CHAPTER I
INTRODUCTION

In petroleum and petrochemical industries, separation of the olefin and paraffin mixture can be achieved by cryogenic distillation which is highly energy intensive. Consequently, there is an enormous economic incentive to develop alternative separation processes with lower energy consumption. Facilitated transport or reactive membranes have long been investigated as an alternative separation technology to a conventional distillation. This offers benefit from the lower capital cost and energy consumption making them attractive for the separation process.

Membrane separations are generally based on size difference and charge difference or solubility difference. However, the difference between olefin and paraffin with the same carbon number is small with respect to their physical properties. Increasing the olefin solubility in membrane via chemical complexation i.e., carrier material or facilitated method is possible for olefin and paraffin separation.

The use of metal based facilitated transport membrane has been studied for a wide variety of olefin/paraffin separations. Facilitated transport membranes containing silver ions (Ag^+) can offer high selectivity for olefin/paraffin separations. Ag^+ can reversibly form a complex with olefin, and the ion can selectively carry the olefin across the membrane. While paraffin can be transferred across the membrane only by a simple physical dissolution-diffusion phenomenon.

For olefin/paraffin separation, the facilitated transport membranes can mainly be separated into two types, namely a support liquid membrane of $AgNO_3$ solution and a dry complex membrane of sulfonated silver membranes. However, the primary problem of liquid membrane is a lack of

both the membrane and carrier stabilities. The membrane requires the feed gas be saturated with solvent to prevent the membrane from drying out. If the membrane dries out during the operation, it causes irreproducible olefin/paraffin separation performance and early membrane failure. In addition, the ionic bond dry complex membrane could perform effectively for olefin/paraffin separation only if the inlet gas is saturated with steam. Therefore, the development of mixed matrix membranes for olefin and paraffin separation has been investigated.

In the present work, two types of mixed matrix membranes for olefin and paraffin separation were developed. The first one was silicone rubber (SR) mixed with Ag-zeolite on porous polysulfone (PS) and the second one was SR mixed with poly(ethylene glycol)(PEG) on PS. The effects of Ag-zeolite and PEG on porous polysulfone membrane were discussed on the basis of the theory of facilitated transport.