SUMMARY

Recently, food security and fossil fuel are hot issues in the world because the number of world population continue to increase. This indicates that the world needs to produce at least 50 % more food to feed 9 billion people by 2050. Therefore, all countries should be seeking and utilizing a new source of food to anticipate food insecurity in the world. Beside that, the world faces fossil fuel problem. In 2012, total consumption of energy in the world is dominated by fossil fuel and only a small portion is renewable fuel. One of an alternative to anticipate food insecurity and fossil fuel problems is sago palm tree. Recently, attention to sago starch as a new food and a food-security crop continue to increase, especially in order to the anticipated increase in human population and potential environmental disasters in future. Several studies have been reported that the sago starch can be extracted only up to 55 – 75% (dry basis) of the total starch in the sago trunk. The remaining starch is still trapped within the parenchyma cells or fiber in sago pith waste (SPW). This fact indicates that not all sago starch potential in the sago trunk can be obtained. The purpose of this study was to minimize the loss of starch through recovery of sago starch from sago pith waste to increase sago starch production.

Overall, this study consists of five consecutive experiments, where each of chapter was discussed in different topic. Chapter 1 was a general introduction which discussed about food security, potency of sago, the role of sago for food security and biofuel production, sago starch extraction process and the general purpose of the study.

Chapter 2 was about recovery of sago starch from SPW by a micro powder mill (MPM). The objective of this study was to recovery of sago starch from SPW by using a micro powder mill. In this experiment, sago starch from sago pith was

produced by using commercial method. Then the true starch yield of sago pith was measured through hydrolysis process using α-amylase from porcine pancreas. To produce micro-powder-milled sago starch, the SPW was milled using a MPM with two kind of coolant, that are water (WC) and ice-water (IC) coolant to reduce the heat from the MPW. Milling process was performed in four disc clearance levels, namely wide (T1), wide-medium (T2), medium-narrow (T3) and narrow (T4). The result shows that the sago starch from SPW which left behind after starch extraction can be extracted by micro powder milling. The highest yield of micro-powder-milled sago starch was T4 (18%) and then followed by T3, T2 and T1 were 17%, 15% and 10%, respectively. This method is more practical and efficient than other milling processes because it is a continuous system and requires a short milling time.

In chapter 3 discusses about physicochemical properties of MPM sago starch. The objective of this study was to investigate the physicochemical properties of sago starch obtained by MPM of SPW for all treatments. The properties of MPM sago starch were investigated using scanning electron microscopy (SEM), normal and polarized light microscopy, particle size analysis, X-ray diffraction (XRD), and differential scanning calorimetry (DSC). The result revealed that MPM sago starch obtained by both water coolant and ice-water coolant in wide treatment (T1), wide-medium treatment (T2) and medium–narrow treatment (T3) properties were similar to those of untreated sago starch (T0). Physical changes in the starch granules, such as changes in the starch surface, granule size, relative crystallinity, and gelatinization properties, predominantly occurred during narrow treatment (T4). Based on the physicochemical properties and the sago starch yield, the best result of micro powder milling of SPW was achieved by medium–narrow treatment (T3).

Chapter 4 is about the molecular weight distribution of MPM sago starch. The objective of this experiment was to analyze the effect of micro powder mill on degradation of either amylopectin or amylose chains. Based on the GPC pattern of untreated sago starch can be divided into two fractions. From fraction number 21 to fraction number 38 proposed as amylopectin equivalent fraction. While fraction number 39 to fraction number 55 proposed as amylose equivalent fraction. The GPC pattern of HW-75F column chromatography shows that untreated sago starch (T0) was not different with those of T1, T2 and T3 treatments for both water and ice-water coolant. However, degradation of amylopectin was higher on T4 treatment. This trend was followed by iodine color where a blue color was decrease around 50% on T4 treatment.

Regional innovation aspect (chapter 5) is further explanation regarding the result of previous experiment (chapter 2 to chapter 5). This chapter discusses about the benefit of this research to farmers, industry, government and environment. Indonesia produced approximately 208,000 t of sago starch and 442,000 t of sago pith waste per year. Using a micro powder mill (dry milling), the sago starch yield will increase around 283,000 t and 288,000 t for T3 and T4 treatments, respectively. While using a super mass colloider mill (wet milling), the sago starch will increase around 300,820 t. The specific energy consumption of a micro powder mill can be reduced with scale up of the capacity of the micro powder mill.