CHAPTER I
INTRODUCTION

Surfactants are widely used in many industries such as food industry, textile, paper and pulp, personal care processing, fire fighting, and many others. Effluents from these industries usually contain surfactants at low concentrations which can cause severe water problems. As environmental regulations tighten, there is increasing concern about reducing the surfactant concentration in these waste streams. Another source of these streams is from the surfactant-based separation processes. Owing to their low energy requirements, these processes have gained increasing interest in the applications to remove various types of pollutants from wastewater and groundwater. The resultant effluent streams from these processes usually contain surfactants, which need to be removed. In addition to satisfying the environmental regulations, the value of the surfactant in the effluent makes recovery operation economical. Micellar-enhanced ultrafiltration is an interesting example of the surfactant-based separation processes. In this process, a surfactant is added to an aqueous stream containing dissolved pollutants. If a surfactant concentration is higher than the critical micelle concentration (CMC), most surfactants are present as aggregates called micelles. Multivalent ions will bind with micelles and organic contaminants will solubilize into micelles. This stream is then treated by ultrafiltration with suitable membrane having pore size small enough to block the micelles but monomeric molecules still can pass through the membrane to present in the permeate at or slightly below the CMC (Scamehorn *et al.*, 1992). For environmental and economic reasons, the surfactant monomers that leak into the permeate have to be recovered. Several methods have been explored to solve this problem including the use of surfactant having low CMC, precipitation and foam fractionation.

Foam fractionation is the process used to concentrate and remove surface-active agents from aqueous solutions. This method is the direct treatment of the rinsing waters by physical separation that would allow for the reuse of both water and surfactants. In this process, the solute species adsorbs at the gas-liquid interface between a dispersed phase (gas bubbles) and a continuous phase (bulk liquid) resulting in removing surfactants from solution. The foam, which forms at the surface, is allowed to drain and once collapsed, to form a concentrated liquid that can be recycled in the production process. The foam fractionation column can be classified into two categories: single-stage and multi-stage mode (Carleson, 1992).

From previous work (Triroj, 2005), the recovery of cationic surfactant (Cetypyridinium chloride, CPC), nonionic surfactant (Polyethylene glycol tert-octylphenyl ether, $OPEO_{10}$) and mixed cationic/nonionic (CPC and $OPEO_{10}$) surfactants from water by multistage foam fractionation in a bubble cap tray were investigated. Effects of surfactant feed concentration, air and liquid flow rates, foam height and number of stages on the performance of fractionation were examined. In this work, the effect of feed position, bottom reflux position and bottom reflux ratio were investigated. This research involves the study of variables on the efficiency of a foam fractionation operation in a pilot-scale fractionator by using the same surfactant that has been previously used. In particular, the effects of feed position and reflux ratio were systematically examined.