CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

In this thesis, we studied the adsorption of three sulfur compounds (3-methylthiophene, benzothiophene, and dibenzothiophene) in simulated transportation fuels on NaX and NaY zeolites. The effects of temperature and fuel to adsorbent weight ratio on the sulfur adsorption were also examined. When comparing between NaX and NaY zeolites, the results indicated that NaX zeolite is more effective in adsorbing both 3-methylthiophene and benzothiophene than is NaY zeolite. For dibenzothiophene, both NaX and NaY zeolites showed nearly the same adsorption potential. Among the three sulfur compounds studied, it was observed that benzothiophene and dibenzothiophene are preferentially adsorbed by NaX and NaY zeolites than 3-methylthiophene, especially at low concentration region. This behavior can be attributed to the relevant properties of the sulfur adsorbate and zeolite adsorbent. For the adsorbent, both number of sorption sites on and acidity of the zeolite surface appeared to play important role in the sulfur adsorption. For the adsorbate, the present of benzene ring in the structure of thiophene derivatives is an important factor on thiophenic compounds adsorption. This could be explained as π electrons in benzene ring trend to form bond with zeolite easily.

For the effect of temperature on the adsorption of sulfur compounds, it was found that for all sulfur compounds on both zeolites the adsorption decreases with increasing temperature in the range of 25-80 °C. This is due to the fundamental of adsorption based on equilibrium constant that decreases with increasing temperature. The study on the effect of fuel to adsorbent weight ratio revealed a general trend that the adsorption of thiophenic compounds used in the studies increases with increasing fuel to adsorbent weight ratio in the range studied.

5.2 Recommendations

Upon the completion of this study, the adsorption of three major thiophenic compounds in transportation fuels using Na-based faujazite zeolite was established. It is interesting to further study towards the modification of faujasite zeolite by loading various metal ions on zeolites. Effect of the amount of exchanged metal in zeolite on sulfur compounds adsorption should be also investigated in details. Heavy metals such as Zn, Ni, and Cu are potential candidates for the modification of the faujasite zeolite. Subsequently, comparison between Na-based faujasite zeolite and zeolite loaded with other metal ions for their surface adsorption capability can be done.