CHAPTER III
EXPERIMENTAL

3.1 Materials

The surfactant used in this study was a cationic surfactant, Cetylpyridinium chloride (CPC), from Zealand Chemical with > 99%. Distilled water was used in all experiments. Manufacturer supplied information about the surfactant used is shown in Table 3.1. The surfactant was used without purification.

Table 3.1 Chemical properties of the studied surfactants

Type	Chemical formula	Formula weight	Purity
Cetylpyridinium chloride (CPC)	$n\text{-}C_{16}H_{33}N(CH{=}CH)_2CHCl$	358.01	> 99% pure

3.2 Experimental setup

The schematic diagram of a multi-stage foam fractionation apparatus used in this study is shown in Figure 3.1. Two columns were made with acrylic with inner and outer diameter of 18 and 18.03 cm, respectively. Both units could be assembled to have several stages up to 5 stages. Bubble-cap trays with two different tray spacings (15 and 30 cm) were used. The dimensions of the multi-stages foam fractionator are given in Table 3.2.

Table 3.2 Dimensions of the multi-stage foam fractionation column

Tray spacing	30 and 15 cm
Column diameter - Inner - Outer	 18 cm 18.03 cm
Weir - Diameter - Height	 5 cm 6 cm
Number of bubble caps	9

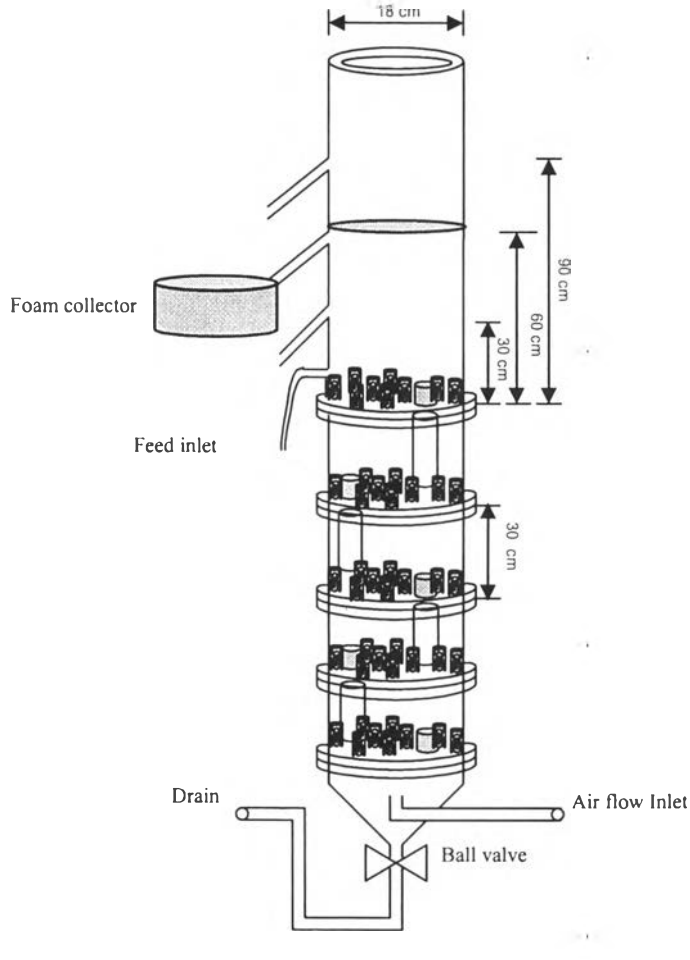

Figure 3.1 Schematic diagram of a multi-stage foam fractionation column.

3.3 Experimental Method

An experimental set up of the multi-stage foam fractionation system is shown in Figure 3.1. The foam fractionation was performed in continuous mode with aqueous solution containing surfactant. The surfactant solution was continuously fed into the top of the column at a constant flow rate in the range of 25-100 mL/min (0.9824-3.9297 L/min.m^2) by using a peristaltic pump. The pressurized air from an air compressor was regulated to have the flow rate of 30-100 l/min by using a rotameter. The compressed air was introduced at the bottom tray. Foamate at the top of the column was collected at three variable positions of 30, 60 and 90 cm from the liquid surface of the top tray. The foam was collected, frozen, thawed and then weighted to get the collapsed foamate volume.

The surfactant separation efficiency of the foam fractionation system was studied under steady state conditions. Steady state was insured when all measured parameters were invariant with time. The ranges of operating parameters are shown in Table 3.3. After steady state was achieved, samples of the outlet stream and foam were taken for analysis and measurement.

In each experiment, volumetric foam production rate (l/min.m^2), foam wetness (grams of foam solution/l of foam), and the surfactant concentration (g/l) in the collapsed foam solution were measured. The concentrations CPC were measured by an UV visible spectrophotometer at wavelength of 260 nm.

The critical micelle concentration (CMC) of each surfactant was also measured experimentally by plotting the specific surface tension versus surfactant concentration showing an abrupt change in slope.

Table 3.3 Operating parameter

Surfactant feed inlet - Type - Concentration - Flow rate	 CPC 0.25-1 CMC 25-100 ml/min
Air inlet - Flow rate	 30-100 l/min
Number of trays	1-5
Foam height	30-90 cm