CHAPTER I
INTRODUCTION

In the production of oil and gas, various contaminants have been generated which affect the environment directly and indirectly. Especially, oil refineries generate a huge quantity of oil sludges while processing crude oil. These sludges are considered hazardous hydrocarbon wastes and required proper treatment and management. The major components of the oil sludges are heavy hydrocarbons, which consist of a mixture of aliphatic, aromatic, nitrogen, sulfur, oxygen containing compounds and asphaltene fractions of crude oil (or the oil sludge).

There is growing concern in industrial sector, government authorities and public about the contamination, toxicity and handling of oil sludge from petroleum industry. The traditional way to handle this type of waste is to dump the sludge into the pits, but possible seepages of oil sludge from the pit over a period of time cannot be ruled out. Therefore, the environmental friendly technologies are increasingly in demand by petroleum industry in order to manage the oil sludge efficiently. In this aspect, the biological treatment seems to be suitable for this problem as it is safe, economical and environmental friendly.

Biodegradation or microbial degradation is a treatment technique and logistically favorable clean-up technology, which attempts to accelerate the naturally occurring biodegradation of contaminants through the optimization of limiting condition. This effective process utilizes the metabolic ability of microorganism to transform the organic contaminants to less harmful, non-toxic substances, which are integrated into natural biogeochemical cycles. The intensity of biodegradation is influenced by several factors, for example; nutrients, pH, oxygen, bioavailability and concentration of contaminants, physical and chemical characteristics and the solubility of the hydrocarbon. Biodegradation is especially suitable for the treatment of hazardous chemical spills and oil sludge. However, its feasibility depends greatly upon the availability of the hydrocarbons present in oil sludges.

Due to the low aqueous solubility, many biodegradable hydrocarbons are poorly available to the degrading microorganisms. This limited bioavailability problem often leads to unsuccessful treatment by biological means. In this aspect,

the surface active agents or surfactants have been shown to be useful for the biodegradation of petroleum contaminated sites because they enhance the solubility of hydrocarbon compounds.

Thus, this thesis focused on the study of the biodegradation of oil sludge from petroleum industry in Thailand and the effect of single and mixed systems of nonionic and anionic surfactants on the bioavailability and biodegradation of hydrocarbons in the sludge. Initially, batch liquid experiments were employed to examine the effect of surfactants at various concentrations on solubilization of hydrocarbons in the oil sludge and on the total petroleum degradation of the sludge. Finally, a lab-scale bioreactor was constructed and used to study the biodegradation of oil sludge in a sequencing batch mode of operation.