

## CHAPTER 1

### INTRODUCTION

#### 1.1 Introduction

Petroleum production facilities generate large quantities of oily sludge as a waste by-product. Although of varying characteristics, the sludge is generally a thick, viscous mixture of sediments, water, and of a high hydrocarbon concentration. Additionally, petroleum production can result in accidental contamination of soil with petroleum hydrocarbons. Oil spilled on soil is an environmental concern because contaminated soils may be unsuitable for agricultural, industrial, or recreational use and are potential sources for surface and ground water contamination. Clean-up technologies that involve excavation for incineration or burial in a landfill are costly (Balba *et al.*, 1998).

Biodegradation is a treatment technology used to remediate a variety of contaminants including soil contaminated with petroleum hydrocarbons. Bioremediation is an engineered process whereby the natural biodegradation of petroleum hydrocarbons by indigenous soil bacteria, fungi and protozoa is accelerated. Vast majority of hydrocarbons in refined products are biodegradable such as *n*-alkane of intermediate length ( $C_{10}$ - $C_{20}$ ), naphthalene, anthracene, phenanthrene and pyrene (Balba *et al.*, 1998). Since the hydrocarbon-degrading microbes are ubiquitous, biodegradation may be an environmentally acceptable way of eliminating oils and fuels. Optimizing the environmental parameters can significantly affect microbial degradation rates of TPH. Growth conditions could be

optimized by varying the oil:soil ratio, the addition of nutrients, adjusting the soil moisture content, soil pH, soil porosity or additional aeration. Hydrocarbon degradation rates calculated directly from changing the rate of hydrocarbon concentration provide estimates of biodegradation time.

One bioremediation technologies is biopile which offers many advantages, including; 1)remediation can be completed in a relatively short time about 3 to 6 months and future containment of the treated soil is not required, 2)it is cost-competitive with landfarming and is the preferred option over landfilling, 3)it is effective on organic contaminants that are difficult to desorb, 4)it can be engineered to be effective for any combination of site conditions and petroleum products (Von Fahnestock *et al.*, 1996).

The Fang Petroleum refinery is one of the oil refineries in Thailand which, besides processing petroleum products, also generates high amounts of oily and viscous residues. Such residues called oily sludge are basically composed of oil, water, solids and their characteristics such as varied composition make their reutilization very difficult. Therefore, the biopile experiment was set up in small-scale laboratory to study the response of aeration to degradation of TPH.

## 1.2 Research objectives

This research is designed to meet the following objectives:

1. To compare remediation effectiveness between control (natural biodegradation) and treatment (nutrients adjustment and aeration addition)
2. To compare variation of air flow rate in order to remediate the hydrocarbons.