CHAPTER I
INTRODUCTION

Nowadays, a dramatic increase in the demand of oil leads to the higher production of oil in petroleum industry. Inevitably, petroleum production and refining generate various types of wastes into the environment. Oil sludge is mostly generated in the production operation or water–oil separation systems in the oil refining processes and accumulation of waste oily materials in crude oil storage tanks. It composes of hydrocarbon mixtures such as aliphatic, aromatics and polycyclic hydrocarbons including sulfur, nitrogen and oxygen containing compounds, which is very complex and usually non-biodegradable in the nature.

Being considered as the environmental problem, oil sludge is targeted by the government and the public to eliminate and reduce both volume and toxicity of the oil sludge. Increasing attention has been paid for developing and implementing innovative technology for cleaning up this waste. Normally, the way to manage the oil sludge is to bury or dispose into the secure pits over a period of times or burns it into less bulky materials. Nowadays the regulations of the treatment, storage, and disposal of hazardous waste are become more stringent and thus, making the burial, disposed, and incineration techniques not appropriate to manage. An alternative treatment, which is more effective and more environmental friendly, is the biological method. This technique is saving, versatile and economical for the oil sludge treatment in petroleum industry. The biological treatment has gained increasing of interest particularly from many oil refineries because it provides several advantages to the users, as it requires low disposal cost and get non-hazardous to human health.

Biodegradation or microbial degradation is the natural process, which bacteria or other microorganisms alter and break down organic molecules into other substances, which are less harmful and non-toxic. This process is a logistically favorable cleanup technology and a cost effective treatment. Many microorganisms have the ability to utilize hydrocarbons as sole source of energy and carbon and that such microorganisms are widely distributed in nature. Nutrients, pH value, oxygen, toxicity, concentration and bioavailability of the contaminants, physical and chemical characteristics in the environment and solubility of the hydrocarbons, etc. are factors

affecting the biodegradation. Using the surfactants to transform hydrophobic hydrocarbons into hydrophilic moieties for further degradation of solubilized hydrocarbons by microorganisms can greatly enhance biodegradation. Microbial degradation is the useful strategy to the treatment of oil sludge, oil spills or hazardous chemical spills in many aspects. Current technology for the biodegradation hydrocarbons and toxic compounds involves the use of microorganisms in batch, continuous or sequencing batch processes, using either suspended or immobilized cultures. The main drawback associated with batch operation is that the initial substrate concentration must be very low, affecting the process productivity. In continuous cultures, low dilution rates are necessary to avoid instability or low conversion. In this aspect, sequencing batch process provides good productivity and stability in the biodegradation including flexibility in the operation.

This thesis focuses on the study of the biodegradation of the oil sludge from PTT PLC and the effects of nonionic surfactants (Tween 80) on the bioavailability and biodegradation of hydrocarbons in the oil sludge. Firstly, on the solubilization the experiments were conducted to examine the effect of surfactant concentration of the oil sludge. Then, the sequencing batch reactors were designed and constructed in which the mixed culture was cultivated with an effective volume of 1 liter. The biodegradation was studied by using the oil loading ranging from 1 to 10 kg/m^3d in the presence of Tween 80 at the optional dose. The performance of the bioreactor was assessed both qualitatively and quantitatively by using total petroleum hydrocarbon (TPH) being degraded, GC/MS, COD, TOC, and dry weight cell.