CHAPTER I
INTRODUCTION

Petroleum is the major feedstock for liquid fuel that is used in industry and transportation. The petroleum consumption has surged during the twentieth century because of the rise of the automobile industry using petroleum as an energy resource and the increase in the world population. Due to the concern of petroleum feedstock availability, the increase in petroleum prices, and the environmental concerns about fossil fuels combustion, renewable fuel has received much attention in the past decade.

There are a number of sustainable alternative energy sources, including hydropower, geothermal energy, wind energy, solar energy, and biomass. There have been many reports on the use of biomass for the production of chemical products and biofuel. Biodiesel is one of the promising alternative energy sources because it can be produced from renewable raw materials, such as vegetable oil and animal fat.

At present, biodiesel can be a substitute for the conventional fuels because of its environmental benefits. Biodiesel is referred to fatty acid methyl ester (FAME) or mono-alkyl esters of fatty acids derived from the conversion of vegetable oil or animal fat via transesterification process. Nevertheless, the product obtained from this process might cause problems to the engine because of its relatively high viscosity, especially at low temperature. This is the result of the high content of oxygen in the product. Therefore, the direct upgrading of vegetable oils or animal fat, which is the triglyceride-containing feedstocks, into hydrocarbons has been proposed.

The deoxygenation of vegetable oils or animal fats at elevated temperature and pressure in the presence of a heterogeneous catalyst seems to be an interesting process. The product of this reaction is called renewable diesel, green biodiesel or hydrogenated biodiesel. There are many advantages of deoxygenation over transesterification process, including compatibility with infrastructure of conventional refinery process, compatibility with engines and fuel standards, raw materials flexibility, and lower processing costs. In addition, the accumulation of pollutant, such as NO_x, SO_x, and particulate matters, in the atmosphere is less.

In the past years, there have been a few research works successfully producing the hydrogenated biodiesel from pure vegetable oils (i.e. palm oil, corn oil, sunflower oil, and jatropha oil) or co-processing with petroleum oil. However, the report on the utilization of animal fat, which is also considered as the alternative feedstock, is still limited.

The purpose of this research is to study the effect of catalyst supports that play an important role in the deoxygenation of animal fat for the production of hydrogenated biodiesel. The activity and selectivity of the catalysts were evaluated. The various catalyst supports can be divided into two groups by the different metals, which are Pd-based catalysts (i.e. Pd/Al_2O_3, $Pd/F\text{-}Al_2O_3$, Pd/SiO_2, Pd/TiO_2, Pd/C, and Pd/KL) and NiMo-based catalysts (i.e. $NiMo/Al_2O_3$, $NiMo/F\text{-}Al_2O_3$, $NiMo/SiO_2$, $NiMo/TiO_2$, NiMo/C, and $NiMo/CeO_2\text{-}ZrO_2$).