CHAPTER 1
GENERAL INTRODUCTION

1.1. Background

1.1.1. Overview of Membrane Technology

Membrane technology has become a dignified separation technology over the last decennial. The main force of membrane technology is the fact that it works without the addition of chemicals, with a relatively low energy use, easy and well-arranged process conductions. Membrane technology is a generic term for a number of different, very characteristic separation processes.

The membrane separation process is based on the presence of semi permeable membrane. The principle is quite simple. The membrane acts as a very specific filter that will let the water flow through, while it catches suspended solid and other substances. Two factors that determine the affectivity of a membrane filtration process are selectivity and productivity. Selectivity is expressed as a parameter called retention or separation factor (expressed by the unit l/m2.h). Productivity is expressed as a parameter called flux (expressed by the unit l/m2h). Selectivity and productivity are membrane dependent. The diagram is shown in **figure 1-1**.

Membrane filtration can be divided up between the Micro Filtration (MF) and Ultra Filtration (UF) and also Nano Filtration (NF) and Reverse Osmosis (RO).

1.1.2. Reverse Osmosis (RO) Polymeric Membrane

Separation and removal of dissolved solids, organics, viruses, submicron colloidal matters, and bacteria from water is named “reverse” osmosis since it requires pressure to force pure water across a membrane, leaving the impurities behind. Reverse osmosis is able to remove 95 – 99 % of the total dissolved solids (TDS). Municipalities and industrial facilities are able to use RO permeate as a consistently pure drinking water supply and to transform drinking water to high purity water for industrial use at microelectronic, food and beverage, power and pharmaceutical facilities. RO involves the reversal of flow through a membrane from a high salinity or concentrated solution to the high purity, or “permeate” stream on the opposite side of the membrane. Pressure is used as the driving force for the separation. The applied pressure (P) must be in excess of the osmotic pressure of the dissolved contaminants to allow across the membrane.

The membrane that used in this process is called reverse osmosis (RO) membrane. Some RO membranes also have an electrical charge that helps in rejecting some chemicals at the membrane surface. Reverse osmosis (RO) membrane commonly cast from polymeric material. Recently, commercial RO membrane is typically made of a “thin film composite” (TFC) in which a microporous support or sub-support layer of membrane (usually polysulfone) and enforcement consist of polyester (PET).Cross sectional image of three layers of RO composite polyamide membrane is shown in **figure 1-2.**

The membrane support or sub-support layer is first produced via “standard” phase inversion method, and then an ultra – thin polyamide film is generated in – situated on the surface of the polysulfone support or sub-support layer of the membrane by means of interfacial polymerization. This thin film composite (TFC) membrane has a pore size in the nano scale (less than 1 nm). They exhibit high water

throughout or flux, while acting as a barrier to dissolve salts and organic material [1].

1.2. Water Purification

Water is one of the important necessities in human interest in the whole world. Clean water is needed in personal daily, household, or in industrial uses. The water may contain some bacteria, viruses, lead, copper, and man-made chemical pollutant. Many contaminants can be dangerous. Characteristic of membrane process in water purification is illustrated in **figure 1-3**.

It is impossible to tell whether the water is safe to drink or not just by looking on it. To drink the water, we should prepare to treat it.

Water purification is the removal of contaminants from raw water to produce drinking water or potable water that is pure enough for human consumption or for industrial uses. Membrane system found the worldwide increasing application in the purification of potable and industrial water, and their design and use are set to grow considerably in years to come .

How does specific water purification method work?

1.2.1. Physical Water Purification

Physical water purification is primarily concerned with filtration techniques. Filtration is a purification instrument to remove solids from liquids. There are several different filtration techniques.

1.2.1.1. Filtration

Cross flow membrane filtration removes both salts and dissolved organic matter using permeable membrane that only permeates the contaminants. The remaining concentrate flows along across the