CHAPTER I
INTRODUCTION

This chapter contains rational and problems, objectives of the research, scope and limitation of the research and anticipated outcomes, respectively.

1.1 Rational and problems

Nowadays, a continuous increase in oil price as a result of global energy crisis is an urgent problem to be solved in many countries (Ayhan, 2005). Kosaric and Vardar (2001) reported in this instance, many issues of energy conservation become an interest. The economical use of energy is the first issue which can decrease the energy expense as a decrease of crude petroleum fuel imported from Organization of Petroleum Exporting Countries (OPEC). In addition, an alternative fuel from renewable resource is also be a current subject for energy conservation in which it can replace petroleum fuel detectable resource, which is normally used at a present (Wyman, 1994).

Now, a renewable energy such as ethanol was used in Brazil and USA as a fuel by mixing fuel oil possesses for the advantage of octane number increase in the fuel oil (Laluce, 1991). Morais et al. (1996) has suggested that the ethanol can be produced through fermentation of lignocellulosic biomass such as sugarcane and corn by bioethanol producing microorganism. Lignocellulosic biomass is a potential source of cheap sugars for producing fuels and chemicals, and a pretreatment stage is essential to make the cellulose accessible to the hydrolysis by dilute acid (Mohagheghi et al., 2004). The utilization of lignocellulosic biomass has been closely associated with a new technological concept, so called Biorefinery (Cazetta et al, 2007). Murphy and McCarthy (2005) showed that the substitution of imported fuel oil (700,000 barrel d^{-1}) by 99.5% ethanol at the rate of 15% will result in decrease of imported fuel oil of 100,000 barrel d^{-1}. Therefore, the ethanol is one of the most important renewable fuels contributing to the reduction of negative environmental impacts generated by the utilization of fossil fuels (Dale, 1999).

Thailand is agricultural based country which is plentifully agricultural wastes such as sugarcane and cassava that can be used as material sources for ethanol fermentation (Oranut, 1999). However, each of these wastes has its own demand in the other ways. Therefore it is interesting toward searching for a new material which has high content of lignocellulosic biomass and possesses the less demand for supplying the ethanol production process, so called Cellulosic ethanol (Lin and Tanaka, 2006). Both of durian and pineapple peels are the agricultural waste which has richly lignocellulosic biomass and they are abundant agricultural waste in Thailand. O'Gara et al. (2004) reported the durian and pineapple peel were utilized in food animals and fertilizers. The preliminary studies in this work showed that durian and pineapple peels contain a plenty of cellulose, hemicelluloses, lignin and a few ester compounds. Therefore the durian and pineapple peel are interesting biomass resource for the bioethanol production.

However, the production of cellulosic ethanol is a complicated process. Reddy and Reddy (2005) described the transformation of biological resources as rich energy crops required the optimum conditions for conversion as cellulosic ethanol by fermenting organisms. Box et al. (1978) reported this process were performed under the principles of statistical methodology of response surface, that is, a statistical model widely used to study an aggregate effect of several variables and to seek optimum conditions for a multivariable system. Maiorella et al. (1984) showed that the aqueous solutions of cellulosic ethanol should be concentrated for obtaining anhydrous cellulosic ethanol. This product has to be dehydrated and used as oxygenate for gasoline. The complexity of this process partly explained why fuel cellulosic ethanol has not played a leading role in comparison to cheaper oil derived fuels (Cardona and Oscar, 2007). Due to rising environmental concerns and the periodic crises in some of the larger oil exporting countries, has cellulosic ethanol become a viable and realistic alternative in the energy market (Bayrock and Ingledew, 2007). And moreover, Boerjan et al. (2003) found that main components of lignocellulosic biomass and type of microorganism can also affect to the cellulosic ethanol production. Thomas and Rose (1979) described the non pretreated lignocellulosic biomass and *Saccharomyces cerevisiae* were used for cellulosic ethanol production with the advantage of a simple cellulosic ethanol production. It can grow in aerobic conditions (Narendranath and Power, 2005) and used in baking and brewing industrials (Lynd et al., 1991). So, it is one of the cellulosic ethanol producing organisms used in industrial processes (Grosz and Stephanpoulos, 1990). However, it cannot convert all of main component in non pretreated lignocellulosic biomass to be cellulosic ethanol (Jones et al., 1981). In this work, the hydrolyzed solution of durian and pineapple peels was subjected to be cellulosic ethanol by using batch fermentation. The preparation and characterization of the cellulose obtained from Technical Association of Pulp and Paper Industrial T203 test method (TAPPI T203) for the enhancement of the bioethanol production was investigated.

1.2 Objectives of the research

Main objective:

1.2.1 To produce cellulosic ethanol from durian and pineapple peel by *S. cerevisiae* under optimal condition in batch fermentation.

Minor objectives:

1.2.2 To study the main components in durian and pineapple peel as raw materials for cellulosic ethanol production.

1.2.3 To determine and characterize of the cellulose, hemicelluloses and lignin after treating processes via TAPPI T203 test method.

1.2.4 To determine the total reducing sugars in the hydrolyzed solution.

1.2.5 To consider cellulosic ethanol and its yield after fermentation.

1.3 Scope and limitation of the research

1.3.1 Removable processes of main components in raw durian and pineapple peel were studied.

1.3.2 The chemical structure in terms of cellulose, hemicelluloses and lignin in each removal steps was characterized and identified by FTIR technique and their determination via TAPPI T203 test method.

1.3.3 The content of the total reducing sugars in hydrolyzed solution was determined using dinitrosalicylic acid (DNS) method.

1.3.4 The quantity of the cellulosic ethanol was measured using by a Gas Chromatograph equipped with a Flame Ionization Detector under the optimal conditions.

1.4 Anticipated outcomes

1.4.1 To obtain the removal steps of the raw durian and pineapple peel for cellulosic ethanol production under optimal conditions.

1.4.2 To get the various samples for using in batch fermentation and the cellulosic ethanol for easy purification.

1.4.3 To obtain determination the content of the total reducing sugars in the hydrolyzed solution with dinitrosalicylic acid method.

1.4.4 To get the determination of cellulosic ethanol in fermentation broths.