

CHAPTER I



INTRODUCTION

1.1 Statement of Purpose

Thailand is the third place among the World's largest producers of palm oil, behind the giant producers of Malaysia and Indonesia. In 2005, Malaysia produced approximately 15.4 million metric tons of palm oil, while Indonesia followed with 13 million metric tons. About 75 % of the palm oil productions was used for the cooking oil production (Aninttida, 2007). The oil was mainly used for deep-frying which degrades the oil and makes it unsuitable for use after a certain period. Used oil has properties different from refined and crude palm oil. The high temperature of cooking processes and the water from the foods accelerates the hydrolysis of triglycerides and increases the free fatty acid content in the oil. Moreover, many harmful compounds such as Polycyclic Aromatics Hydrocarbons or PAHs are generated from cooking of foods at high temperatures, e.g. grilling, roasting, and frying. PAHs level in food are under control of the European Community and of the Environmental Protection Agency (EPA) because of their high toxicity and carcinogenicity. They can cause DNA damage, chromosomal mutation and increase risk of leukaemia in childhood. Due to the large volumes of used frying oil and the harmful compounds in it, the disposal of used frying oil becomes a huge problem in each country (Tsai *et al.*, 2007).

At present, there is no systematic method for management of used frying oil as most of this oil ends up in wastewater which then is discharged to natural water. As component of wastewater, oil is classified together with fats and waxes as grease. The degradation of grease by microorganisms happens very slowly because of their low solubility in water. They float on the water surface, creating unsightly films which may interfere with biological life and environment. One of the management methods for used frying oil is *via* landfills, without any treatment (Tsai *et al.*, 2007). This method can cause several environmental problems such as odor and self-ignition. Used frying oil should not be disposed by open burning as it causes black smoke, which is prohibited. Another possibility for the management of used oil is used as a fuel (for transportation or other uses). There are several management methods for used frying oil as described in Chapter 2. The utilization of used frying oil for biodiesel production is one of them. Biodiesel production using used frying oil yields advantages of both economical and environmental benefits. At present, biodiesel is one of the alternative sources of energy that can help the current status of total energy supply. In principle utilization of this energy does not add carbon dioxide, which is one of the major greenhouse gases, to the atmospheric environment.

For the benefits in waste management and valuable product production, in this study, used frying palm oil was salvaged for lipase-based biodiesel production. Then, the accumulation of PAHs in used frying palm oil will be determined. The investigation of PAHs dissimilation as the result of enzymatic process used for biodiesel production will provide knowledge as one of the toxic waste remediation methods.

1.2 Objectives

1.2.1 Main objective

The aim of this study is to salvage used palm oil for enzymatic (lipase – based) production of biodiesel.

1.2.2 Sub- objective

1.2.2.1. To examine the possibility to salvage the used palm oil for the production of biodiesel.

1.2.2.2. To determine polycyclic aromatic hydrocarbons (PAHs) accumulated in used palm oil and if PAHs accumulated in used palm oil affects the production efficiency of biodiesel.

1.2.2.3. To investigate if PAHs are dissimilated as the result of enzymatic process used for biodiesel production.

1.3 Scopes of the investigation

This research contains two major parts including:

1.3.1 Characterization of used cooking palm oil focusing on accumulation of PAHs.

1.3.1.1 Physical and chemical properties of used palm oil such as color, viscosity, water content and fatty acid composition were examined.

1.3.1.2 Determination of type(s) and concentration of PAHs formed and accumulated in used palm oil by HPLC and/or GC- MS.

1.3.1.3 Evaluation of the dissimilation of PAHs after the enzymatic transesterification of used palm oil.

1.3.2 The utilization of used palm oil for lipase-based biodiesel production.

1.3.2.1 Determination of the transesterification conditions for biodiesel production using used palm oil and immobilized lipase.

1.3.2.2 Determination of effect of PAHs on transesterification reaction by immobilized lipase with used palm oil.