the crystallization of CNB to obtain an insight on how the presence of various particle sizes of *m*- and *p*-CNB, and impurities affected the phase diagram of the *m*- and *p*-CNB mixture.