CHAPTER I
INTRODUCTION

Separation of olefin and paraffin gases is one of the most important processes in petrochemical industries. Of special importance worldwide are ethylene and propylene as raw materials in the synthesis of several important chen (Sridhar and Khan, 1999). Currently, the separation of olefins and paraffins is carried out by a low temperature distillation process with substantial energy consumption. Membrane-based separation processes are alternative energy-saving separation technologies because of low energy consumption, compact unit, and simple operation. However no commercial membrane process has been developed for olefin/paraffin separation. This is mainly due to low olefin/paraffin selectivity and low olefin permeability.

Facilitated-transport membranes have been widely adopted where the membrane are loaded with selective carriers such as silver or copper to form molecular complexes with olefins in order to achieve a better separation. Although these membranes were reported to display high olefin flux and olefin/paraffin selectivity, the major problem of instability precludes the use of facilitated-transport membranes (Ho and Dalrymple, 1994).

To enhance selectivity and permeability, mixed matrix membranes (MMM) have been proposed as an alternative approach by adding specific dispersed materials ; solid or/and liquid into a processable polymer matrix. The heterogeneous or hybrid membrane concept combines the advantages of each medium: high separation capabilities of the dispersed materials and the desirable mechanical properties and economical processing capabilities of polymer.

There are many types of mixed matrix membranes (MMM) such as dispersed solid-polymer mixed matrix membrane which has dispersed solid in polymer phase like silicalite-cellulose acetate MMM and dispersed liquid-polymer mixed matrix membrane which has dispersed liquid in polymer phase like polyethylene glycol (PEG)-silicone rubber MMM. However, the liquid PEG was not stable and leak out at relatively high pressures (Charoenphol *et al.*, 2002).

From previous study (Rattanawong *et al.*, 2001) dispersed NaX , AgX and silicalite into cellulose acetate (CA) membrane. It was reported that all adsorbent materials were selective to olefin over paraffin by testing equilibrium adsorption of hexane and hexane. However, only silicalite-CA MMM enhanced propylene/propane separation. Currently, polyimide, glassy polymer, was found to be one of the especially attractive classes of polymer showing high selectivity combined with high performance. However, attempts at fabricating MMM using glassy polymers and zeolites resulted in presence of voids at the polymer-zeolite interface, thus reducing the separation performance of MMM relative to the pure polymer. The way to solve this problem is to modify zeolite surface properties to make it more compatible with polymer chains by means of silane coupling agents.

The present study, mixed matrix membranes for olefin and paraffin separation were developed by incorporating three types of zeolite: NaX , AgX and silicalite into one type of the polyimides ; Ultem polymer. In addition, modification of zeolite surfaces by utilizing silane agent was studied to promote greater adhesion between zeolite surfaces and polymer chains.