CHAPTER I
INTRODUCTION

Worldwide energy demand has increased steadily as the world population has grown and more countries have become industrialized. The fossil fuels, such as crude oil, coal and natural gas, have been the major resources to challenge the increased energy demand; however, they are non-renewable resources and the utilization of fossil fuel has drastically increased the level of greenhouse gases (Ballesteros *et al.*, 2006). Uncertainties of petroleum resources and awareness about global climate changes have led to the development of alternative liquid fuels. Bioethanol is another renewable source, which promises cleaner combustion, leading to a healthier environment.

Most of the fuel ethanol production in the world is sourced from the major crops such as corn, barley, oat, rice, wheat, sorghum, and sugarcane. To avoid conflicts between human food use and industrial use of crops, lignocellulosic biomass is considered, and the technology for ethanol production from non-food plant sources is being developed rapidly (Lin and Tanaka, 2006). Lignocellulosic materials, such as agriculture residues and herbaceous biomass, serve as a cheap and abundant reproducible feedstock to produce bioethanol at reasonable costs.

Biomass residues from 10 main agriculture residues in Thailand, which possess energy potential, were studied (Sajjakulnukit *et al.*, 2001). Moreover, the plant biodiversity of Thailand shows the different potentials of herbaceous biomass, such as Miscanthus, Napier grass, and Arundo donax, for effective ethanol production.

The production of ethanol from lignocellulosic biomass involves different steps of pretreatment, hydrolysis, fermentation, and ethanol recovery (Van Zessen *et al.*, 2003). The pretreatment step is important for cellulose conversion process because it is used to remove lignin and hemicelluloses, decrease cellulose crystallinity, and increase the porosity of material (McMillan *et al.*, 1994).

Among many pretreatment methods, microwave pretreatment is the effective pretreatment method with high heating efficiency, easy operation, and combinable process with chemical reaction. The ethanol production from microwave-assisted alkali pretreated wheat straw was studied (Zhu *et al.*, 2006).

The objectives of this work are to evaluate 5 different weeds from different places in Thailand as lignocellulosic materials using the two-stage pretreatment with dilute alkaline/microwave and dilute acid/microwave pretreatments, and to compare the monomeric sugar yield to be obtained from different lignocellulosic materials.