CHAPTER I

INTRODUCTION

1.1 Introduction

Biodiesel (fatty acid alkyl ester) is produced by chemically reacting (transesterification) fat or oil with an alcohol in the presence of catalyst. Alternative fuels for diesel engines are becoming increasingly important due to diminishing petroleum reserves and environmental consequences of exhaust gases from petroleum-fuelled engines, decreasing the emission of CO, SO_x and unburned hydrocarbons during the combustion process [1]. Common feedstocks for biodiesel production are crude oils or refined oils but the cost for low-value materials such as soapstock and waste grease for use biodiesel production can be substantially less than the cost of a refined oil feedstock. Soapstock-based biodiesel could be a more economically viable product than biodiesel from soy oil, costing nearly 25% less to produce [2]. Soapstock is the main co-product of the vegetable oil refining industry. Sodium soaps are formed during the initial refining of the crude oil by reaction of extracted free fatty acid with sodium hydroxide. The material typically contains sodium fatty acid soap, glycerides, phosphoglycerides, sterols, organic phosphates, poly-alcohols, carbohydrates and proteinaceous material [3].

For the production of biodiesel fuel, an alkali-catalysis process approximately 4000 times faster than that catalyzed by the same amount of an acidic catalyst (transesterification by acid catalysis is much slower than that by alkali catalysis) [4,5]. In alkali-catalyzed transesterification, the glycerides and alcohol must be substantially anhydrous because water caused a partial reaction change to saponification, which produced soap [6], and recovery of glycerol and by-product that is difficult. Enzymatic transesterification method can overcome the problems mentioned above, lipase are enzymes that hydrolyze the ester bond of fat and oils. Lipase is catalyst for esterification, transesterification and hydrolysis. Enzymes are also able to effectively catalyze the transesterification of triglycerides in either aqueous or nonaqueous system. In addition the free fatty acids contained in waste oils and fats can be completely converted to methyl esters [7]. Production of biodiesel by enzyme lipase has been reported such as conversion of degummed soybean oil to biodiesel fuel with immobilized *Candida antractica* lipase [8], enzymatic conversion of waste cooking oils into alternative fuel biodiesel [9], stepwise ethanolysis of tuna oil using immobilized *Candida antractica* lipase [10], enzymatic alcoholysis for biodiesel fuel production and application of reaction to oil processing [11]. Enzymatic catalysis for the production of biodiesel from soapstock has not been reported due to a semisolid consistency of soapstock which prevent effective mixing of the substrate with particles containing the lipase and also prevent recovery of catalyst at the end of the reaction.

In this research, biodiesel was produced from rice bran oil soapstock using Novozyme 435 catalyst to solve above problem, the impurities in soapstock need to be eradicated before running reaction and oil was extracted by solvent free system and optimal conditions can be found from the effects of molar ratio of methanol to fatty acid or triglyceride, concentration of enzyme base on oil weight, reaction temperature, reaction time and operational stability of enzymes.

1.2 Objectives and scope of the research

1.2.1 Objectives

a) To optimize conditions of biodiesel production from soapstock, acid oil and rice fatty acid using Novozyme 435 catalyst.

b) To study the properties of the resulting biodiesel.

1.2.2 Scope of the research

a) Literature survey and study of the research work.

b) Preparation of equipments and chemicals.

c) Production of biodiesel from rice bran oil soapstock, acid oil and rice fatty acid using Novozyme 435 catalyst.

d) Determination of important biodiesel properties.

e) Summary of results.