CHAPTER I
INTRODUCTION

The increasing energy consumption and depleting fossil fuels are now considered as the critical issues. In addition, negative environmental impact from using fossil fuels has also been highly concerned. Therefore, research work on renewable energy has received much attention in the past several decades. There are various renewable energy sources i.e. water, wind, solar, geothermal, and biomass etc. that play an important role in the future of energy demand (Pandey, 2009). One of the potential alternative renewable energy sources to sustain petroleum-based energy is vegetable oils. Vegetable oils, such as jatropha, palm, sunflower, soybean, and rapeseed oils, are the major renewable feedstock for biodiesel production.

Biodiesel is typically defined as fatty acid methyl esters (FAMEs) or mono-alkyl esters of fatty acids derived from bio-oils such as vegetable oils and animal fats. It is produced via transesterification of triglycerides-presenting feedstock with alcohol. The advantages of biodiesel over petroleum-based diesel are biodegradability, nontoxicity, low green house gas emission (Pandey, 2009), CO_2 neutrality, and low sulfur and metal content (Gandarias *et al.*, 2008). However, biodiesel produced from transesterification process has some drawbacks that limit its utilization such as poor cold flow properties and increased NO_X emissions (Maher and Bressler, 2007). In addition, due to high oxygen content in biodiesel results in high viscosity, corrosiveness, poor thermal and chemical stability, immiscibility with fossil fuels, and low heating value (Yang *et al.*, 2009). Accordingly, bio-oils upgrading by removal oxygen from oxygenated molecules is the key challenge to improve quality of bio-fuel. The catalytic deoxygenation of triglyceride to produce renewable diesel or hydrogenated biodiesel is the promising process.

Hydrogenated biodiesel can be produced by directly converting triglyceride-containing vegetable oils to alkanes via catalytic deoxygenation over conventional hydrotreating sulfided catalysts like $NiMo/Al_2O_3$ and $CoMo/Al_2O_3$. There are many advantages of this process over transesterification, including compatibility with infrastructure of conventional refinery process, compatibility with engines and fuel standards, lower processing costs and raw materials flexibility (Stumborg *et al.*, 1996). Also, the hydrocarbons obtained from this process have similar or even better properties to conventional diesel. Furthermore, feedstock of hydrogenated biodiesel production is commonly available in local area. For example, jatropha and palm are commonly grown in Thailand.

The main aim of this work is to study the effect of active metal catalysts on the deoxygenation performance for the production of hydrogenated biodiesel from jatropha. The metals studied are Pd, Pt, Cu, NiCu, NiMo, and CoMo on Al_2O_3 support. The catalytic activity, selectivity and stability of the catalysts are also studied.