CHAPTER I
INTRODUCTION

Gas separation is one of the most important chemical processes in petroleum and petrochemical industries. In the past two decades, membrane separation technology for gases has received much attention and been developed continuously to a competitive level with the conventional separation methods of cryogenic distillation, absorption and pressure-swing adsorption. Polymeric membrane based separation technologies can be expected to overcome not only the energy problem of distillation based separation, but also have low capital investment, ease of operation and space efficiency. Separation by polymeric membrane is based on the principle of molecular size dependent permeability. Glassy polymeric materials such as polysulfone, poly(vinyl chloride) and cellulose acetate are known to have good size-sieving mechanism properties and are commercially available. At the present, the practical separations using membranes include: air separation; recovery of hydrogen from mixtures with large components such as nitrogen, methane and carbon monoxide; and removal of carbon dioxide from natural-gas mixtures.

On the other hand, in the petrochemical industries, separation of minor components or volatile organic compounds (VOCs) from gas mixtures is also a very important process owing to the value of hydrocarbon gases as well as the elimination of VOC emissions for pollution prevention. VOCs separation by using conventional glassy polymer membranes requires membranes with high organic-vapor-supercritical gas selectivity and resistance to high organic-vapor flux. However, an alternative approach for VOCs separation can be based on utilizing the differences in solubility of organic vapor in the membrane rather than sieving during diffusion which can be defined as

solubility selectivity. The main factor for determining the permeation of organic vapor through membrane will be their solubility parameters, controlled by changing the chemical structure of the polymeric membrane.

It has been known that rubbery polymers such as polydimethyl siloxane (PDMS) with flexible backbone and long segmental motion separate gases on the basis of solubility in the membrane. Recently, Pinnau (Pinnau *et al.*, 1996) proposed that a glassy polymer with high free volume such as poly(1-trimethylsilyl-1-propyne)(PTMSP) can exhibit solubility selectivity for gas separation and can be used for VOCs separation. One of the interesting polymeric membrane materials is poly(vinyl alcohol) which has a hydroxyl group at each repeating unit for the chemical modification to adjust hydrophilic/phobicity and improve the solubility characteristic between organic vapor molecules to obtain a novel type of organic vapors separation membrane.

Based in theses ideas, the present work is concentrated on a functional polymer by using glassy polymer with a high free volume in the matrix.