CHAPTER I

INTRODUCTION

1.1 General Introduction

Surfactants are widely used as household and industrial products. After use, surfactants are simply present in wastewater and eventually exists in the environment. In addition to satisfying environmental regulations, the value of surfactants being emitted sometimes makes recovery operations more economical. One of the most efficient method to recover surfactant at a low concentration is foam fractionation process. Foam fractionation process has been used to concentrate and remove surface-active agents from aqueous solutions. Moreover, nonsurface active materials can be also removed by interaction with the surfactant and are carried along into the foam.

Foam separation is an adsorption bubble separation method that selectively separate surface-active compounds from a solution, by concentrating at the rising foam which is skimmed off from the flotation vessel. This process is especially effective for separation of materials at low concentrations. Surface-inactive compounds (colligens) can be removed from solution if an appropriate surface-active material (collector) is added to unite with the compound so that it can be adsorbed preferentially at the bubble surface. Foam fractionation separates dissolved materials, while froth flotation separates insoluble materials.

An alternative approach to the biodegradation of surfactants is the direct treatment of the rinsing waters by physical separation that would allow for the reuse of both water and surfactant. A significant reduction in use of fresh rinsing water is not only ecologically sensible but also be cost-effective. Foam fractionation employs the characteristics of surfactants to adsorb preferentially on the gas-liquid interface of air bubbles rising through the solution. The foam which forms at the solution surface, is allowed to drain and once collapsed, to obtain the surfactant concentrated liquid that could be recycled to the production process. Figure 1.1 shows the mechanism of foam fractionation.

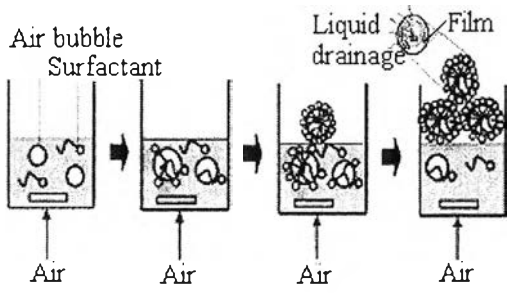

Figure 1.1 Principle of foam fractionation.

There are two modes of foam fractionation, simple mode (batch or continuous), and higher mode with enriching and/or stripping. The foam fractionation column can also be classified into two categories; single-stage and multistage as shown in Figure 1.2. In a continuous apparatus, a feed solution is continuously introduced to the column while foamate and residue are withdrawn continuously. Recovery (percent removal and the concentration of surfactant in foamate) can be increased by using a stripping mode and enriching mode, respectively. In the stripping mode the feed is introduced into the foam so that some amount of separation takes place while it is descending through the foam itself. In the enriching mode a certain amount of reflux is achieved by the feeding part of the foamate back to the top of the column for increasing the separation. The purpose of multistage continuous foam fractionation is to remove as much as possible of the solutes in order to recover a pure residue.

1.2 Objectives

The objectives of the present study were as follows :

1. to study the operating parameters affecting multi-stage foam fractionation process on the recovery of three types of surfactants (anionic, cationic, and nonionic)
2. to study the foam stability and foamability of three types of surfactants and to compare the removal efficiency of the three types of studied surfactants.

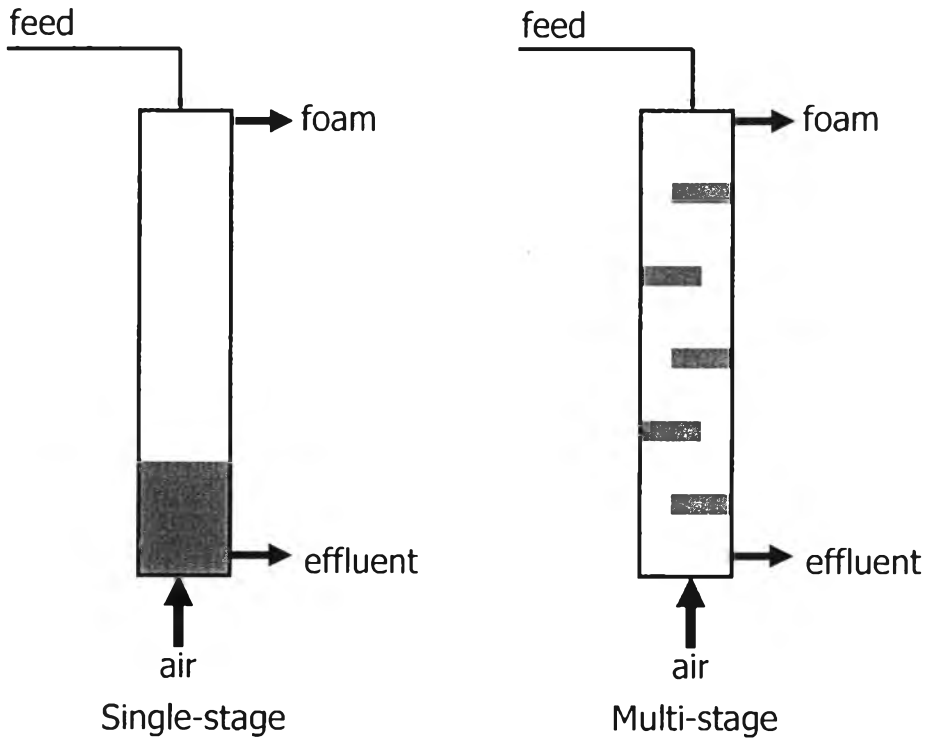

Figure 1.2 Two types of foam fractionation separating columns.