CHAPTER I
INTRODUCTION

Olefin/Paraffin separations represent a class of the most important and also most costly separations in the chemical and petrochemical industry. Of special importance worldwide are ethylene and propylene as raw materials in the synthesis of several important chemicals (Sridhar and Khan; 1999). The olefin/paraffin mixture obtained is difficult to separate because of the similar physical properties of the saturated/unsaturated hydrocarbons (Bickel and Koros, 2000). Membranes for olefin/paraffin separation have long been considered as an alternative to adsorptive or distillated separation due to their lower capital cost and high-energy efficiency (Huges *et al.*, 1986). 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.

To enhance olefin/paraffin selectivity and increase the permeability of olefin, two types of mixed matrix membranes, liquid-polymer and solid-polymer mixed matrix membranes, have been developed earlier at UOP (Kulprathipanja *et al.*, 1996, 1988a, 1988b, 1988c and 1992). The liquid-polymer mixed matrix membrane (PEG/silicone rubber coated on porous polysulfone support) has been developed for ethylene/ethane separation (Sukapintha, 2000). The result showed that the membrane was selective for ethylene over ethane and the selectivity of ethylene to ethane was about 2.38. Similar polymer membranes containing zeolite showed no increasing in selectivity due to large differences in pure material permeability.

Thus, in this work, solid-polymer membranes composed of NaX-zeolite/cellulose acetate, AgX-zeolite/cellulose acetate and silicalite/cellulose acetate were studied for ethylene/ethane and propylene/propane separation. NaX was selected because it was selective for olefins over paraffins (Rosback

and Neuzil, 1977). AgX was selected because it was expected that silver ion (Ag^+) can reversibly form a complex with olefin, and the ion can selectively carry the olefin across the membrane in the facilitated transport mechanism, while paraffin can be transferred across the membrane only by a simple physical dissolution-diffusion phenomenon. Silicalite was selected because the previous study by Kulprathipanja *et al.* (1988b and 1992) showed that silicalite/cellulose acetate mixed matrix membrane could enhance the selectivity of oxygen to nitrogen between 3 and 4 in comparison to the selectivity of pure cellulose acetate membrane about 2.99. Furthermore, cellulose acetate was used as the polymer since it is also selective for olefins (Ito and Hwang, 1989).