CHAPTER I
INTRODUCTION

Currently, membrane-based separation processes have been widely used by many industries such as petrochemical, food, and pharmaceutical industries not to mention their uses in a variety of environmental applications (Anderson *et al.*, 2002). The membrane technique offers an attractive alternative due to its lower capital cost and greatly reduced energy consumption. Furthermore, the elimination of heat requirements and cleaner-safer mode of operation are other advantages of this technique compared to conventional processes like distillation, adsorption, and absorption (Sridhar and Khan, 1999).

Many solid polymeric membranes such as cellulosic polymers, polysulfone, polydimethylsiloxane and polyphenyleneoxides have been investigated for gas separation (Krol *et al.*, 2001). However, polyimide was found to be an especially attractive class of polymers showing high selectivities combined with high performance (Krol *et al.*, 2001). For example, copolyimide membrane has been used for p-/o-xylene separation and the separation factors of p-xylene to o-xylene are between 1.15 and 1.47 (Schleiffelder and Staudt-Bickel, 2001). Moreover, 6FDA/BPDA-DDBT copolyimide were tested for olefin/paraffm separation. The separation factors of C_3H_6/C_3H_8 and C_4H_6/C_4H_{10} are 15 and 69, respectively (Staudt-Bickel and Koros, 2000).

To further enhance the commercial applicability of the membrane technology, Mixed Matrix Membranes (MMMs) have been developed. These solid/polymer MMMs have been studied for gas separation and shown that the incorporation of molecular sieves increases the selectivity of pure polymer membranes. For instance, the addition of silicalite into silicone rubber can improve the selectivity of O_2/N_2 from 2.1 to 2.5, 2.7, and 2.9 for 50, 64 and 70 wt% silicalite, respectively (Jia *et al.*, 1973).

Besides the previously mentioned separation processes, other important separation processes include the separation of paraffins, olefins and aromatics, which are starting materials for many petrochemical processes. Practically, the separation of olefins and paraffins is carried out by low-temperature distillation, which is highly energy intensive and potentially hazardous (Chan *et al.*, 2002). A large capital investment and operating cost is also required. For the separation of C_8-aromatics containing ethylbenzene as well as o-, m-, and p-xylene is currently achieved either by low-temperature fractional crystallization or by an adsorption process using special zeolite based molecular sieve (Schleiffelder and Staudt-Bickel, 2001). However, these processes are very complex and in general, energy intensive.

There are many researches involved the gas separation of low molecular weight paraffin and olefin such as propane/propylene, but in a lesser extent for high molecular weight hydrocarbons such as n-octane, n-octene and C_8-aromatics, which are the liquid phases at room temperature. So, it is of interest to find alternatives for the separation of these hydrocarbons in the liquid phase.

As mentioned above, polyimide is the one of the most attractive polymeric membranes, and the concept of MMM's has proven to increase the separation efficiency of polymer membranes. In this work, polyimide-based membranes were tested for their applicability for the separation of high molecular weight n-olefins, n-paraffins, and C_8-aromatics. MMM's of the polymer were also obtained through the incorporation of silicalite, NaY, and activated carbon, tested and compared their performances to the pure polyimide membrane.