CHAPTER I
INTRODUCTION

Motor oil is a type of liquid oil used for lubrication by various kinds of motors, especially internal combustion engines, used for cooling by carrying heat away from moving engine parts, and used for cleaning and corrosion inhibition in internal combustion engines. In industrial processes, machines are an important part of industries. Most machines such as compressors, pumps and turbines require motor oil as a lubricant introduced between two moving surfaces to reduce the friction and wear between them (Mortier and Orszulik, 1997). However, motor oil is often found in wastewater systems affecting the environment. Hence, it is necessary to get rid of motor oil from the wastewater before discharging to the public water.

Froth flotation is a surfactant-based separation process (Scamehorn, 1989). It has been widely used in the mineral industry, but now being extended to wastewater. Froth flotation operations are suitable for dilute wastewater treatment because it has several 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 and Choi, 1996). Consequently, froth flotation has been increasingly used in many wastewater treatment problems.

In the froth flotation process, a surfactant is usually added into an oily wastewater to enhance the flotation of the oil. Air is introduced into the system through 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 to the air bubbles while they rise through the solution. The oil together with the air bubbles are concentrated as 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 aggregates is required in the froth flotation technique to enhance separation efficiency (Freund and Dobias, 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 added electrolyte (Feng and Aldrich, 2000).

A mixture of motor oil, water and surfactants in the form of microemulsion was prepared as studied wastewater since a microemulsion has superior characteristics such as ultralow interfacial tension, relatively large interfacial area and large solubilization capacity for both water-soluble and oil-soluble compounds as compared to many other colloidal systems (Bourrel and Schechter, 1988). It has been known that the lower the interfacial tension, the higher the efficiency of removal is which is related to froth flotation efficiency (Pondstabodee *et al.*, 1998). These properties render microemulsion intriguing from a fundamental point of view and versatile for industrial applications. Thus, microemulsion was introduced to apply in the froth flotation technique in this work.

This study investigated the effects of the operational parameters on the separation performance of continuous froth flotation to remove motor oil from water. Alfoterra 145-5PO (branched alcohol propoxylate sulfate, sodium salt) was used as a surfactant to form a Winsor Type III microemulsion or the middle phase with motor oil. The effects of surfactant concentration and NaCl concentration, where the minimum surfactant concentration can form the middle phase in a microemulsion systems, or critical microemulsion concentration, were studied. After that, the continuous froth flotation experiments were performed to investigate the efficiency of motor oil removal from water using Alfoterra 145-5PO. The effects of concentration of surfactant, hydraulic retention time (HRT) and bubble size distribution on foam characteristic and froth flotation performance were also investigated.