CHAPTER 1

INTRODUCTION

Oil price increasing and environmental concern lead to the search for alternative fuel. Ethanol is an alternative fuel which is steadily increasing used around the world (Ali, 2011). It is more environmentally friendly than fossil fuel because using ethanol can reduce the amounts of greenhouse gas emissions such as carbonmonoxide into the atmosphere and lower exhaust emission and toxicity (Balat and Balat; 2009). Moreover, ethanol is lower cost than fossil fuel (Yamaji *et al*., 2003). Ethanol can be produced from sugar and starch materials such as sugar cane, sugar beet, molasses, cassava flour and corn starch (Demirbas, 2005; Gopal and Kammen, 2009; Ocloo and Ayernor, 2010; Shigechi *et al*., 2004). However, these raw materials will not be adequate to meet the increasing demand for ethanol fuel as it complete with the use of sugar and starch for human food and animal feed (Farrell *et al*., 2006). Therefore, agricultural residues such as rice straw, wheat straw and wood will be promising as source for ethanol production because they are cheap and widespread availability (Balat and Balat, 2009; Lu *et al*., 2009). However, they must be converted into sugar by acid hydrolysis, enzymatic hydrolysis and microbial fermentation before fermented by yeast to produce ethanol (Abedinifar *et al*., 2009; Dias *et al*., 2010; Karimi *et al*., 2007; Lu *et al*., 2009).

Longan is a valuable subtropical plant, which is widely distributed in the north of Thailand (Jeerasantikul, 2005; The Plant Variety Protection Office, 2002). Thailand is the largest longan exporter in the world (Office of Agricultural Economics, 2009). Longan production is often fluctuated. During high production years (above 480,000 ton), longan is glut and the price was very low during its harvesting season. Therefore, it is necessary to transform fresh longan to other product especially dried longan (Chaimongkol, 2003; Panyatep, 2005). If dried longans are stored for a long time, the quality will be deteriorated and not suitable for consumption. If this deadstock dried longan was exported, it would pose

a severe effect on Thailand's reputation (The Administrative Court, 2009). During 2004, about 67,000 ton of low-quality dried longan was stock in 115 warehouses in the north of Thailand (Fresh Plaza, 2007). Therefore, they must be destroyed. The disposal by burning and burying were considered less useful, expensive and cause environmental problem (Ruamchai, *et al*., 2012). An alternative solution to this problem is to use as substrate to produce ethanol. Nevertheless, this process can be used in the case of dried longan which is stored for a few years and still has high sugar content (Agustina, 2009). In case of the older dried longan stock, a very low sugar content was found in dried longan which not suitable for ethanol production (Agustina, 2009). However, it also has cellulose, hemicelluloses and starch as a major component (Lai *et al*., 2000; Sumphanwanich, 2006; Visuthithada, 2008). Therefore, hydrolysis methods or other should be used to increase sugar content in this raw material for ethanol production.

Microbial pretreatment is an alternate method to acid/alkali hydrolysis for hydrolyzing agricultural wastes (Havannavar and Geeta, 2007). The main advantage of this process is using lower cost for management than others hydrolysis method because it require low energy, no corrosion of equipment and mild conditions because this process require low temperature and no chemical such as acid required (Keller *et al*., 2003). Furthermore, microbial pretreatment can produce less poisonous and inhibitors product such as furfural and hydroxymethylfurfural for ethanol fermentation (Keller *et al*., 2003).

The objective of this study were to investigate possibility of utilizing sugar depleted dried longan to cultivate 5 strains of fungi *i.e. Aspergillus niger* TISTR 3063, *A. niger* TISTR 3089, *A. foetidus* TISTR 3461, *Trichoderma reesei* TISTR 3080 and *T. reesei* TISTR 3081 in order to screen for reducing sugar and to investigate the proper harvesting time for reducing sugar. The subsequent bioethanol production by *S. cerevisiae* TISTR 5606 was the followed.