CHAPTER I
INTRODUCTION

n-Paraffin and n-olefin are ones of the most important raw materials in petrochemical processes. Lower molecular weight n-paraffin can be used as fuel while higher ones can be converted to cyclic or aromatic compounds by catalytic reforming processes. In addition, many chemicals like iso-paraffin are derivatives of n-paraffin. n-Olefin is important in the production of polymer in petrochemical industry. Separation processes are needed to fully utilize both classes of chemical. Although many separation techniques are available, most of them are not practical in both energy and economical points of view. Adsorption has emerged as an alternative for the separation of such the compounds. Nowadays, selective adsorption with the use of solid adsorbents such as zeolites is generally considered to be the most economical among the industrial processes.

Adsorption mechanisms of n-paraffin and n-olefin by an adsorbent like silicalite are highly complex. To achieve efficient performance for the separation, adsorption mechanisms have to be understood. Attempts have been made to understand the mechanisms of n-paraffin and n-olefin on silicalite. It was found that the equilibrium adsorption capacity of n-paraffin on silicalite and intracrystalline diffusion of n-paraffin in silicalite crystal are directly affected by molecular chain length of the adsorbate species (Richards and Rees, 1986; Zhu *et al.*, 1998; Sun *et al.*, 1996; De Meyer *et al.*, 2003; Hufton and Danner, 1993; Talu *et al.*, 1998). An increase in the molecular chain length of n-paraffin results in a decrease in both saturation capacity of n-paraffin on silicalite and diffusivity of n-paraffin in silicalite pores. However, saturation capacity of n-paraffin in silicalite decreases rapidly from n-heptane to n-octane instead of decreasing steadily (Sun *et al.*, 1996; De Meyer *et al.*, 2003), and the diffusivity increases from n-hexane to n-octane instead of decreasing as the molecular weight increases (Talu *et al.*, 1998). This phenomenon was attributed to the packing forms of the adsorbate on difference pore systems of silicalite.

Despite the fact that most of the studies in adsorption on silicalite have been conducted intensively for n-paraffin in vapor phase, less are studies on n-paraffin, n-olefin and mixtures between n-paraffin and n-olefin in liquid phase. Hence, a thorough study on the n-paraffin, n-olefin and multi-component of n-paraffin/ n-olefin adsorption on silicalite in liquid phase is needed.

In this work, a range of n-paraffin and n-olefin with carbon numbers from 6 to 20 was used. Adsorption isotherms were investigated in both single component adsorption of n-paraffin and n-olefin and binary competitive adsorption between n-paraffin and n-olefin at the same carbon number. Selectivity was determined for binary adsorption. Pulse test experiments were also performed to study the selectivity in the multi-component system.