CHAPTER I
INTRODUCTION

Currently, the major source of energy is fossil fuel. Unfortunately, there are several concerns with the use of fossil fuels, including limited fuel reserve, unpredictable crude oil price, and unwanted gas emission, e.g. SO_x and NO_x. As the energy demand continues to increase, and the fossil fuel contains sulfur and nitrogen-containing compounds that can cause damage to the environment when it is burnt, the development of alternative and sustainable energy is important to satisfy the demand of energy consumption, as well as to reduce the toxic emission.

There have been many sustainable alternative energy sources, including hydropower, thermal energy, wind energy, solar energy, biomass, and biofuels. Biodiesel is one of the most interesting biofuels as it can replace fossil fuels in transportation sector. Biodiesel is safe and biodegradable. It produces lower levels of air pollutants than fossil fuels. However, biodiesel still has some undesired properties, e.g. high viscosity and low heating value. This may cause engine problems, especially at low temperature. However, alkane (non-oxygenate) biodiesel is also available. The hydrocarbon-like biodiesel is called "renewable diesel", "green diesel" or "hydrogenated biodiesel".

Biodiesel is referred to fatty acid methyl ester (FAME) or mono-alkyl esters of fatty acids derived from bio-oils, such as vegetable oils and animal fats. Biodiesel is mainly produced via a transesterification reaction. It is the fastest growing alternative fuel in the world. Biodiesel is safe and biodegradable, and produces lower levels of air pollutants than fossil fuels. However, biodiesel is usually more expensive than the fossil fuels, and it has some undesired properties, e.g. high viscosity and low heating value. This may cause engine problems, especially at low temperature. However, alkane (non-oxygenate) biodiesel is also available. The hydrocarbon like biodiesel is called "renewable diesel", "green diesel" or "hydrogenated biodiesel".
Hydrogenated biodiesel can be produced by hydrotreating triglyceride or fatty acid under standard hydrotreating conditions (300-450 °C and 500-2000 psia) with conventional hydrotreating catalysts (sulfided $NiMo/Al_2O_3$, $NiMo/\gamma\text{-}Al_2O_3$ or $CoMo/\gamma\text{-}Al_2O_3$) via the catalytic hydrodeoxygenation reaction. In previous studies,

the hydrodeoxygenation of vegetable oil to hydrocarbons has been investigated in many aspects. However, the study of animal fats as feedstocks is still limited in open literatures. Therefore, the objective of this work is to investigate the deoxygenation of animal fats to hydrogenated biodiesel over different mono- and bi-metallic catalysts, including Ni, Ni-Mo, Ni-Rh, Ni-Ru, Ni-Ir, Ni-Cu, Ni-Co, Ni-W, Cu, Cu-Mo, Cu-Co, Cu-W, Cu-Zn, Pt, and Pd, supported on Al_2O_3. The product selectivity and stability of each catalyst will also be investigated.