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Original Research Article

Gebang (*Corypha utan* Lamk) Tree as A Food Resource for Timorese People

Herianus J. D. Lalel[1*], Yuliana Tandi Rubak[1]

[1]Fakultas Pertanian, Universitas Nusa Cendana, Jl. Adisucipto Kupang, NTT, Indonesia

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Abstract: Gebang (*Corypha utan* Lamk.) has been using by Timorese people as one of the food buffers crops, especially during the food shortage period due to drought and other extreme conditions. Gebang tree is one of food buffering resource for people in Timor Island. One mature tree can result 281 kg dry starch or about 280 liters sap because both utilizations will cause the death to the tree. The sugar content in the sap is enough to be used to form sugar palm. The starch from gebang is almost similar with that resulted from sagu tree, with proportion of amylose and amylopectin are 24.44% and 75.56%, and temperature of gelatinization of 80.55ºC.

Keyword: Gebang tree, *Corypha utan* Lamk, buffer food, Timor Island, sap, starch.

INTRODUCTION

The dry season in Timor Island is far longer than its wet season, which is about 8 to 9 mounts each year. It causes a typical ecological system to this island that may be very risk to the food shortage condition. Many researchers have studied in developing food crops that may sustain in this dry agroclimatic ecology (Arsa *et al.*, 2017; Seran Mau *et al.*, 2013; Lalel, 2016; Mukkun *et al.*, 2021).

Traditionally, Timorese people use many food resources available around them including wild plants to cope the harsh condition in this island. One of the plants which the people rely on most is gebang (*Corypha utan* Lamk), a kind of palm trees. Local people use the plant by harvesting the sap of its shoot and by cutting down the tree and taking its stem pith for extracting the starch. The sap of the plant can be processed to be liquid sugar, vinegar and traditional wine; while starch be used for making pan cake and dry grits snack, called “akasonen”. The starch can also be used for making noodle and other kind of foodstuff (Yamamoto *et al.*, 2015; Lobo *et al.*, 2017, Lalel *et al.*, 2022). This study has been conducted to underpin the potency of sugar and starch of the gebang tree.

MATERIALS AND METHODS

Materials

Gebang stem pith was obtained from Kupang Regency, East Nusa Tenggara Province of Indonesia. Chemicals for analyses were pa grades purchased from several chemical providers.

Methods

a. Determination of Plant Sample for Harvesting Sap

Plants choosen for harvesting its sap were located in Kupang Regency with above 7 years old and normally growth. All leaves, except the last one were cut down and the shoot were chopped for getting its sap (Figure 1). The dimension aspect of the tree was measured using metric roll tape. The sap was collected untill no more drops can be obtained.

b. Starch Extraction

The starch was extracted from the stem pith according to the wet method described by Lalel *et al.*, (2018). As briefly, the stem pith was cut into small pieces about 5 cm long and 2 cm thick. Then, the loave of the pith was added with water at the proportion of 1:3, then crushed with a chopper machine and mixed to get a watery dough. Then, the watery dough was put on double cloth filters to pass the starch solution. Furthermore, the solution was kept for about 30 minutes to let the starch be decantated. Finally, the supernatant was poured out,

***Corresponding Author:** Herianus J. D. Lalel
Fakultas Pertanian, Universitas Nusa Cendana, Jl. Adisucipto Kupang, NTT, Indonesia

and the starch was sundried for about six hours and then sieved using 80 mesh Sieve.

Parameters

a. Chemical Analysis

The sap was only measured for its sugar content using refractometer (Atago, Japan). The starch, however, was analyzed for its chemical properties including the proximate contents, starch as well as amylose and amylopectin contents, and the content of some important minerals and vitamins. Proximate analyzes and the content of starch were performed according to AOAC (1984); while the content of amylose and amylopectin were measured using IRRI method described by Juliano (1971). Minerals were analyzed using Atomic Adsorbance Spectrophotometer according to AOAC (1984), and vitamins were determined using High Pressure Liquid Chromatography (HPLC) as described in ASEAN Manual of Food Analysis (Puwastien *et al.*, 2011).

b. Physical Analysis

The physical properties of starch recorded were pasting profile, color, and bulkiness. Pasting profile was performed using a Rapid Visco Analyzer (RVA, Newport, NSW, Australia). Color and whiteness of starch were recorded using Samsung digital camera (16 megapixels) fitted with constant light (2800 lx). Camera was equipped with On Color Measure software (Potatotreesoft Company) to record real-time RGB value, HSV value, Hex code and HTML color name. RGB values were then converted to CIE Lab values using Colormine software (Colormine.org). Bulk density, Carr's index and Hausner ration were measured and calculated as described by Navaf *et al.*, (2020).

RESULTS AND DISCUSSION

a. Sap and Sugar Content

Gebang plant has important role for Timorese people. Almost all part of the plant has been utilized for food and non-food purposes. For food purposes, its sap and starch are the most valuable source. Sap can be collected from the tree by cutting the tip of its flower or by cutting the shoot of the tree. After harvesting the sap through this technique, the plant will die. Table 1 shows the production of sap by cutting its shoot (Figure 1).

Figure 1: Condition of gebang plant ready to be harvested its sap from the shoot

Table 1: Sap production of gebang tree from shoot

Sample	Tree Hight (m)	Stem Diameter (cm)	Stem volume (cm^3)	Sap production (ml)	Sugar content (^oBrix)
1	11.8	43	2824141	226800	9.5
2	8.30	80	6766879	295200	8.5
3	10.40	170	6491720	324000	14.1
Average	10.17	97.67	5360913	282000	10.7

From table 1 it can be seen that sap can be produced through the shoot for more than 280 liters. The sap production is positively related to the volume of the stem. The average sap production within one week is 50 liters, which is a bit higher than reported by Obahiagbon and Osagie (2017) found in *Raphia hookeri*, another kind of palm grown in Nigeria, which is the sap production is 3-38 liters per week.

Sugar content of the sap ranges from 8.5 to 14.1 ^{o}Brix (Table 1), which is almost similar to the sap of coconut tree (8.4 to 16.9^{o}Brix) reported by Haryanti *et al.,* (2017); however, it is lower than the sugar of sap found in *Arenga pinnata* which can be reached to 19.1^{o}Brix (Marsigit, 2005). Naiola (2008) reported that the gebang sap contains 4.0% of fructose, 3.6% of saccharose and 3.5% of glucose. As known that sap from coconut tree and *Arenga pinnata* can be processed to be palm sugar and has relatively high economical value. Therefore, it is a high possibility to process sap of gebang tree to be palm sugar.

b. Starch

The starch can be extracted from the pith of many kinds of palm trees. In gebang tree, we found that the starch can be harvested from its pit by wet extraction process, which is 281 kg dry starch per tree in average or 23% of the pit (Lalel *et al.,* 2018). The chemical content of the starch is presented in Table 2.

Interestingly that the proportion of amylose and amylopectin is 24.44% and 75.56%, which is almost similar to the composition of the sago starch (Ahmad *et al.,* 1999). The content of minerals, especially zinc, Indonesian food standard (SNI 3729) restricts to be not more than 40 mg/kg (BSN, 2008), and it is found lower in gebang starch.

Table 2. Nutrition content of gebang starch (per 100 g)

No.	Parameter	Value
1	Water (g)	13.88
2	Energy (kcal)	351.55
3	Protein (g)	0.36
4	Lipid (g)	0.09
5	Carbohydrate (g)	85.40
6	Starch (g)	67.00
7	Water soluble starch (g)	6.30
7	Amylose (g)	16.37
8	Amylopectin (g)	50.63
9	Crude fiber (g)	2.89
10	Ash (g)	0.23
11	Calcium (mg)	43.57
12	Phosphor (mg)	16.22
13	Iron (mg)	2.40
14	Sodium (mg)	23.17
15	Potassium (mg)	28.59
16	Zinc (mg)	3.19
17	Thiamin (mg)	0.16
18	Riboflavin (mg)	4.86
19	Niacin (mg)	1.62

The physical properties of gebang stach is presented in Table 3. Pasting peak reached at 80.55^{o}C with maximum consistency of 4085 cP (Figure 1). Ahmad *et al*., (1999) reported that pasting peak of sago starch is 71.40, this means that gebang starch has higher gelatinization temperature than that of sago starch. Gelatinization temperature of a starch depends on several physical properties, including micro structure and dimension of particle. Smaller granules size causes higher temperature of gelatinization, while ratio of amylose and amylopectin also affects the gelatinization temperature (Ahmad *et al*., 1999).

Table 3 also shows bulk density of gebang starch is 0.63 g/ml and compact bulk density is 0.85 g/ml which cause carr's index to be 25.21% and Hausner ratio of 1.34. All these data indicate that gebang starch is classified as low flowability flour, because materials having Carr's index greater than 20-25% are classified as non-free flowing (Valaei *et al.,* 2012). A bit different characteristic is found in the starch of Talipot palm (*Corypha umbraculifera* L.) which have carr's index of 16.9% and Hausner ratio of 1.20 (Navaf *et al*., 2020).

Table 3. Physical properties of gebang starch

No	Parameter	Value
1	Temperate of gelatinization (°C)	80.55
2	Maximum consistency (cP)	4085
3	Temperature at maximum consistency (°C)	85.7
4	Loose bulk density (g/ml)	0.63
5	Compact bulk density (g/ml)	0.85
6	Carr's Index (%)	25.21
7	Compressibility (%)	25.20
8	Hausner ratio	1.34
9	HTML color	Silk brown
10	Hex color code	#ffb6a794
11	Nilai CIE Lab (L*, a*, b*)	67.7118; -9.01455; 70.3583

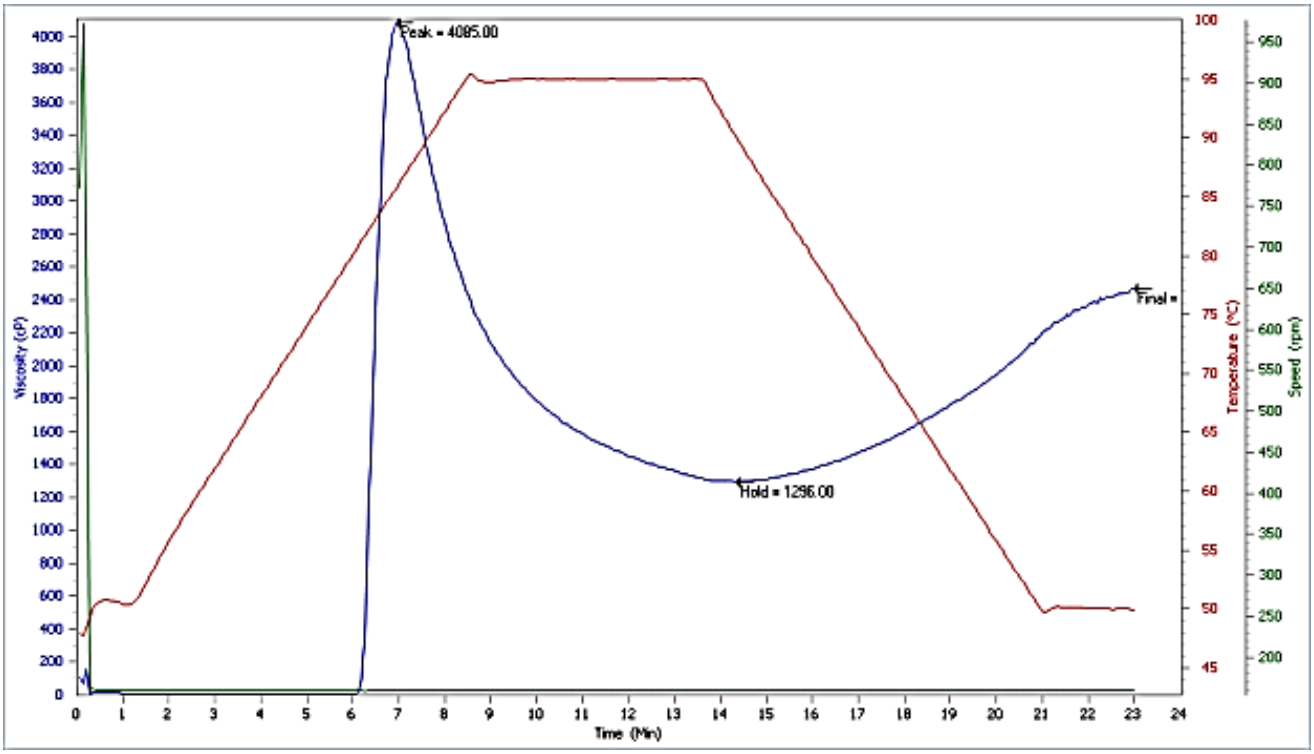

Figure 1: Pasting profile of gebang starch

As shown in Table 3 that the color of gebang starch is silk brown (HTML color) with the lightness value is 67.71. Comparing to some other palm starch such as sago (L value of 88.15) Talpot palm (L value of 90.8) (Achudan *et al.*, 2020; Navaf *et al.*, 2020), the color of starch from gebang is darker than others. This may due to enzymatic browning reaction occurred during extraction of stach in gebang pith. Momuat and Suryanto (2016) reported that the content of polyphenols and polyphenol oxidase in the gebang pith are found high.

CONCLUSION

Gebang tree is one of food buffering resource for people in Timor Island. One mature tree can result 281 kg dry starch or about 280 liters sap because both utilizations will cause the death to the tree. The sugar content in the sap is enough to be used to form sugar palm. The starch from gebang is almost similar with that resulted from sagu tree, with proportion of amylose and amylopectin are 24.44% and 75.56%, and temperature of gelatinization of 80.55°C.

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