

CHAPTER I

INTRODUCTION

As continuously expanding economy of Thailand, the subsequent increasing energy demand, hence, the requirement of alternative fuel is of primary concern. Diesel fuels play an important role in the industrial economy of the country. These fuels have been widely used as power of engineering machinery, automobile, and shipping equipment for its excellent drivability and thermal efficiency [Xing-cai *et al.*, 2004]. Thailand, an oil-importing country, has an abundance of agricultural resources that are suitable as raw materials for biofuels. For more than two decades, His Majesty the King has been embarking Thailand on the experimentation with bio-based fuels, such as alcohol-blend gasoline and diesel. Such utilization of agricultural product based energy will help stabilize commodity prices, decrease the nation's energy dependency on foreign oil and also increase farmer income.

Development of bioenergy especially biofuels such as ethanol and biodiesel for use in the transportation sector, is one of the top agenda. A national ethanol program to promote blending 10% of ethanol, produced from sugarcane and cassava, in gasoline without significant modification to engines has shown encouraging results. Also, the blend between ethanol and diesel called "diesohol" is being tried on public transport vehicle. The use of ethanol in diesel fuel can yield significant reduction of exhaust emission in terms of CO and NO_x [Ajav *et al.*, 1999] and particulate matter (PM) emissions for motor vehicles [He *et al.*, 2003; Xing-cai *et al.*, 2004; Hansen *et al.*, 2005]. However, there are many obstacles of using ethanol in diesel engine [Xing-cai *et al.*, 2004], which are listed as follows:

- Ethanol has limited solubility in diesel fuel. Phase separation and water tolerance in ethanol-diesel blend fuel are crucial problem.
- Ethanol fuel has an extremely low cetane number, whereas the diesel engine is preferred to high cetane number fuels which makes auto-ignition easily and gives small ignition delay.

- The dynamic viscosity of ethanol is much lower than that of the diesel fuel, so that the lubricity is a potential concern of ethanol-diesel blend fuel.

According to these limitation, ethanol-diesel blend preferably need additives. Biodiesel is known to act as an additive or emulsifier due to its potential to improve the solubility of ethanol in diesel fuel over a wide range of temperatures [Makareviciene *et al.*, 2006; Sendzikiene *et al.*, 2006] and the blend properties.

The use of higher alcohol, propanol and butanol, could solve the problem with fuel instability at low temperature according to more solubility in diesel. Butanol is as preferable as ethanol because it can be produced from renewable resources via fermentation of sugar and starch.

Thus, this work was focused on studying the use of biodiesel as an additive in stabilizing ethanol-diesel and butanol-diesel blends. The main objectives are to investigate the phase stability of ethanol-biodiesel-diesel and butanol-biodiesel-diesel three-component systems at different component concentrations, the dependence of solubility upon temperature and finally to evaluate some basic fuel properties such as cetane number, flash point, pour point, density at 15 °C, kinematic viscosity at 40 °C and heat of combustion.