CHAPTER 1

INTRODUCTION

1.1 Background of Study

The application of membranes in gas separation problems has grown rapidly since the installation of the first industrial plants in the early 1980’s. It has been used on a large commercial scale for years, and dramatic improvements in membrane permeability and process designs have been made during that time.

The main purposes on improving the membranes’ permeability are to get constant quality upgrades to optimize membrane performance and systems for specific applications besides than to enhance troubleshooting. It is because hydrogen sulfide (H$_2$S), carbon dioxide (CO$_2$), mercaptans and other contaminants are often found in natural gas streams. H$_2$S is a highly toxic gas that is corrosive to carbon steels. CO$_2$ is also corrosive to equipment and reduces the heating value of gas.

Membranes are reliable and cost effective process solution for CO$_2$ removal across a wide range of operating conditions. The technologies are reviewed and process parameters have been identified. This efficient and effective process could remove contaminants such as carbon dioxide and hydrogen sulfide by chemical reaction so the gas is suitable for transportation and use.
Carbon dioxide removal natural gas has been practiced using polysulfone membranes. Introduction of more selective and higher flux membranes has begun and, in time, is likely to make membrane processes more competitive with amine absorption which is applied widely in petrochemical and refinery growing applications.

Research on gas processing plants and membrane companies, the CO₂ gas was also being removed by a Benfield (hot potassium carbonate) process and remaining hydrocarbons where processed into sales gas. As production grew, the increase in CO₂ in the return gas was outpacing the Benfield plant’s capabilities. To avoid a major capital expansion to the Benfield plant, emerging technologies such as CO₂ membrane separation of the produced gas have to be improved.

The new technology carried some risk initially. To keep cost and technology risks under control, the membrane for CO₂ removal have to be designed, built, own and operated. A major concern at the time was the economics associated with how long each membrane element would last.

This study summarizes the development of flat sheet polysulfone membrane for carbon dioxide separation and studies of CO₂ permeability of polysulfone membrane.

1.2 Problem Statement

CO₂ is corrosive to equipment. In petrochemical plants, CO₂ must be removed to prevent freezing in the low-temperature chillers. It also reduces the energy value of gas and need to be separated from the products. Besides, not many researches on differentiations of permeability value of polysulfone membrane at different immersion times have been done. Other than that, the study on the right preparation method of forming polysulfone membrane is very lack.
As production grew, the increase in CO₂ in natural gas production was outpacing the gas processing plants and membrane companies’ capabilities. To avoid a major capital expansion to the plant, emerging technologies such as CO₂ membrane separation of the produced gas have to be improved. Therefore, in order to obtain a cost effective system, membrane with high retention of CO₂ has to be developed.

1.3 Objective of Study

The aims of this study are:-

- To prepare and produce flat sheet polysulfone membrane for CO₂ separation.

1.4 Scope of Study

Several scopes that have been outlined in order to achieve the objectives of this study are as follows:-

- Preparation and development of flat sheet polysulfone membrane for CO₂ separation.

- Permeability test on the produced polysulfone membrane at different immersion time.