

CHAPTER III EXPERIMENTAL

3.1 Materials

3.1.1 Surfactants

Two types of surfactants were used in this work, branched alcohol propoxylate sulfate, sodium salt (Alfoterra 145-5PO Sulfate), and sodium laurylsulfate (SDS). Alfoterra 145-5PO Sulfate with 28.7% purity was supplied in the liquid form by Sasol North America Inc., Texas, USA. Alfoterra 145-5PO Sulfate is an anionic surfactant with a negatively charged sulfate head group. SDS was purchased by Carlo Erba Reagenti with purity in the range of 94-98 %. SDS is an anionic surfactant with a negatively charged sulfate head group and alkyl chain length of twelve carbon units. The general properties of the studied surfactants are shown in Table 3.1.

Table 3.1 General properties of studied surfactant

Surfactant	Molecular weight	Chemical Formula
Alfoterra 145-5PO Sulfate	595	$C_{16}H_{32}(C_3H_6O)_5SO_4Na$

3.1.2 Studied Oil Contaminant

Diesel was selected as a model oil contaminant in this research work. It was purchased from PTT Public Co., Ltd. Diesel is a complex combination of hydrocarbons produced by the distillation of crude oil. It consists of hydrocarbons having carbon number predominantly in the range of C9-C20 and having a boiling point in the range of approximately 163-357 °C.

3.1.3 Water

Distilled water was used in all experiments for preparing aqueous surfactant solutions and rinsing glassware. It was supplied by The Government Pharmaceutical Organization, Bangkok, Thailand.

3.1.4 Electrolyte

Analytical grade of sodium chloride (NaCl) was used as an electrolyte and obtained from Labscan Asia Co., Ltd. with purity of 99%.

All chemicals were used as received without further purification.

3.2 Experimental Procedures

In this work, experiments were divided into three main parts. The first part was a study of colloidal gas aphrons, the second part was froth flotation experiments, and the third part was foam ability and foam stability experiments. For all experiments, the surfactant concentration and salinity were expressed as percent by weight based on aqueous solution. All experiments were conducted at 30 °C.

3.2.1 Study of Colloidal Gas Aphrons

Figure 3.1 shows the colloidal gas aphrons studied. CGAs were used for diesel removal. Aqueous surfactant solutions were prepared according to Table 3.1. CGAs were created by using a homogenizer; model PT 3100 from Kinematica AG, at high speed. After that, 5 ml of diesel oil was added to the CGAs. The mixture was stirred at the speed of 900 rpm for 5 min. The system was allowed to separate into a CGAs (top) phase and a liquid (bottom) phase, and the liquid phase was then removed by pipet. Both of phases were analyzed for oil contents.

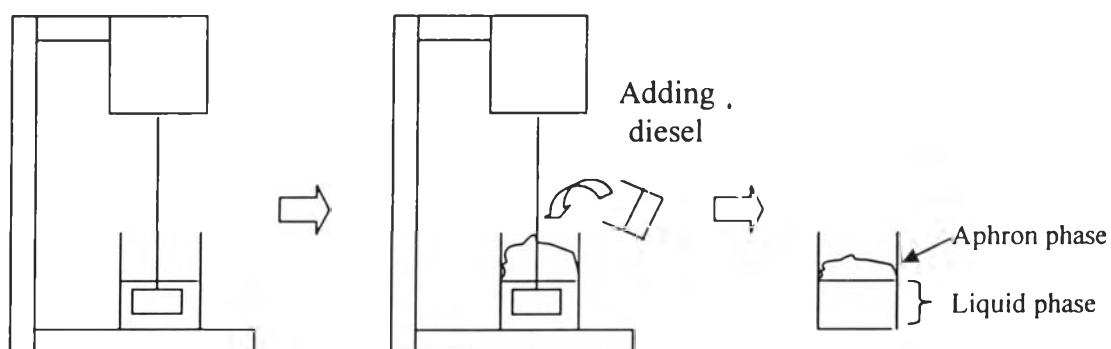


Figure 3.1 Schematic experiment of colloidal gas aphrons in diesel removal.

Table 3.2 Experimental conditions for CGAs preparation

Experimental number	Speed (rpm)	Time (min)	[Alf] (wt.%)	[NaCl] (wt.%)
1	4000	5	0.10	3
2	5000	5	0.10	3
3	6000	5	0.10	3
4	7000	5	0.10	3
5	8000	5	0.10	3
6	5000	2	0.10	3
7	5000	5	0.10	3
8	5000	10	0.10	3
9	5000	15	0.10	3
10	5000	5	0.05	3
11	5000	5	0.10	3
12	5000	5	0.15	3
13	5000	5	0.50	3
14	5000	5	0.10	2
15	5000	5	0.10	3
16	5000	5	0.10	4
17	5000	5	0.10	5
18	5000	5	0.10	6

3.2.2 Froth Flotation Experiments

Figure 3.2 shows the schematic experiment of froth flotation. The froth flotation apparatus consisted of a glass cylindrical column with 5 cm inside diameter and 120 cm height. Compressed air was first filtered to remove all particles and oil and then passed through a water filter. The flow rate of the filtered air was regulated by a mass flow controller before it was introduced into the bottom of the column through a sinter glass disk. A well-mixed solution, which composed surfactant, water, and oil under microemulsion condition, was fed with a desired volume into the froth flotation column by using a peristaltic pump. The air bubbles ascended through the solution generated foam. The foam overflowed from the column and was collected over different time intervals. After that, the froth was collapsed to analyze diesel concentrations and surfactant concentrations in the froth by using the extraction and titration method, respectively.

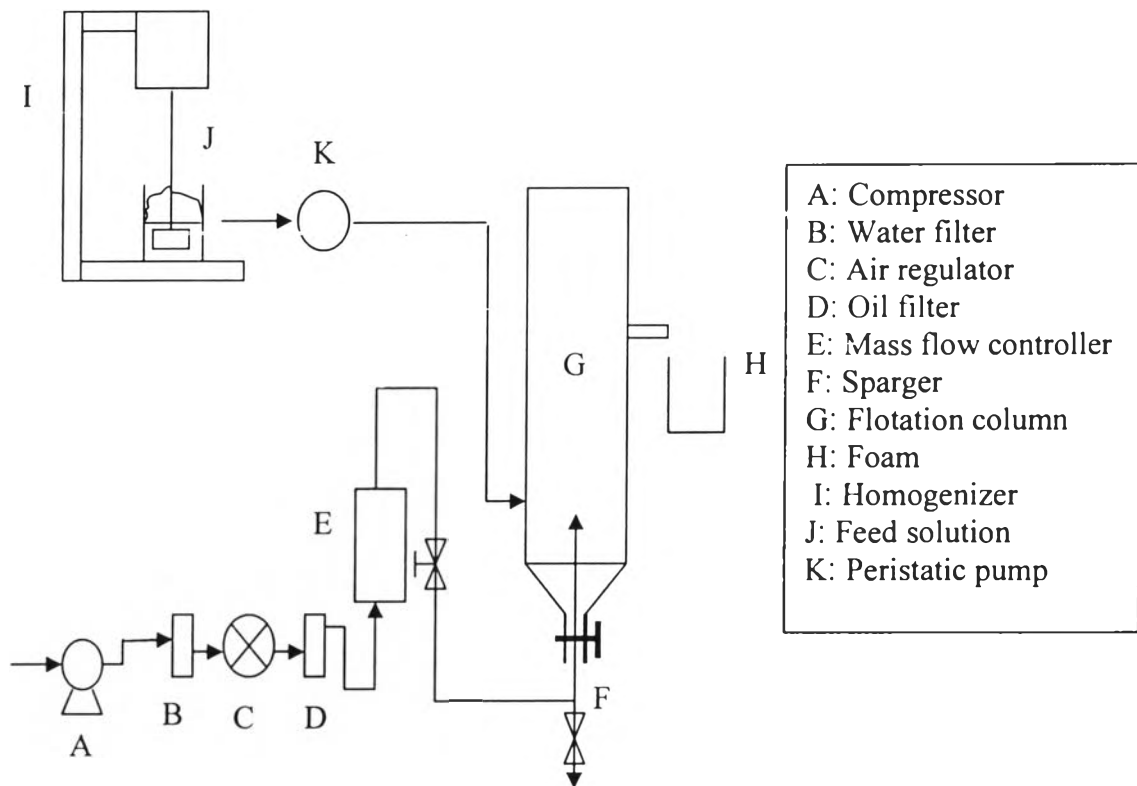


Figure 3.2 Schematic experiment of froth flotation.

3.2.3 Foam Ability and Foam Stability Experiments

In the foam ability and foam stability experiments, 100 ml of the sample was transferred to a glass cylindrical column with 5 cm inside diameter and 120 cm height. The filtered air was introduced through the sinter glass disk. The flow rate of air was controlled by using the mass flow controller. The solution in the column was aerated continuously until the foam height in the column was constant. Thus, the maximum foam height was recorded. After that, the filtered air to the column was stopped. The time required for the foam volume to collapse by half was recorded. Foam ability is defined as the ratio of maximum foam height to initial solution height whereas foam stability ($t_{1/2}$) is the time required for the foam volume to collapse by half.