CHAPTER I
INTRODUCTION

Machines are an important and necessary part of industries, in today's world. Most machines require cutting oil and other fluids like transmission and brake fluid to run properly. To keep a vehicle running well, an owner should change the vehicle's motor oil and fluids regularly as defined by the manufacturer. To manufacture small support parts such as bolts nuts and fitting, cutting oils are needed to cool down during drilling and cutting metals. As a result, wastewater discharged from their manufacturing plants always contains a significant portion of cutting oil which has to be removed primarily.

Froth flotation is one of surfactant-based separation processes. It has been widely used in ore processing but now being pointed out to be a promising technique to solve oily wastewater problems (Scamehorn, 2000).

In froth flotation process, a surfactant is first added into an 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 while they ascend through solution and 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 table bubble particle aggregates is required in the froth flotation technique to enhance separation efficiency (Freund, 1995).

A formation of cutting oil, water and surfactants in the form of microemulsion was prepared as a stimulated wastewater. Since microemulsion has special characteristics such as relatively large interfacial area, ultra-low interfacial tension and large solubilization capacity for both water-soluble and oil-soluble compounds as compared to many other colloidal systems. It is known that in froth flotation operation, the lower the interfacial tension, the higher the efficiency of oil removal (Pondstabodee *et al.*, 1996). These properties render microemulsion intriguing from a fundamental point of view and versatile for industrial applications. Therefore, microemulsion was applied in froth flotation in this work. Mixed

surfactants were used to form microemulsion in this work. Since they can provide a proper value of hydrophile-lypophile balance (HLB).

This study was to investigate all operational parameters affecting froth flotation performance in continuous mode of operation to remove cutting oil from water. Alfoterra 145-5PO (branched alcohol propoxylate sulfate, sodium salt) and SDS (sodium dodecyl sulfate) were used as surfactants to form a Winsor Type III microemulsion or the middle phase with cutting oil. For microemulsion study, effects of surfactant concentration, NaCl concentration, and oil to water ratio on the ultra-low interfacial tension of cutting oil was investigated. After that, both batch and continuous froth flotation experiments were performed to investigate the efficiency of cutting oil removal from wastewater using mixed surfactants of Alfoterra 145-5PO and SDS. Effects of oil/water ratio, concentration of surfactant, salinity, air flow rate, foam height and hydraulic retention time (HRT) on flotation efficiency were determined.