CHAPTER I
INTRODUCTION

The alternative fuels from vegetable oils are an option for renewable fuels production to replace or partial substitute diesel oils. The vegetable oils have the same comparable physical and chemical properties to those of diesel oils thus they have comparable performance to utilize in diesel engines (Pryde, 1983; Ryan *et al.*, 1984; Altin *et al.*, 2001). However, usability of neat vegetable oils can lead to engine stability problems because of theirs viscosity being higher than that of diesel such as a poor atomization of fuel. There are four methods that can reduce viscosity of vegetable oils: (1) vegetable oil/diesel blends, (2) pyrolysis, (3) vegetable oil transesterification to fatty alkyl esters or biodiesel, and (4) vegetable oil-based microemulsification (Balat, 2008). Transesterification is widely used method to produce biofuel, known as biodiesel. Transesterification reaction of triglycerides with an alcohol in the presence of a catalyst produces fatty acid methyl ester (FAME) as a main product and glycerol as a co-product. In addition, a by-product, glycerol requires a complex process to purify, resulting in additional energy consumption and environmental problems. (Galan *et al.*, 2009; Pagliaro *et al.*, 2007).

Due to the disadvantages of the transesterification process, microemulsions of vegetable oils can be considered as an alternative method to omit the environmental burden. A microemulsion biofuel based vegetable oils can be formulated with supplementary viscosity reducers such as methanol, ethanol or butanol (Goering *et al.*, 1984; Ma *et al.*, 1999). This biofuel is a transparent and thermodynamically stable of mixed liquid fuels classified into Winsor Type II microemulsion (W/O) where the polar alcohol phase is solubilized in reverse micelle occurring in the non-polar phase. Ethanol has been used as a polar phase to produce microemulsion fuels. The benefit of the use of ethanol is that it is a renewable energy source which produces from very common crops such as sugar cane and corn. However, ethanol has an extremely low cetane number whereas diesel engines prefer high cetane number fuels. Therefore, butanol has been observed due to its comparable fuel property. Butanol is a renewable biofuel similar to ethanol but it has higher heating value and cetane number, more miscibility with diesel and less hydrophilic moiety compared to those of methanol and ethanol (Altun *et al.*, 2011; Sukjit *et al.*, 2013; Yoshimoto *et al.*, 2013).

Since alcohol-diesel blends are limited indirect blend technology because they are immiscible at wide range of temperature. This study, nonionic surfactant is used as an emulsifier to stabilize the miscibility of ethanol and diesel by Winsor Type II microemulsion. The nonionic surfactant has been found as an appropriate system for microemulsion formation or many reasons (Arpornpong *et al.,* 2014). Methyl oleate (MO) is used as a nonionic surfactant which have been found that it can dramatically decrease the bulk viscosity and produce uniformly size of microemulsion droplets while uses the least amount of surfactant for solubilizing ethanol-in-oil in the microemulsion system. Octanol is used as a cosurfactant, due to the fact that it can work well with methyl oleate (Arpornpong *et al.*, 2014). For more practical usability of chemicals as raw materials that can reduce viscosity by microemulsion technique, palm oil methyl ester (POME) known as biodiesel can be used as a surfactant for reverse micelle microemulsion. Because POME is an amphiphile molecule contained hydrophilic group of ester and hydrophobic group of alkyl chain length. Evenmore, It is naturally biodiesel is naturally derived products which can help reduce dependency on foreign oil. Thefore, the use of POME or Biodiesel as an emulsifier in microemulsion biofuel can directly use with less engine problems.

The main objective of this research is to formulate single phase reverse micelle microemulsion consisting of palm oil/diesel blend for stabilizing alcohol in oil phase. For more details of the work are devided in four topics including;

1. To study the effect of surfactant structure on phase behavior of palm oil/diesel blends.
2. To study the effect of the blending ratio (vegetable oil/diesel blends and ethanol/butanol) that appropriate for form single phase reverse micelle microemulsion of palm oil/diesel blends.

3. To study the use of refined bleached deodorized palm oil (RBDPO)/diesel blends as an oil phase on the minimum surfactant used to formulate single phase microemulsion and kinematic viscosity study compare to palm olein/diesel blends.
4. To determine the fuel properties of the microemulsion biofuels including; kinematic viscosity at 40 ^{o}C, gross heat of combustion, cloud point, flash point, and electrical conductivity in comparison to those of the diesel fuel.