CHAPTER I
INTRODUCTION

Oil production and shipping operations often result in accidental contamination of petroleum in the environment. Petroleum refining, being considered as a downstream process, also generates large quantities of petroleum wastes such as oil sludge, which is usually non-biodegradable in nature. Oil sludge contains hydrophobic substances which mainly are petroleum hydrocarbons, water and suspended solids. Hydrocarbon compounds normally present in oil sludge are aliphatic, aromatic, and polycyclic hydrocarbon, ranging from short C_3 to much longer chains.

In recent years, government, industry, and the public have increasingly recognized the need to reduce the volume and toxicity of petroleum-contaminated wastes and to develop safe, effective, and economic alternatives for their treatment and disposal. Consequently, petroleum refinery operators face more stringent regulations of the treatment, storage, and disposal of hazardous wastes. Under these tight regulations, a number of suitable treatment techniques have been investigated. Clean-up technologies such as incineration and burial of sludge in secure landfills have increasingly been considered neither suitable nor economical. Effective treatment techniques such as biological method, which is safe, versatile and economical, are needed to protect human health and the environment from wastes as diverse as oily wastewater, petroleum-contaminated soil, and oil sludge.

Microbial degradation or biodegradation is a cost- and treatment-effective and sometimes logistically favorable cleanup technology, which attempts to accelerate the naturally occurring biodegradation of contaminants through the optimization of limiting condition. This process utilizes the metabolic ability of microorganism to transform or mineralize organic contaminants into less harmful, non-hazardous substances, which are then integrated into natural biogeochemical cycles. Many microorganisms have the ability to utilize hydrocarbons as sole sources of energy and carbon and that such microorganisms are widely distributed in nature. The intensity of biodegradation is influenced by several factors, such as nutrients, oxygen, pH value, composition, concentration and bioavailability of the

contaminants, chemical and physical characteristics and the pollution history of the contaminated environment. Transformation of hydrophobic hydrocarbons into hydrophilic moieties using surfactants and further degradation of solubilized hydrocarbons by microorganisms could be the viable solution for disposal of these sludges.

This study examined the effect of surfactants on the solubility and bioavailability of hydrocarbon in oil sludge and the biodegradation of oil sludge as enhanced by various types of nonionic surfactants. Oil sludge was obtained from API separator of PTT (Public) Co., Ltd. The biodegradation was studied by using indigenous microorganisms originally present in the sludge as well as microorganism isolated from petroleum-contaminated sites in Thailand, which is identified as *Pseudomonas aeruginosa*.