CHAPTER III
EXPERIMENTAL

สำนักงานวิทยทรัพยากร
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3.1 Materials

The following materials were kindly donated by UOP LLC; the silicone rubber used in this work was RTV615A and a curing agent RTV615B was purchased from General Electric Co., Ltd.; activated carbon (Calgon); polysulfone support membrane coated on non-woven cloth. The solvent used was cyclohexane from Lab-Scan Co., Ltd. Polyethylene glycol (PEG) MW400 was used as a plasticizer. Potassium carbonate (K_2CO_3) was used as a carrier agent. Gases used in this study were carbon dioxide (CO_2) and nitrogen (N_2) from Prax Air Co., Ltd.

3.2 Membrane Preparation

3.2.1 Preparation of K_2CO_3 Impregnated Activated Carbon

The impregnated activated carbon was prepared by adding an appropriate amount of K_2CO_3 solution into a known amount of activated carbon. The activated carbon was dried at 110°C for overnight.

3.2.2 Mixed Matrix Membrane Preparation

3.2.2.1 Solid-polymer MMM and liquid-polymer MMM

Mixed matrix membranes were prepared by solution-casting and solvent evaporation methods as schematically shown in Figure 3.1. The solution was formed by mixing 1.08 grams of silicone rubber RTV615A with 0.12 grams of curing agent RTV615B in 10 ml of cyclohexane. After mixing together liquid or solids were admixed into the solution. The liquid was PEG having molecular weight of 400. And the solids were activated carbon and K_2CO_3 impregnated activated carbon. The casting solution was then degassed by using a vacuum pump. The bubble free solution was casted on a polysulfone sheet. The thickness of coating layer was adjusted by a caster knife to a 30-mil thick film. The cast film was

allowed to cure at a temperature of 85°C for 1 hr in order to initiate the crosslinking reaction and to remove the residue solvent.

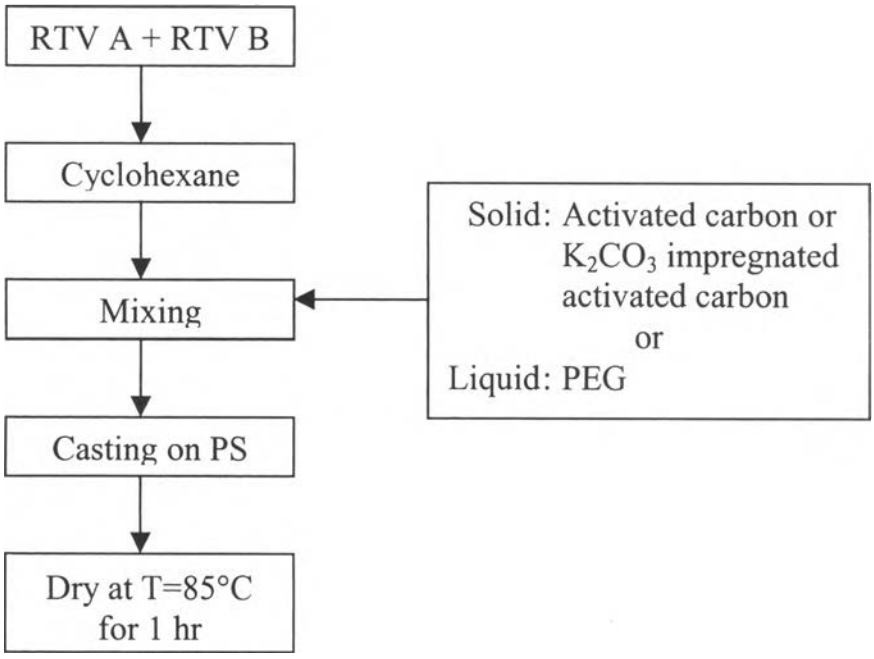

Figure 3.1 Solid-polymer or liquid-polymer MMM preparation procedure

3.2.2.2 Liquid-solid-polymer MMM

PEG-activated carbon-silicone rubber and PEG-K_2CO_3 impregnated activated carbon-silicone rubber MMM were prepared in a similar manner to the solid-polymer and liquid-polymer MMM, except that after mixing silicone rubber with cyclohexane, PEG followed by activated carbon or K_2CO_3 impregnated activated carbon were added into the solution.

3.3 Gas Permeability Measurements

The experimental setup used for the determination of gas permeability is schematically shown in Figure 3.2. The membrane was tested by placing a 7.5 centimeters in diameter membrane sample inside the membrane-testing unit with an O-ring sealing around the edge as shown in Figure 3.3. The membrane was supported by a metal plate. The tested gas was humidified with water before passing through the membrane-testing unit. The testing unit was pressurized at 40 psig on

the membrane feed side while the permeate side was at atmospheric pressure. After the system attaining steady state, the gas flux was measured by using a bubble flow meter.

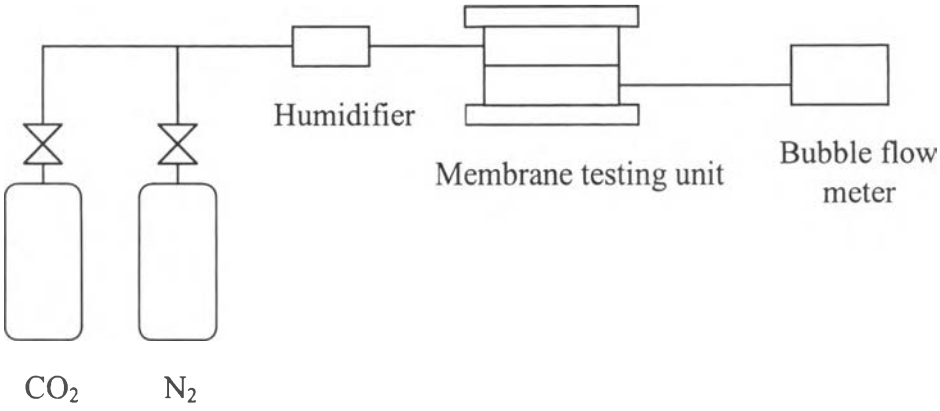

Figure 3.2 Experimental setup for measuring gas permeability

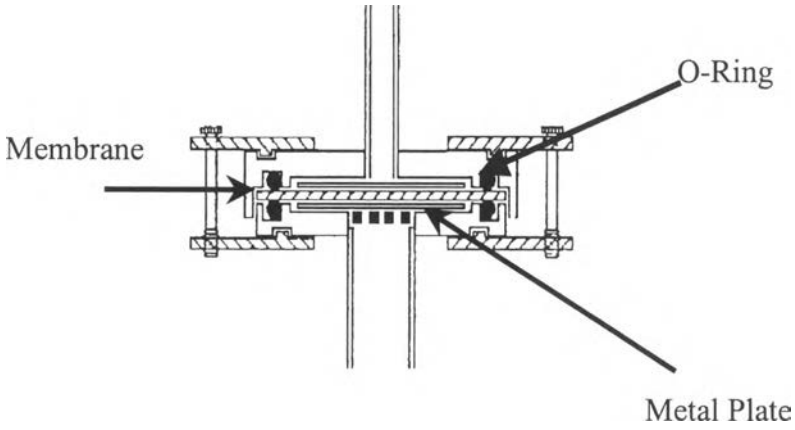

Figure 3.3 Membrane testing unit