CHAPTER I
INTRODUCTION

Nowadays, the fossil fuel prices are continue growing up. They are not only expensive but they are also the major causes of global warming problems. Furthermore, The main cause of global climate change is a greenhouse gas emissions that is increasing and it becomes a critical of energy and environmental policy issues. The transportation is a major section that creates greenhouse gas. Gasoline and diesel fuels are displaced by bio-fuel. It is away out of this problems and it could develop the transport system effectively. Consequently, it is possible to reach a sustainable transport system. Bio-fuel has a large potential of reducing CO_2 emissions throughout the fuel cycle, as the vehicle combustion of bio-fuel does not contribute to net emissions of CO_2. An increased use of bio-fuels reduces the oil import also.

Bio-fuel is a fuel produced from renewable biomass materials, commonly used as an alternative, cleaner fuel source. Now, bio-fuel used is bio-ethanol, bio-butanol, biodiesel, biogas and vegetable oil. Because transportation is the major section that creates greenhouse gas and it is also the largest sector of energy consumption in Thailand. So this work will focus on mainly bio-ethanol to represent the bio-fuel. Bio-ethanol can be produced from many sources including sugar substances (such as sugarcane juice and molasses), starchy materials (such as wheat, corn barley, corn barley, potato and cassava), and lignocellulosic materials (such as forest residuals, straws and other agricultural by-products). This work interested in bio-ethanol that is derived from potential biomass in Thailand, such as molasses.

Thailand is the largest producer of sugarcane in South-East Asia, also is a country to export molasses largest in the world. Production of sugarcane is 75 million tons per year, which will produce 7.5 million tons of sugar and 3.75 million tons of molasses. Around 1.8 million ton of molasses export to other countries and 1.4 million ton of molasses are estimated to use as raw materials in various industries in the country such as liquor industry, animal food production, monosodium glutamate (MSG) production, vinegar production, etc. The approximate 0.5 million tons of molasses are used in ethanol production to produce bio-ethanol fuel grade (99.5% purity), 1 ton of molasses can produce ethanol around 260 liters, so total amount of

ethanol gain from molasses are 130 million liters per year; actual value around 138 million liters per year (www.talentfluid.co.th). Considering the process, molasses can be fed directly to the fermentation step without pretreatment step, so the plant costs are lower than starch and lignocellulosic feed. But there is demerit of the molasses used in the ethanol process which is the fluctuation of raw material costs. On the other hands, there are several advantages for example, the farmers have more sources to sale raw materials, these raw materials can produce itself by never run out, this kind of industry creates jobs for farmers to reduce unemployment rate and it is a distribution gateway to the countryside, and it can increase turnover in terms of economics, etc. In 2009, total production of gasoline in Thailand is 8,852.1 million liters, if considering gasohol that contains ethanol 10% which is 885.21 million liters ethanol need to be adding in gasoline (www.eppo.go.th). Now, Thailand has only 399 million liters of ethanol that produce from biomass per year (1.33 million liters per day), but the Energy Ministry has targeted the production of ethanol at 9 million liters per day (2,700 million liters per year) in 2023(Bloyd, 2009). If compare to conventional gasoline, the production and use of sugarcane ethanol can reduce emission of carbon monoxide (CO) 35 percent, reduce derivatives of nitrogen (NO_x) 42 percent, reduce NMHc 43 percent, reduce particles suspended in air (Particulate matters, PM) 39 percent and reduce carbon dioxide (CO_2) has to 79 percent (Suksaroj, 2009). Using biomass as process fuel makes it possible to reduce greenhouse gas emissions (CO_2 equivalent) to near zero because CO_2 was consumed when biomass glowed. The efficiency of bio-fuel in terms of energy and environmental aspect, Life Cycle Assessment (LCA) is required to evaluate environmental impact of the bio-ethanol process. This assessment consists of two main stages. The first is collecting the data involving making detailed measurements (from the farming of raw materials, manufacture, and distribution to disposal). The second is characterization of those data into environmental impact categories and interpretation of the results which can help manufactures analyze their process and improve their products.

The objectives of this work comprise of three main parts. Firstly, to design bio-ethanol conversion based on molasses as raw material. Secondly, to develop the process to be more sustainable by using sustainability analysis as a tool to generate new design alternatives. And finally, to make use of alternative fuels most efficiently

in both energy and environmental aspects, Life Cycle Assessment (LCA) is utilized to evaluate environmental impact, focusing on global warming potential (GWP as kg CO_2-equivalent).