CHAPTER I
INTRODUCTION

Thailand is an agricultural country with abundant crop products, such as sugar cane, corn, rice straw, etc. With that, a large amount of agricultural waste is associated with the crop production and utilization. The waste could be a potential resource for energy and other more valuable chemicals. Among many types of agricultural waste, corncob is of interest to such the utilization, in part, because using corncob helps in reducing the cost of feedstock, and their ingredients also consist of a huge amount of cellulose and hemicellulose (Saha, 2003).

Corncob is an important lignocellulosic by-product from the corn industry. Approximately, 18 kg of corncob is produced from 100 kg of corn grain. It is a potentially useful raw material to obtain value-added products (Rivas *et al.*, 2003). A worldwide production of corncob more than 6.95×10^{8} tons was estimated for 2005 (Torres *et al.*, 2009). Such the feedstock was reported to contain 45 % cellulose, 35 % hemicellulose, and 15 % lignin (Tacherzadeh and Karimi, 2007a). Thus, it can serve as a potential source of renewable biomass for the production of fermentable sugars and other useful chemicals by enzymatic or microbial processes (Andren *et al.*, 1976).

Lignocellulosic materials contain a mixture of carbohydrate polymers (cellulose and hemicellulose) and lignin. Cellulose is a polysaccharide of glucose units that serve as the main structural component of the cob's cell walls. It is also a polymerized form of glucose molecules with β-1,4-linkage. It is formed by both intra- and inter-molecular hydrogen bonds, and it consists of composite forms of highly crystallized microfibrils among amorphous matrices (Li *et al.*, 2003). Hemicellulose is complex polysaccharides that exist in association with cellulose in the cell wall. It is a mixture of polysaccharides, composed almost entirely of sugars, such as glucose, mannose, xylose, arabinose, etc. (Ana-Rita and Ian, 1996). Lignin is a complex, non-carbohydrate, structural component, which binds to cellulose and stiffens plant cell walls. It can be formed and interfere along the process. The cellulose and hemicellulose in corncob can be hydrolyzed and broken down into simple sugars.

The hydrolysis of cellulose and hemicellulose can be carried out via chemical and enzymatic processes. Chemical hydrolysis is associated with a large amount of sulfuric acid, while enzymatic hydrolysis of cellulose is carried out by cellulase enzymes, instead of acid, to break down the cellulose (Werner, 2006). Generally, the hydrolysis rate of the amorphous cellulose is faster than the crystalline cellulose. Several pretreatment methods have then been proposed and applied. They include steam explosion, carbon dioxide explosion, hot water treatment, dilute-acid treatment, alkali treatment, ozonolysis, and ionic liquid treatment (Kumar *et al.*, 2009).

In this research, the effects of the hydrolysis conditions, substrate particle size, and temperature on the conversion of corncob to sugars were investigated in batch cultivations. The optimum conditions for a maximum sugar production were determined. In addition, the compositional and structural changes of corncob during the hydrolysis process were examined in order to understand the mechanism of the degradation.