CHAPTER I

INTRODUCTION

It has been recognized that the cost of energy from natural sources such as petroleum gas and oil is increasing due to high demand of energy, while the resources are limited. This research focuses environmental on development and investigation of a new renewable energy source which is friendly.

Biodiesel is one of the renewable energy sources which is obtained from renewable biomass feedstocks. It can be used in diesel engines as neat fuel or blended at various proportions with conventional fossil diesel fuel. It consists of mono-alkyl esters usually produced by transesterification of triglyceride with mono-alkyl alcohols, such as methanol [1-3]. Also known as alcoholysis, this reaction is commonly carried out in the presence of homogeneous base or acid catalysts. An acidic catalyst such as sulfuric acid slowly catalyzes the transesterification of triglyceride and a high molar ratio of methanol-to-oil is needed. Alkaline metal hydroxides such as KOH and NaOH are usually used as basic catalysts for this reaction. As the catalytic activity of the base is higher than that of the acid and acid catalysts are more corrosive, the base catalysis is preferred and it has been used commercially[3-6].

However, in the conventional operations, which use catalyst in liquid phase, removal of the catalyst after the reaction is a major problem, since aqueous quenching often results in the formation of stable emulsion and sponification, making separation of the methyl esters difficult. Moreover, large amount of wastewater is produced from separation and cleaning of catalyst and the products. Therefore, conventional homogeneous catalysts are expected to be replaced in the near future by environmentally friendly solid-phase heterogeneous catalysts mainly because of environmental constraints and simplifications in the existing processes [6-8]. At the laboratory scale, many heterogeneous catalysts have been developed to catalyze the

transesterification of vegetable oils with methanol. It has been reported that zinc oxide is widely used as a catalyst support [7-9]. More recently, Zhenqiang et al. [10] has reported zinc oxide loaded with alkali metal as an effective heterogeneous basic catalyst for soybean oil transesterification.

In the present work, the alkali metal salt loaded on ZnO was adopted as solid catalyst for the production of biodiesel via transesterification. The catalysts are characterized by X-ray diffraction (XRD), specific surface area determination via Brunauer-Emmett-Teller (BET) method, Thermogravimetric and Differential Thermal Analysis (TG-DTA), Scanning electron microscope (SEM) and Temperature-Programmed Desorption of CO_2 (CO_2-TPD). The biodiesel samples were analyzed by gas chromatograph (GC) equipped with a flame ionization detector.

The objectives of this research are listed as follows:

1. To investigate effects of type and content of loadings alkali metal loaded on zinc oxide, which was used as heterogeneous basic catalyst for soybean oil transesterification.

2. To study the effects of various reaction variables such as the amount of catalyst, methanol-to-oil molar ratio and the reaction time to find optimal condition for biodiesel production.

This thesis is divided into five chapters.

Chapter I is an introduction to this research.

Chapter II covers some background information regarding properties of ZnO, biodiesel, theory of transesterification reaction and reviews of the previous works carried out on transesterification using heterogeneous catalyst as well as analysis of methyl ester.

Chapter III describes experimental procedures, including the preparation of alkaline metal-loaded ZnO by impregnation method and biodiesel synthesis via transesrification.

Chapter IV In this chapter, the components of soybean oil were firstly discussed. The catalysts used in this work were characterized to overview the differences of their characteristics and properties. Finally, the results of all experiments were expressed in each parameter, which affected the transesterification.

Chapter V presents the conclusions of this research and makes the recommendations for future work.