CHAPTER I

INTRODUCTION

Ethanol is a promising alternative energy of Thailand, an agricultural country, because it is produced from agricultural products. At present, Thailand produces fuel ethanol from cassava and molasses. But both substrates are relatively expensive resulted in high price of ethanol produced compared to gasoline prices. To reduce production cost of ethanol, other cheap raw materials are investigated. There are many studies focusing on evaluation of agricultural wastes as substrate for ethanol production. However, agricultural wastes have a problem of amount controlling and gathering. So this research focusing on evaluation of purple guinea grass (*Panicum maximum* CV TD 53) as substrate for ethanol production. The purple guinea grass is a popular animal feeding grass in Thailand. It grows well on a wide variety of soils and under light shade of trees and bushes. Therefore, it can grow all over Thailand and can be inserted in empty space of fully growing agricultural area, such as pararubber plantation ditches. Purple guinea grass is resistant to drought, but responds quickly to fertilizer and watering. It gives a very high yield (1.5 – 4.0 tons/rai) which lasts for 10 years or longer and also easy harvesting (Ria, 2001). The purple guinea grass has no problem of amount due to controllable cultivation area, less gathering cost. In bioconversion of the purple guinea grass-lignocellulose to fermentable sugar, the purple guinea grass should undergo pretreatment to increase its enzymatic digestibility. Three kinds of the pretreatments are reported: 1) biological pretreatment by using lignin-degradation microorganisms for partial delignification: This method takes long time and is not cost effective. 2) chemical pretreatment by using, for example sodium hydroxide , sulfuric acid or lime; the acid solubilizes hemicellulose , decreases cellulose crystallinity while alkaline causes structure swelling. Both methods improve accessibility of the cellulose component to cellulases. 3) Physical pretreatment by cutting, milling and heating: which reduces substrate particle size (increases the available surface area), decreases in cellulose crystallinity and degree of polymerization. Disadvantage of the physical pretreatment is high energy requirement (Karimi *et. al.*, 2006; Taherzadeh and Karimi, 2007). The best pretreatment is a combination of physical and

chemical method. An important step for lignocellulosic ethanol production is pretreatment step which enhances accessible of enzyme to substrate resulting in an increase of fermentable sugars and ethanol, the process product (Taherzadeh and Karimi, 2007).

The objective of this work is to develop methods for pretreatment, enzymatic saccharification of purple guinea grass, then ferment the resultant fermentable sugar to ethanol. An efficiency of dilute sulfuric acid and lime pretreatment method on cellulase susceptibility of the pretreated purple guinea grass was compared. Enzymatic saccharification of the pretreated purple guinea grass was optimized. And the hydrolysate was fermented to ethanol by *Saccharomyces cerevisiae* by both separate hydrolysis and fermentation (SHF), and simultaneous saccharification and fermentation (SSF) methods.