CHAPTER I
INTRODUCTION

Membrane-based separation processes are finding today wide and ever increasing use in petrochemical, food, and pharmaceutical industries, biotechnology, and a variety of environmental applications, including the treatment of contaminated air and water streams. The most direct advantages of membrane separation processes, when compared to their more conventional counterparts (adsorption, absorption, distillation, etc.), are energy savings and reduction in the initial capital investment requirements (Kulprathipanja, 2002).

Although membranes have many advantages, they have problems with stability such as plasticization problem. Plasticization of polymeric membrane is defined as the increase in permeability as a function of feed pressure. When permeation is accelerated, membrane looses its selectivity.

In polymeric membrane-based gas separation thin nonporous polymeric membrane performance tasted by permeation rate through membrane material gave low selectivity. However, the permeability and selectivity values of membranes should be as high as possible by addition of some materials such as molecular sieve in thin polymer film on porous support to improve property of membrane. Therefore mixed matrix membrane will be created (Zimmerman et al., 1997).

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.

Membrane separations are used in many applications such as to remove CO_2 from gas stream in many industrial applications among which natural gas processing. Natural gas often contains varying amounts of CO_2. If present in high enough quantities, CO_2 content needs to be reduced to minimize corrosion potential of pipelines and downstream processing unit as well as to maintain a higher heating value of the gas stream.

In petroleum refining and petrochemical industries one of the important tasks is the separation of paraffinic and olefinic gases such as propane/propylene. Unsaturated hydrocarbons specifically propylene are highly demanded in the mass production of polypropylene. In most practical applications, the separation of olefin and paraffin is carried out by low temperature distillation that consumes intensive energy in the phase transformation steps. In contrast, membrane technology offers an attractive alternative that may minimize the operating cost.

From a previous study (Charoenphol, 2002) dispersed activated carbon (Act.C.) in silicone rubber mixed matrix membrane (MMM) for CO_2/N_2 separation was firstly investigated. It has been reported that CO_2/N_2 selectivity was improved when compared with pure silicone rubber membrane. Moreover, it was found that dispersed liquid polyethylene glycol (PEG) in silicone rubber MMM could enhance CO_2/N_2 selectivity significantly by increasing solubility coefficient of CO_2 through PEG molecules. The CO_2/N_2 selectivity was observed to increase as the concentration of PEG in the membrane increases.

Therefore to enhance performance of membrane Act.C. and PEG will combined together in silicone rubber. This work studied effect of amounts of activated carbon incorporated in the MMM and effect of amount of PEG in PEG/Act.C./silicone rubber/polysulfone MMM on CO_2/N_2, CO_2/H_2, C_3H_6/C_3H_8 separations. In addition, a plasticization phenomenon has been intensively taken into consideration.