CHAPTER I
INTRODUCTION

Besides being a cheap, renewable, sustainable and environmental friendly resource, lignocellulosic biomass like agricultural residues help in reducing solid wastes that increase dramatically from the growth in population and industrialization. Lignocellulosic materials consist of cellulose, hemicellulose, lignin, and small amounts of extractives, minerals, and ash. Cellulose is a glucose polymer containing linear chains of D-glucopyranose units with β-1,4-linkage. Hemicellulose is a complex polysaccharide existing in association with cellulose. Lignin is an amorphous heteropolymer, which is adjacent to cellulose fibers. Cellulose and hemicellulose can be broken down into fermentable sugars in order to be converted to more valuable products such as biofuels. However, production of biofuels and biogas from lignocellulosic materials still faces conversion and low yield (Leitão de Carvalho, 2009).

One of the important agricultural residues found in huge quantities to be considered, especially in tropical countries, is sugarcane bagasse. Sugarcane bagasse is usually used to generate heat and power to run a sugar milling process. The utilization of sugarcane bagasse in biotechnology and chemistry has been currently reviewed (Hernández-Salas *et al.*, 2009). These include electricity generation, pulp and paper production, and products based on fermentation such as alcohol and alkaloids, mushrooms, protein-enriched animal feed, and enzymes (Pandey *et al.*, 2000).

Sugarcane bagasse basically consists of 40–50% cellulose, 20-30% hemicelluloses, 20-25% lignin, and 1.5-3.0% ash (Saxena *et al.*, 2009). Fermentable sugars derived from sugarcane bagasse are glucose, xylose, arabinose, mannose, and galactose (Gírio *et al.*, 2010). Glucose is a simple sugar that is an important carbohydrate in biology. However, glucose is useful not only biologically but also chemically. Many chemical industries use glucose as a feedstock such as fermentation process to produce bioethanol and biohydrogen. Conversion of sugarcane bagasse into fermentable sugars is possible through chemical, thermal, or enzymatic hydrolysis.

Production of glucose from lignocellulosic materials via an enzymatic hydrolysis process requires two major steps: 1) a pretreatment step, which is applied to reduce the structure constrain to increase surface area for the next step; and 2) the enzymatic hydrolysis, which depolymerizes cellulosic materials into simple sugars by enzymes. These enzymes can be produced by bacteria in higher termite's gut. Taechapoempol (2009) obtained strains with a high specific activity for depolymerization of cellulosic material.

The purpose of this research was to study and optimize the production of sugars through hydrolysis of sugarcane bagasse using cellulose-producing bacteria, *Microcerotermes* sp., from Thai higher termites. Without a pretreatment of sugarcane bagasse, effects of particle size of ground bagasse (40 and 60 mesh), operating temperature (30 and 37°C), bacteria strain (A 002 and M 015) and type of fermentation media were investigated.