CHAPTER I
INTRODUCTION

The unavoidable depletion of fossil fuels and the increased concerns on greenhouse gas emissions have resulted in a worldwide interest in exploring alternative energy sources to replace fossil fuels. Various agricultural residues or lignocellulosic biomass, such as corn stover, wheat straw, rice straw, and sugarcane bagasse, can be used to produce ethanol as alternative transportation fuel and other chemicals.

Miscanthus Sinensis, widely found in South East Asia, is believed to have a great potential as an energy crop for ethanol production. It naturally grows using a C_4 photosynthesis system (Acaroglu and Aksoy, 2005; Sørensen *et al.*, 2008) and is highly tolerant toward salt and drought. Of special important is the fact that planting and growing *miscanthus* only require low energy input and no need to use fertilizers or pesticides (Guo *et al.*, 2008; Chou, 2009).

The main problem of ethanol production from lignocellulosic biomass is the low conversion of lignocellulosic biomass to fermentable sugars, which is the result from the presence lignin and hemicellulose in lignocellulosic biomass, affecting to the digestibility of cellulose (Mosier *et al.*, 2005). There are several techniques or so called pretreatment to improve digestibility of cellulose by converting cellulose to the structure of cellulosic biomass, making cellulose more accessible for enzymes or acid to convert into fermentable sugars (Kumar *et al.*, 2009; Hendriks and Zeeman, 2009). Alkali pretreatment is also used to remove lignin, lowering the accessibility of an enzyme to hemicelluloses and cellulose (Chang and Holtzapple, 2000; Han *et al.*, 2009).

Microwave heating pretreatment is a technique to improve the efficiency of the pretreatment (Ooshima *et al.*, 1984; Zhu *et al.*, 2005; Zhu *et al.*, 2006). This technique is nowadays widely used in many applications of chemical research due to its fast heating; homogeneous temperature, reduced reaction time, and increased reaction rate (Hoz *et al.*, 2005). K. Jeamjumnunja *et al.* (2009) and Hu *et al.* (2008) used microwave to increase digestibility of biomass and the sugar yield in pretreatment stage.

In this work conversion of *Miscanthus Sinensis* to maximum monomeric sugar was studied via microwave heating. The optimal conditions, pretreatment temperature, time, liquid-to-solid ratio, alkali and acid concentration, and different acid types, were investigated. Moreover, two-stage pretreatment, alkali/microwave followed by acid/microwave was also conducted.