CHAPTER 1 INTRODUCTION

1.1 Overview

At present, the use of diesel in Thailand has increased steadily. There are mostly imported from the other countries. Diesel is a very important part in the economic structure. Since the oil crisis that began in Thailand in the year 2543 to the present. Vegetable oil could be blended with diesel oil in a proper composition and it could be used to run diesel engine. In Thailand, there were some studies reported the results of diesel oil directly blended with crude palm oil (CPO) for running in diesel engines. The composition of CPO should not exceed 20 % by volume and the recommended one was 10 % by volume [1]. However, since the chemical and physical properties of the vegetable oil are quite different from those of the diesel, especially the viscosity which is 9-10 times of the diesel oil then the atomization of the fuel droplets and the fuel volatility are poorer than those of the diesel oil which results in poorer combustion performance.

Another approach is the use of vegetable oil instead of diesel fuel is mixed in the emulsion, which has advantages for emissions reduction but result in a higher wear of parts. Emulsified oil containing a mixture of fuel and water can reduce some types of exhaust gases. Combustion phenomenon of emulsified oil is called microexplosion. Type of emulsion is sprayed on a hot combustion chamber, heat convective on the surface of the fuel droplet. As water and diesel have different boiling temperatures, the evaporation rates of these two liquids will be different. The water molecule will reach its superheated stage faster than diesel creating vapor expansion break-up.

In this study, diesel oil and crude palm oil (CPO) in a form of emulsion with compositions of diesel blended with CPO of 5, 10 and 15 % by volume and blended with water of 2, 4, 6, 8 and 10 % by volume were taken as fuels in a four-stroke single cylinder diesel engine having a pre-combustion chamber. The engine performances and the emissions were considered. The mass transfer theory of a single droplet combustion will be developed to evaluate the engine performance.

1.2 Objectives of the study

The objectives of this research are;

- To evaluate the physical and chemical properties of crude palm oil-diesel emulsion at different compositions.
- To develop mass transfer model for prediction of engine power when the CPOdiesel emulsion is used as the engine fuel.

1.3 Significance of the study

- The physical and the chemical properties of the CPO-diesel oil emulsion at different compositions could be evaluated.
- The performance of small diesel engines with CPO-diesel oil emulsion could be estimated.
- 3. A new concept to evaluate engine performance from a mass transfer theory.

1.4 Scopes of the study

1. Fuel used for testing was crude palm oil blending with diesel oil in a form of emulsion. The ratios of crude palm oil were 5, 10 and 15% by volume and those of water were 2, 4, 6, 8, and 10% by volume.

2. The tested engine was a 4-stroke single-cylinder indirect injection diesel engine.

1.5 Thesis outline

This thesis is divided into seven chapters. The first chapter serves as an introduction to the thesis containing the statement and significance of the problem. Chapter 2 gives theory and literature reviews. Chapter 3 gives the properties of emulsified oil. Detailed of experimental study on single droplet combustion of emulsified oil with various compositions are described in Chapter 4. Performances of a small diesel engine with emulsified oil as fuel in terms of output torque, engine power, specific fuel consumption and emissions are described in chapter 5. A discussion on the prediction of power generation by mass transfer theory is given in chapter 6. Finally, chapter 7 presents the main conclusions of the present work and provides recommendations.

ลิ<mark>ปสิทธิ์มหาวิทยาลัยเชียงไหม่</mark> Copyright[©] by Chiang Mai University All rights reserved