CHAPTER I
INTRODUCTION

Surfactants appear in the effluent wastewater from a number of industries such as textile, pulp and paper, food processing and detergent manufacturing. As environmental regulations tighten, there has been growing concern about reducing the surfactant concentration in aqueous streams. In addition, surfactant-based separation processes have gained increasing interest in the remediation of wastewater and ground water in recent years. In these processes the surfactants are added to remove toxic pollutants from the waste streams. Consequently, the resultant effluent streams often contain low surfactant concentrations. In general, surfactant concentrations in these effluent streams are around or below the critical micelle concentration (CMC).

An example of the surfactant-based separation process is micellar-enhanced ultrafiltration (MEUF) (Scamehorn *et al.*, 1992). In MEUF, a surfactant is added to an aqueous stream containing dissolved pollutants. The surfactant is at a concentration well above the CMC, so most of the surfactant is present as aggregate micelles. The micelles solubilize organic contaminants and bind multivalent ions valence. The stream is then treated by ultra filtration with membrane pore sizes small enough to block the micelles from entering the permeate (stream passing through the membrane). The surfactant concentration in the permeate is at or slightly below the CMC (Scamehorn *et al.*, 1992). The surfactant must be recovered from the stream for an economical separation (Robert, 1993).

Foam fractionation of the surfactant 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. The process employs the characteristics of surfactants to adsorb on gas-liquid interface of bubbles rising through water to remove them from solution. The foam which forms at the surface, is allowed to drain and once collapsed, forms a concentrated liquid that could be recycled in the production process.

There are two modes of foam fractionation, simple mode (batch wise 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. In our laboratory, the recovery of single surfactants from aqueous solution by foam fractionation has been studied in both single and multistage systems. In this study, we focused on the recovery of a cationic surfactant, Cetylpyridinium chloride or CPC, using multistage foam fractionation. Two fractionator columns were built with different tray spacing so that the column performance could be evaluated under different conditions. Effects of various system parameters such as surfactant feed concentration, liquid feed flow rate, tray spacing, air flow rate, foam height, etc. on removal efficiency were investigated.