CHAPTER I
INTRODUCTION

In the recent years, the world oil crisis is violence increase; it makes a cost of crude oil increasing continuously. The petroleum fuels, especially diesel fuel play an important role in the development of industrial growth, transportation, agricultural sector and to meet many other basic human needs. The diesel consumption in Thailand is expected to be rising every year. And the demand of import crude oil as well as petroleum products is also increasing. Moreover, with depletion of the world's petroleum reserves and the increasing of environmental concern, there is a great demand for alternative source of petroleum-based fuel. One of these alternative fuels is biodiesel, which still plays an important role in alternative fuel.

Biodiesel, which is defined as fatty acid methyl ester (FAME), is derived from renewable biological sources such as palm oil, soybean oil, cottonseed oil, rapeseed oil, various animal fats, and waste frying oil. The advantages of biodiesel over petroleum diesel are the improvement in lubricity, higher flash point, lower toxicity, lower emission of SO_x, CO, NO_x and biodegradability. Biodiesel, which is derived from vegetable oil, can be used as conventional diesel fuels in diesel engine because its properties are close to petroleum-based diesel fuel. It has proper viscosity, high cetane number, and no engine modifications are needed. There are many processes to produce biodiesel from vegetable oils such as pyrolysis, dilution, microemulsification, and transesterification. Among these, transesterification is the most commonly used method, as the product is cleaner compared to the product from other methods.

However, the use of biodiesel is limited by some of its characteristics. Two of important properties, which are suspected to be the limitations, are the oxidative stability and cold flow properties. The oxidative properties depend on the degree of unsaturation of the FAME chain (Kapila *et al.*, 2009). If the degree of unsaturation is higher, the oxidative stability of FAME will be lower. On the other hand, if the degree of saturation is too high, the cold flow properties will be bad.

Therefore, partial hydrogenation will be use to upgrade the properties of biodiesel, especially the oxidative stability. This method can increase oxidative stability, storage properties, However is not influence to cold flow property (Nicolaou *et al.*, 2009). In 2006, Snare and co-worker studied the deoxygenation of stearic acid to biodiesel, the result showed that Pd supported on carbon is the best catalyst in term of high activity and high selectivity compare to other metal catalyst on different supports. However, Pd particles are mainly supported on mesopores rather than micropores. And Pd particles supported on mesopores are suggested to play an important role in catalytic activity for hydrogenation (Tamai *et al.*, 2009). From this reason, carbon aerogel was being used as a support for the catalyst in this study. This is because carbon aerogel are highly mesoporous solid materials with extremely low densities, large open pore, and high specific surface areas; moreover, its pore size can be controlled by changing starting material.

The purpose of this work is to study the partial hydrogenation of poly-unsaturated fatty acid methyl ester for biodiesel upgrading using Pd supported on varies types of carbon support. which are Pd/carbon aerogel, Pd/activated carbon and Pd/granule activated carbon. The catalysts were prepared by incipient wetness impregnation method. The performance of Pd/carbon aerogel, Pd/activated carbon and Pd/granule activated carbon catalyst in the partial hydrogenation of polyunsaturated FAME was studied. The percentage of palladium loading and the size of catalyst were evaluated.