CHAPTER I
INTRODUCTION

The continuous expansion of the world economic results in the high demand of crude oil which affects the oil price to rise steadily over the past several years. This fossil fuel is not only expensive, but it is also the major cause of global warming from its combustion which generates CO_2, one of the most important greenhouse gases. Thailand is heavily dependent on crude oil which accounts 42% of the total primary energy supply and it is used mostly in transportation sector especially diesel and gasoline. In response to this, the Thai government has been trying to promote the use of alternative fuels. Biofuels such as bioethanol have become more important with the advantages of having lower price and less greenhouse gas emissions.

As being an agricultural country, Thailand has a massive potential of agricultural goods as well as agricultural residuals. A large amount of these residues are lignocellosic materials which can be utilized as raw materials to produce bioethanol fuel grade (99.5% purity). The process simulation is performed to design bioethanol conversion process from lignocellulosic material based on the facilities in Thailand. In order to develop the process to be more sustainable, sustainability analysis is needed to generate new design alternative. The sustainability analysis tool, SustainPro, is used in the analysis of indicators, sustainability metrics, and safety indices which are further analyzed to provide directions for improvements. Alternative designs are generated both in process and energy efficiency aspects.

To make use of alternative fuels most efficiently in both energy and environmental aspects, Life Cycle Assessment (LCA) can be used to evaluate environmental impact of the bioethanol process. This assessment consists of two main stages. The first is to collect the data which involves making detailed measurements—how much energy and raw materials are used, and how much solid, liquid and gaseous waste is generated—during the manufacture of the product, from the farming of raw materials used in its production and distribution, through to its use, possible reuse or recycling, and finally disposal. The second is the characterization of those data into environmental impact categories and interpretation

of the results which can help manufacturers analyze their processes and improve their products, and also enable consumers to make more appropriated choices.

The purposes of this research are to study on the potential of lignocellulosic materials for bioethanol production in Thailand and to develop a sustainable process design of the bioethanol conversion from selected materials. The environmental burden associated with the process is to be assessed including energy and materials used and emissions to the environment based on life cycle approach. Environmental impact categories considerations in this study are then eventually evaluated based on CML 2 baseline 2000 and Eco-indicator 95 method. Finally, the comparison of all results between the base case design and alternatives is also performed.