Bogor Agricultural University
The Indonesian Sago Palm Society

ISS 2011

ISSN : 2089-1202

Proceedings of The 10th International Sago Symposium

Sago for Food Security, Bio-energy, and Industry from Research to Market

Bogor, Indonesia
October 29-30, 2011

Editors:

Iskandar Z. Siregar
Tahlim Sudaryanto
Hiroshi Ehara
Suwardi
Iskandar Lubis
Sintho Wahyuning Ardie

Supported by :

KSPI DIPLOMA
MB RKS WR Business - IPB

PT. SAMPOERNA AGRO

PT. ANEKA TAMBANG

PT. Nusa Ina

KABUPATEN
KEP. MERANTI

LIST OF POSTER PRESENTATION

Utilization of Sago Starch from Various Regions in Indonesia for Glucose Syrup Production

Titi Candra Sunarti, Fridayani, Indah Yuliasih
Department of Agroindustrial Technology, Bogor Agricultural University, Indonesia
Kampus IPB Darmaga, PO Box 220, Bogor 16002, e-mail :*titi-cs@ipb.ac.id*

ABSTRACT

Sago is one of carbohydrates sources representing potential commodity as staple food and industrial raw materials. Indonesia has the largerst area of sago in the world, and sago trees spread out in all parts of Indonesia. Five samples of sago starch from small-scale processing industries (S1 North Sulawesi, S2 West Java, S3 Riau, S4 Papua, and S5 South Kalimantan) were analyzed their chemical compositions, and utilized them for glucose syrup production, compared to commercial corn and cassava starches. Most of samples have similar compositions, except for moisture and ash contents as influenced by extraction process. Sago starch can be utilized for glucose syrup production through acid or enzymatic hydrolysis. Compared to commercial starch, sago can be converted into glucose syrup in similar quality for enzymatic hydrolysis with DE of 93.14-96.54, while acid hydrolysis produced lower quality of syrup with DE 47.38-51.35. Since all sago samples have low degree of whiteness, it influenced to the clarity of glucose syrup.

Key words : *sago, Indonesia, glucose, acid hydrolysis, enzymatic hydrolysis*

INTRODUCTION

Sago palm was considered to be an ideal crop for starch-based sweetener and alcohol fuel feedstoc. Sago starch, unlike the other starches, is derived from the pith of numerous kinds of palm trees, namely *Metroxylon sp.* Sago palm distributed and grew naturally in almost every island through out Indonesia, especially in the swampy coastal area along the river. There are many different type of sago palm, but they are not distinguishing clearly. Sago starch, one of the least expensive starches, has a low quality. Yatsugi [1] and Gumbira Said et al. [2] have identified several problems associated with sago starch and manufacture, including whiteness, viscosity, starch particles, and starch content in sago starch produced by rural factories in the tropics. The color of the starch, which turns brown in the process of separation, is one of the factors responsible for the low quality. When sago palm pith is chopped up and grated into a powder, colored substances are formed and bound tightly to the starch granules. Glucose syrup, are obtained by hydrolysing starch, by a process which cleaves the bonds linking dextrose units. The method of hydrolysis affects the final carbohydrate composition, and many functional properties. Originally, acid conversion was used to produce glucose syrup, but today because of their specifity, enzymes are used to catalyze the hydrolytic process of sago starch. This research exploring the utilization of sago starch from several regions in Indonesia for glucose syrup production compared to commercial starch.

MATERIALS AND METHODS

Materials. Five samples of sago starch collected from Sangirtalaud-North Sulawesi (S1), Bogor-West Java(S2), Selatpanjang-Riau(S3), Jayapura-Papua (S4), and Banjar-South Kalimantan (S5). Tapioca and cornstarch purchased from local market in Bogor. The enzymes (thermamyl and glucoamylase) were technical food grade from Novo Enzyme-Indonesia.

Enzymatic Hydrolysis. An aqueous starch slurry (30% w/v contains 200 ppm of $CaCO_3$) is adjusted to pH 5.2 and then gelatinized and liquefied by α-amylase (1.75U/g starch) at 95°C for 3 hours. After liquefaction the pH of slurry is adjusted to 4.5 and the temperature lowered to 60°C. Glucoamylase (0.3 U/g starch) was added and the hydrolysis reaction allowed to continous stir for 72 hours. The syrup was then purified by addition 2% (w/v) of activated carbon and then filtered.

Acid Hydrolysis. Starch slurry (30% w/v) is adjusted to pH 2 by addition of 0.1% of HCl solution. The flask was then wrapped tightly and heated on autoclave at temperature 121°C for 1 hours. After hydrolysis the pH of slurry is adjusted to neutral pH by using 1 N of NaOH solution. The syrup was then purified by addition 2% (w/v) of activated carbon and then filtered.

RESULTS AND DISCUSSION

Sago is one of carbohydrates sources representing potential commodity as staple food and industrial raw materials. Indonesia has the largerst area of sago in the world, and sago trees spread out in all parts of Indonesia. Previously Yuliasih et al. [3] have reported the chemical composition of these five samples of sago starch from small-scale processing. Most of samples have similar compositions, except for moisture and ash contents as influenced by extraction process. All samples have high purity since consisted mainly of starch (85.9-87.5% db), almost similar to tapioca (82.1%) and corn starch (89.7%). Sago starch also showed a significant higher residual protein level (1.7-2.2%) which can contribute to unacceptable level of browning.

Sago starch can be utilized for glucose syrup production through acid or enzymatic hydrolysis (Table 1).Thermamyl™ is endo-amylase which hydrolyses the α-1,4 linkages in starch (amylose and amylopectin) almost at random. The breakdown products formed mainly soluble dextrins and oligosaccharides with DP 2.15-2.53 higher than corn but lower compared to tapioca. Compared to commercial starches, sago can be converted into glucose syrup in similar quality for enzymatic hydrolysis with DE of 93.14-96.54, while acid hydrolysis produced lower quality of syrup with DE 47.4-51.4. Kearsley & Dziedzic [4] reported that DE 55 of acid hydrolysis products mainly consist of glucose (31%) and oligosaccharides >DP4 (28%).

The standard color of glucose syrup is usually described as colorless. Since all native sago samples have low degree of whiteness, it influenced to the clarity of glucose syrup.Color formation (browning) in glucose syrup may occur as a results of Maillard browning and caramelisation due to the effects of heat on carbohydrate. In many application, low clarity of starch syrup can be used for fermentation substrates.

CONSLUSIONS

Characteristics of glucose syrup and enzyme susceptibility & digestibility of sago starch were not different compared to glucose syrup from tapioca and corn starch, except the clarity of syrup. Glucose syrup from enzymatic hydrolysis of sago starch gave higher quality compared to acid hydrolysis. Sago starch from all regions of Indonesia can be used as raw material for glucose syrup industry.

REFERENCES

Yatsugi T. 1985. Problem of Sago Starch Manufacturing. Proceedings of the 3rd International Sago Symposium. Tokyo-Japan, May 20-23, p201-207

Gumbira-Said E, Sunarti TC, Ermawati WJ. 1999. Towards the Improvement of Sago Starch Quality in Indonesia. (I) Examination on the Quality of Commercial Sago Starch. Proceeding 1st Regional Roundtable Meeting"Sustainable Small-scale Sago Starch Extraction and Utilization : Guidelines for the Sago Industry. Thailand, 9-11 August 1999.

Yuliasih I, Irawadi TT, Sailah I, Pranamuda H, Setyowati K, Sunarti TC. 2007. Influence of Fractionation Process of Sago Starch to the Characteristics of Amylose Fraction. *Indonesian J of Agroindustrial Technol* 17(1) : 29 – 36.

Kearsley MW, Dziedzic SZ. 1995. Physical and chemical properties of sago starch. In Kearsley MW, Dziedzic SZ.*Handbook of Starch Hydrolysis Products and their Derivatives*. London: Blackie Academic & Professional. P129-154.

Table 1. Characteristics of glucose syrup

Characteristics	Enzymatic Hydrolysis			Acid Hydrolysis		
	Sago (S1-S5)	Tapioca	Corn Starch	Sago (S1-S5)	Tapioca	Corn Starch
Dextrose Equivalent						
-Liquifaction	39.6-46.9	38.4	48.3	-	-	-
-Saccharification	93.1-96.5	94.3	98.6	47.4-51.4	44.9	50.9
Degree of Polymerization						
-Liquifaction	2.15-2.53	2.61	2.07	-	-	-
-Saccharification	1.04-1.07	1.06	1.01	1.95-2.11	2.23	1.97
Total Solids (% db)	39.5-57.0	37.4	36.7	38.3-45.6	37.61	40.7
Yields (%)	59.4-80.1	71.1	61.7	47.5-56.9	52.9	58.2
Ash Content (%db)	0.08-0.27	0.26	0.12	0.35-0.59	0.46	0.44
Syrup Clarity (%T)						
-Before Purification	11.1-60.3	59.2	66.4	5.4-20.8	28.1	33.0
-After Purification	66.6-71.5	85.9	98.5	49.7-64.5	87.7	95.5