Chapter 1

Introduction

In recent year, solvent separation process developed in various ways, however in each similar way of development factors such as technology requirements, economic implications, and anticipated environment impact have to be taken into consideration. As for technology requirements, separation techniques such as gas stripping, liquid-liquid extraction, adsorption, perstraction, reverse osmosis and pervaporation have been applied for solvent separation, and concentration. Among these techniques, membrane process such as pervaporation, reverse osmosis and perstraction have attracted recent attention because they can be more selective, more energy efficient and more environmental friendly than non-membrane processes. The pervaporation process is one of the membrane processes and also one of the most promising techniques. Comparing with perstraction, and reverse osmosis, pervaporation can accomplish separation and partial concentration of clean products in one step without solvent recovery from extractants.

In acetone-butanol fermentation, substrate conversion during fermentation is essentially limited by the concentration of butanol in fermentation medium. One way to reduce this problem would be the use of extractive fermentation by pervaporation process, thus the feedback inhibition of butanol has been removed. As a result of low inhibition, the substrate consumption and solvent productivity can be increased. This procedure are beneficial for the economics of the production process. Furthermore, pervaporation of different volatile fermentation products will be explored.

Therefore, in this research study, focus will be on acetone-butanol separation and concentration from water-acetone-butanol-ethanol-acetic acid -butyric acid mixtures and acetone-butanol fermentation broth by the pervaporation process.

The Objective of this thesis

1. To study the pervaporation process for solvent separation of water-acetone-butanol-ethanol-acetic acid-butyric acid mixtures, and acetone-butanol fermentation broth which obtained with Clostridium acetobutylicum.

2. To study the effects of system parameters on solvent separation.

3. To determine the optimum conditions for solvent separation from water-acetone-butanol-ethanol-acetic acid-butyric acid mixtures

4. To determine the optimum conditions for solvent separation from acetone-butanol fermentation broth which obtained with Clostridium acetobutylicum.

The Scope of this work

1. Preparate the silicone hollow fiber module for solvent separation and concentration from water-acetone-butanol-ethanol-acetic acid-butyric acid mixtures and acetone-butanol fermentation broth by the pervaporation process.

2. Vary key system parameters (as shown below) of the pervaporation process for solvent separation from water-acetone-butanol-ethanol-acetic acid-butyric acid mixtures, and acetone-butanol fermentation broth which obtained with Clostridium acetobutylicum.

-Feed Temperatures were varied between 40-80°c

-Permeation Pressures were varied between 2-30 torr

-Membrane thicknesses were varied between 0.25-1.0 mm.

3. Compare the effects of key system parameters on solvent separation of water-acetone-butanol-ethanol-acetic acid-butyric acid mixtures, and acetone-butanol fermentation broth which obtained with *Clostridium acetobutylicum* using pervaporation.

4. Find the optimum conditions of the pervaporation process for solvent separation of water-acetone-butanol-ethanol-acetic acid-butyric acid mixtures

5. Find the optimum condition of the pervaporation process for solvent separation of acetone-butanol fermentation broth which obtained with *Clostridium acetobutylicum.*