CHAPTER VIII
CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

Catalytic isomerization from 1,5- to 1,6- and 2,6-DMN, adsorptive purification of 2,6-DMN and the combinations of the two techniques were conducted in this study, aiming to demonstrate an alternative to produce high purity 2,6-dimethylnaphthalene (2,6-DMN). Both the isomerization over acidic zeolites and adsorption over ion-exchanged faujasite zeolites have been revealed for their nature. For the catalytic isomerization, it was found that the 1,5- to 1,6-DMN isomerization is more endothermic than that of the subsequent 1,6- to 2,6-DMN; thus, it is the limit for the maximum yield of 2,6-DMN, especially for the isomerization in a solvent free system. Interestingly, such the obstruction can be overcome when performing the isomerization in toluene media. This is believed to be the mass transfer enhancement and the modification of the system thermodynamic by the presence of the solvent. In addition, it was found that the DMNs would be converted to other side products only when the applied thermal energy exceeds that is required for the reaction to reach its equilibrium. For the adsorption study, the results suggest that the adsorption of DMN on the adsorbent would be governed by at least molecular diffusion, acid-base interaction, preferential interaction with cation and molecular displacement. In addition, the success of using ion-exchanged faujasite zeolites to purify 2,6-DMN has also been revealed in a rejective system, particularly when using KX, CaX, LiY, NaY, KY, RbY, SrY and BaY. Finally, the potential to produce high purity 2,6-DMN using the combined system of the isomerization and adsorption have been assessed. The different combination approaches also need the different operating conditions to be accomplished. For instance, performing the isomerization in equilibrium is suitable for the system that connects the adsorption unit right after the isomerization with the selected adsorbent, catalyst and desorbent, while the reactive adsorption should be carried out at the appropriate temperatures below the equilibrium.

8.1 Recommendations

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

1) Other types of solvent should be studied for their effect on both thermodynamics and kinetics of the 1,5- to 2,6-DMN isomerization to substantiate the solvation hypothesis,

2) Effect of other solvents on both the adsorption on ion-exchanged faujasite zeolites and the reactive adsorption over a physically mixed bed of H-beta/NaY should be investigated,

3) Partially H-exchanged NaY zeolite (and other suggested potential adsorbents) with different degrees of exchange should be investigated for their potential to simultaneously isomerize the 2,6-triad DMN isomerization and purify 2,6-DMN at the same time for the reactive adsorption based production,

4) Acidic zeolite catalysts that possess the lower activity than H-beta, e.g. H-mordenite, should be employed to investigate their potential for being used with NaY in the reactive adsorption system,

5) Up scaling the system from the pulse test to be simulated moving bed (SMB) should be conducted to assess the potential of the demonstrated systems in this study under more realistic condition.