CHAPTER 1 INTRODUCTION

1.1 Background

Inorganic membranes made from silica, alumina or zeolite has good solvent-resistant properties. The membranes are also chemically and thermally stable and free of swelling. They can be alternatives to polymeric membranes for some applications [1, 2]. Microporous carbonized polymer is another promising inorganic membrane. The carbon membrane can be synthesized from many polymeric precursors including polyimide. Jones and Koros [3] reported that carbon membranes prepared from polyimide provided good separation and mechanical properties. Pore size of carbon membranes synthesized from commercially available Kapton® polyimide was found to be smaller than 1 nm [4, 5, 6 and 7].

Permeation through inorganic membranes such as ceramic, zeolite and carbon membranes involves the adsorption of a molecule on the membrane surface and the diffusion of the molecule through pores of membrane [8 and 9]. Chana [10] and Varaporn [11] studied the preoperative dehydration of alcohols by carbonized Kapton® polyimide. Experiments with single-component feed demonstrated that molecular diameter was an important factor in the permeation through the membrane. Nonetheless, the presence of water in the feeds resulted in the selectivity higher than the ideal selectivity. This was because permeability of alcohols was much lower than that of the single-component feed experiments. It was likely that the preferential adsorption of water on the membrane suppressed the adsorption of alcohol and block alcohol from entering the membrane pores.

In this research, the influence of dipole moment and molecular size on the permeability of organic compounds through carbonized Kapton® polyimide was investigated. The experiments were carried out in pervaporation and vapor permeation mode of operations.

1.2 Objectives

To study the dependence of organic permeation through carbon membrane on dipole moment and molecular diameter.

1.3 Scope of Work

1. Polyimide used as a precursor in this study is commercially available Kapton®. To prepare the carbon membrane, Kapton® was carbonized at 600 ^{o}C.
2. The single-component permeation tests were done with methanol, ethanol, isopropanol and acetone as feeds, whereas bi-component experiments were performed with acetone/isopropanol (20/80 wt %), methanol/acetone (20/80 wt %), methanol/ethanol (20/80 wt %) and acetone/ethanol (50/50 wt %) mixtures.
3. Feed temperature for pervaporation and vapor permeation experiments was 55 ^{o}C.

1.4 Expected Benefits

Results from this study lead to a better understanding of how organic compounds permeate through a carbon membrane. Such comprehension could provide a guideline of membrane properties required to separate a mixture of organic compounds.