CHAPTER I
INTRODUCTION

Diesel is widely used in several industrial processes such as metal manufacture and machining, food processors as well as petroleum refinery plant. Consequently, diesel is often found in contaminated wastewaters (Patterson, 1975). Therefore, it is necessary to get rid of diesel from wastewaters before discharging into public water. Hence, a cheap and high efficiency separation method is needed to solve this problem.

Froth flotation is one of interesting separation methods, which is a surfactant-based separation method. It requires relatively low energy as well as its simplicity in operation. It has also been widely used in mineral processing. In addition, it is now being developed to solve environmental problems and recently applied for wastewater treatment such as the removal of dispersed oil from oily wastewater (Sylvester and Byeseda, 1980; Bradley, 1985; Gu and Chiang, 1999; Ramirez and Davis, 2001; Moosai and Dawe, 2002).

Froth flotation operations are suitable for dilute waste treatment because it has many advantages including rapid operation, low space requirement for equipment set-up, high efficiency of removal, flexibility of application to various pollutants at various scales, and low cost (Choi *et al.,* 1996). Consequently, flotation has been used in many waste treatment problems (Leu *et al.,* 1994; Zouboulis *et al.,* 1994; Choi *et al.,* 1996; Wungrattanasopon, 1996).

In froth flotation processes, a surfactant is first added into the oily wastewater, and gas is introduced into the system by a sparger which generates fine bubbles. At the air/water interface, the surfactant tends to adsorb with the hydrophilic or head groups in the water and the hydrophobic or tail groups in the air. The oil tends to attach at the air bubbles as they ascend through solution and are concentrated in the foam or froth at the top of the flotation cell which is generally skimmed off. As a result, the formation of stable bubble particle aggregate is required in the froth flotation technique to enhance separation efficiency (Freund, 1995). Various parameters affecting the efficiency of oil removal are the height of the foam–liquid interface, the air flow rate, the bubble diameter, the feed concentration, and the concentration of the added electrolyte (Feng *et al.*, 2000).

A formation of diesel, water and surfactants in the form of microemulsion was prepared as studied wastewater since microemulsion has superior characteristics such as ultra low interfacial tension (IFT), relatively large interfacial area and large solubilization capacity. It has been known that the lower the interfacial tension, the higher the efficiency of removal which is related to froth flotation efficiency (Pondsatabodee *et al.*, 1996). These properties give microemulsion intriguing from a fundamental point of view and versatile for industrial applications. Then, microemulsion was introduced to apply in the froth flotation technique in this work.

The formation of microemulsion with diesel oil was investigated in order to find out the minimum interfacial tension which is the first criteria for selecting what surfactant system is suitable for froth flotation operation (Withayapanyanon, 2003). The oil removal efficiency of the froth flotation process did not correspond to the minimum IFT of the system indicating that the ultra low IFT alone cannot be used as a sole criterion for froth flotation operation. Foam stability was revealed to be another crucial factor in the froth flotation operation (Watcharasing, 2004).

The use of colloidal gas aphrons or CGAs, which are aggregates of micron-sized bubbles stabilized by a surfactant in flotation process, is a relatively new technique. The ability of CGA bubbles to collect oil dispersions depends upon the slight hydrophobicity of the encapsulating soap film surrounding the bubbles. The oil droplets tend to adhere to the outside of this film, and being much smaller than the gas bubbles, a large number of droplets can be accommodated on each aphron and separated by flotation.

This study investigated the relationship between the efficiency of froth flotation and the enhancement efficiency of separation by CGA bubbles in the ultra low interfacial tension condition of diesel in wastewater by froth flotation. The CGA bubbles produced by a homogenizer and the froth flotation experiments were performed to investigate the efficiency of diesel removal from wastewater using Alfoterra 145-5PO, a surfactant that provides the ultra-low IFT as well as the good performance on foam ability and foam stability.