CHAPTER I
INTRODUCTION

Lignocellulosic biomass is the largest source of biomass available on earth. Conversion of abundant lignocellulosic biomass to biofuels as transportation fuels presents a viable option for improving energy security and reducing greenhouse emission (Kumar *et al.*, 2009; Harun *et al.*, 2010). Lignocellulosic biomass is mainly composed of cellulose, hemicellulose, and lignin, along with smaller amounts of pectin, protein, extractives, and ash (Lin *et al.*, 2010). It includes materials such as sawdust, poplar trees, sugarcane bagasse, brewer's spent grains, corncob, rice straw, and switchgrass.

Enzymatic hydrolysis of lignocellulose has attracted an increased attention as an alternative to concentrated acid hydrolysis because the process is highly specific, which can be performed under milder reaction condition (pH around 5 and temperature less than 50 ^{o}C) with lower energy consumption and lower environmental impact. In addition, it does not present corrosion problems and gives high yield of pure glucose with low formation of by-products that are favorable for the subsequent hydrolysate used in the fermentation processes (Mussatto and Teixeira, 2010).

Enzymatic hydrolysis of cellulose is a reaction carried out by cellulase enzymes, which correspond to a mixture of several enzymes, among which at least three major groups of cellulases are involved in the hydrolysis of cellulose: 1) endoglucanase (EG, endo 1,4-D-glucanohydrolase, or EC 3.2.1.4.); 2) exoglucanase or cellobiohydrolase (CBH, 1,4-β-D-glucan cellobiohydrolase, or EC 3.2.1.91.); 3) β-glucosidase (EC 3.2.1.21) (Sun and Cheng, 2002; Mussatto and Teixeira, 2010). In 2010, Taechapoempol *et al.* isolated bacterial strains (A 002 and M 015) from Thai higer termite's gut, which can produce effective cellulase enzyme.

Corncob is one of the potential agricultural biomass feedstocks for renewable energy industries to reduce the current energy and the greenhouse gas problems. The ultimate analysis of corncob has shown not only high percentage of cellulose and hemicellulose but also low percentage of ash and sulfur, which makes it suitable to be a feedstock for enzymatic hydrolysis (Kaliyan and Morey, 2010).

The purpose of this research was to study the possibility of microbial hydrolysis, which is enzymatic hydrolysis using bacterial cell loading, of corncob using a batch reactor and to optimize the production of glucose. Effects of particles size, bacterial strains, and concentration of secondary carbon source for the microbial hydrolysis were also investigated.