สำนักงานวิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

CHAPTER I
INTRODUCTION

During the last decades, shortages of petroleum and climate change have increased the interest in renewable energy in many countries. Conversion of abundant lignocellulosic biomass to biofuels as transportation fuels presents a viable option for improving energy security and reducing greenhouse emission (Chang *et al.*, 2011). Lignocellulosic biomass, a carbon neutral resource, mainly consists of three components: cellulose, hemicellulose and lignin, together with some extractives and minerals (González *et al.*, 2010). Cellulose and hemicellulose are the largest fraction of the plant cell wall of agricultural residues such as straw from wheat, corn, rice soy and cotton, sugarcane bagasse, and cassava residue. However, they are bonded with lignin in the cell wall matrix that needs to be broken.

Cassava residue, a potential candidate for bioethanol production, is a solid fibrous dry (moisture content: 12-13%) by-product of cassava-processing industry. The dry residue has a composition of starch (56-60%), cellulose (15-18%), hemicellulose (4-5%), lignin (2-3%), protein (1.5-2.0%), pentosans (2%), and reducing sugars (0.4-0.5%). Because of its low content of cellulose and hemicellulose and high starch content, cassava residue could be considered as a cellulo-starch by-product. And due to the rich organic nature and low ash content, cassava residue could offer numerous advantages in comparison to other crop residues such straw of rice and wheat. When compared with sugarcane bagasse, it offers advantages, as it does not require any pretreatment and can be easily attacked by micro-organisms (Pandey *et al.*, 2000; Nair *et al.*, 2011).

Enzymatic hydrolysis of cellulose is carried out by cellulase enzymes, which are highly specific. Products of the hydrolysis are usually reducing sugars including glucose. This method has many advantages compared to chemical hydrolysis such as low utility cost of enzymatic at mild operating conditions (pH 4.8 and temperature 45-50 ^{o}C), higher sugar yields and no corrosion problem (Sun and Cheng, 2002; Soares *et al.*, 2011).

Cellulases are usually a mixture of several enzymes. At least three major groups of cellulases are involved in the hydrolysis process: 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). These cellulases can be produced by bacteria in higher termite's gut. Taechapoempol *et al.* (2010) obtained strains with a high specific activity for the cellulases.

The purpose of this research was to study and optimize the production of glucose and other fermentable sugars through enzymatic hydrolysis of cassava residue. Effects of various types of bacteria and concentration of secondary carbon source for the enzymatic hydrolysis were investigated.