CHAPTER I
INTRODUCTION

In recent years, scientists attempt to investigate novel ways to replace fossil fuels. Lignocellulosic biomass has received much attention as the replacement for the conventional fossil fuels due to its low cost, renewability, and abundance in nature. Since the most popular sources of bioethanol are from food crops such as corn, sugarcane, potato, and cassava, many people become more concerned with increasing demand for food supply. Thus, researchers strive to discover other plants in order to avoid jeopardizing the global food source.

The interest in lignocellulosic biomass to produce ethanol has continuously grown as the result. It has the potential to substitute food crops in the production of bioethanol. With rapid growth in addition to low fertilizer and herbicide requirements, grasses have been most highly recommended as energy crops. Grasses possess high tolerance against poor soil and harsh climates. Many researchers have been scrutinizing grasses for their high levels of cellulose (Lee *et al.*, 2008). One of the grass candidates for bioethanol production is mission grass (*Pennisetum polystachion*). Mission grass is ubiquitous in South East Asia regions. It has short growth period; and it can be easily cultivated and transported.

Mission grass is subjected to undergo alkaline pretreatment to remove lignin. Then cellulose and hemicellulose are hydrolyzed by dilute acid pretreatments assisted by microwave. Hydrolytic enzyme such as cellulase is utilized to further increase glucose yield. During the hydrolysis process, various compounds in addition to sugar are released (Palmqvist *et al.*, 2000). The presence of the released compounds such as furan derivatives, aliphatic acids, and phenolic compounds may be toxic to the fermenting microorganism, which may result in poor fermentability as well as low ethanol yield.

Detoxification is mandatory to remove the toxic compounds. One of the oldest detoxification processes is called overliming (Leonard *et al.*, 1945). Under the overliming process, the pH of the hydrolyzate is raised by using calcium hydroxide.

Then, sodium sulfite is added followed by heating for 30 minutes at 90°C. The changes of glucose and ethanol concentration are detected by high performance liquid chromatography and gas chromatography, respectively. In this work, a variety of strains of *Saccharomyces cerevisiae* are tested for the highest ethanol yield in a submerged fermentation system.

The objectives of this work are to examine the detoxification of mission grass hydrolyzate, to discover the suitable fermentation environment, and to investigate the optimal conditions of glucose fermentation process of *Saccharomyces cerevisiae* in order to maximize the yield of ethanol.