CHAPTER I
INTRODUCTION

There is increasing concern about the amount of sulphur compounds in gasoline and diesel as they are converted to sulfur oxide during combustion of these fuels in automotive engine. Sulfur oxide can potentially poison the catalyst in catalytic converter and reduce its efficiency to remove carbon monoxide, unburned hydrocarbons and nitrogen oxide from automotive exhaust. More importantly, these gases are poison to human. In recent years, law and regulations concerning the sulfur content in transportation fuels have become more stringent. For example, U.S. Environmental Protection Agency (EPA) has recently issued new regulations that will require all refineries in the United States to reduce the sulfur content in gasoline from the current 300 ppmw to 30 ppmw and in diesel from 500 ppmw to 15 ppmw by 2006 (Ma *et al.*, 2003).

The conventional process which has been widely used for the removal of sulfur compounds in the refinery is hydrodesulfurization (HDS). This process can reduce the concentration of sulfur compounds to a few ppmw but it requires severe conditions such as high temperature and high pressure. Under these conditions, thiophenic compounds such as thiophene, benzothiophene, alkyl thiophenes, alkyl benzothiophenes and alkyl dibenzothiophenes which are refractory sulfur compounds can also be removed. However, aromatic and olefin in gasoline are saturated and consequently the octane number is reduced. In removing sulfur from diesel fuel by HDS, the cetane is improved but there is a high cost in hydrogen consumption. This hydrogen is consumed by both hydrodesulfurization and aromatic hydrogenation reactions. Therefore, there is still a need of a better process for the desulfurization of gasolines and diesel fuels which has minimal effect on octane number while achieving high level of sulfur removal without hydrogen consumption (Khare, 2001).

In this aspect, increasing attention has been paid to a new promising process, adsorptive desulfurization, which can remove sulfur compounds at ambient temperature and pressure without using hydrogen gas. However, the effectiveness of the process relies on the availability of adsorbents which have high adsorption capacity and selectivity for refractory sulfur compounds. Thus, the objective of this research was set to study the adsorptive desulfurization to remove sulfur compounds from transportation fuels by using X and Y zeolite adsorbents. Batch liquid experiments were carried out in 20-mL crimp-cap glass vial. Effects of several factors such as type and concentration of sulfur compounds, aromatic content, temperature and water content in the zeolite on the adsorption and desorption of sulfur compounds were examined.