# CHAPTER I
# INTRODUCTION

At present, the energy consumption has surged due to the rise of the world population which led to the sudden decrease in energy supply especially in fossil fuel. There are many concerns with the use of fossil fuel, including limited fuel reserves, unpredictable crude oil price, and unwanted gas emission, e.g. $SO_X$ and $NO_X$. The number one blame of these concerns goes to the emission of diesel engines from automobiles and industrial equipments that use fuel.

From these problems, the development of alternative and sustainable energy is important to satisfy the demand of energy consumption, as well as to reduce the unwanted gas emission. There are several sustainable alternative energy sources, including hydropower, thermal energy, wind energy, solar energy, biomass, and biofuels. The most prominent of these energies which can compensate diesel fuel is biodiesel as it has same performance as regular fuel engines, emit less pollution, and can be produced from renewable raw materials.

Biodiesel is referred to the fatty acid methyl ester (FAME) or mono-alkyl esters of long-chain fatty acids derived from vegetable oils or animal fats via tranesterification process. Biodiesel is biogradable and produces lower level of air pollutants than fossil fuels. Notwithstanding, biodiesel price is usually higher than the fossil fuels and it has some undesired properties, e.g. high viscosity and low heating value which may cause engine problems especially at low temperature. These properties are the result of the content of oxygen in the product. However, the hydrocarbon like biodiesel which is called "renewable diesel", "green diesel", or "hydrogenated biodiesel" is also available.

The hydrogenated biodiesel can be produced via the hydrodeoxygenation of triglyceride-containing feedstocks at elevated temperature and pressure (300-450 $^{o}C$ and 500-2000 psia) in the presence of conventional hydrotreating catalysts and hydrogen. There are many advantages of hydrodeoxygenation over tranesterification, including 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 decreased.

There have been many research works focused on biodiesel and biodiesel production from vegetable oil (i.e. palm oil, corn oil, and jatropha oil) and some research focused on the effect of various impurities in feedstocks which reduce the activity of hydrotreating catalysts. However, the report on the utilization of animal fats, which are considered as the alternative feedstock, is still limited. The objective of this research is to study the effect of triglyceride-based feedstocks (i.e. jatropha oil, palm oil, beef fat, pork fat, and chicken fat) on the production of hydrogenated biodiesel over 1 wt% $Pd/TiO_2$ catalyst. The activity and selectivity of the catalysts and major impurities in feedstocks were investigated.