CHAPTER I
INTRODUCTION

The energy demand of the world is being dramatically increased due to more population, industrial development, agricultural sector and transportation. The petroleum fuel has been depleting day by day. Therefore, finding out an alternative source is very important. Biodiesel seems appropriate because it is made from renewable biological sources. It is biodegradable and nontoxic, has low emission profiles, un-burnt hydrocarbon and particulate matters, higher cetane number as compared to petroleum based diesel and so is environmentally beneficial (Ma *et al.*, 1999).

Biodiesel or fatty acid methyl ester (FAME) can be produced from vegetable oils or animal fats with methanol via the transesterification reaction. The fatty acid composition of feedstock has a significant impact on the properties of the biodiesel obtained because the fatty acid profile in the feedstock is identical to that of the resulting biodiesel. The main problem of biodiesel consisted of oxidative stability and cold flow properties. Polyunsaturated fatty esters leads to low oxidative stability and low cetane numbers, while high content of fully saturated fatty esters has a negative effect on cold flow properties. Monounsaturated methyl esters such as methyl oleate (18:1) and methyl palmitoleate (16:1) are the ideal components of biodiesel. Therefore, partial hydrogenation of polyunsaturated FAMEs to monounsaturated compounds can substantially increase fuel quality (Shin *et al.*, 2013). In 2011, McArdle and co-worker studied the influence of support and metal content on the catalytic properties of Pd and Pt for hydrogenation, the result showed that Pd-based catalysts are the most active compared to commercial Ni and the Pt catalysts. However, Pt catalysts showed the best selectivity towards *cis*-isomer formation. In 2009, Tonetto and co-worker studied the use of two edible modifiers of the selectivity, magnesium glycinate, and ethyl benzoate for a decrease in the *trans*-isomer formation during the partial hydrogenation of sunflower oil on a supported-Pd catalyst, the result showed that ethyl benzoate promoted the formation of *trans*-isomers, whereas the magnesium glycinate diminished it. In 2012, Numwong and co-worker studied the effect of pore size of the SiO_2 support with a variety of pore sizes: Q3, Q10, Q30, and Q50 with pore diameters of 3, 5, 30, and 50 nm, respectively. The result showed that mesoporous silica (SiO_2) with an average pore diameter of 30 nm (Q30) exhibits the highest hydrogenation activity.

The purpose of this research is to study the effect of metal type on *cis-trans* selectivity and stability of the catalyst for partial hydrogenation of FAMEs. By using different metals; Ni, Pd, and Pt supported on mesoporous SiO_2 support (Q30) which the catalysts were prepared by incipient wetness impregnation method. Furthermore, the effect of modifier of the magnesium nitrate on the *trans*-isomer formation during the partial hydrogenation was investigated. Additionally, the effect of reaction temperature was also observed. The dispersion of metals on support, size of catalysts, and surface area of catalysts were examined. Moreover, the important fuel properties of partial hydrogenated biodiesel, particularly oxidative stability, and cold flow properties were measured.