The Physicochemical Characteristics of Dry Gelugur Slices 
(Garcinia atroviridis)

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Abstract. Asam Gelugur (Garcinia atroviridis) have been used for food in Indonesia, like for spices and tea. The study was consisted of two steps. Step 1 was conducted to determine physicochemical properties of raw, half–ripe, and ripe of gelugur. Step 2 was conducted to determine the effect of maturity level and drying time on the quality of dry gelugur slices, then used a randomized factorial design with 2 factor namely the maturity level (K): war, half-ripe, and ripe and drying time (L): (12 hour), (13 hour), and (14 hour). The result showed that the level of maturity had a very significant effect on moisture content, ash content, and total soluble solid. The interaction between two factors had a very significant effect in moisture content. The level of maturity raw and drying time 12 hour produced the best and more acceptable quality of gelugur dry.

1. Introduction
Strain of Garcinia fruits (local name in Indonesia “gelugur acid”), is generally found in Indonesia is Garcinia atroviridis, the second common strain is generally found in Southern India is Garcinia cambogia [1]. Gracinia fruits are semi growing wild and have been used for years [2]. W. Ritirut and C. Siripana. garcinia fruits have been used in Indonesia for seasoning purposes, like “Asam Padeh”. The principal acid of Garcinia atroviridis and Garcinia cambogia, (-)-hydroxycitric acid (HCA) has been investigated [3-9]. Many reports have recently shown that Garcinia atroviridis exhibit strong antimicrobial, antioxidant antitumour-promoting activities [10-11]. In this research, Garcinia atroviridis were used for raw material, and were cut into flat. This study was consisted of two steps. Step1 was conducted to determine physicochemical properties of raw, half-ripe, and ripe of gelugur. Step 2 was conducted to determine the effect of maturity level and drying time on the quality of dry gelugur slices, then used a randomized factorial design with 2 factor namely the maturity level (K): war, half-ripe, and ripe and drying time (L): (12 hour), (13 hour), and (14 hour).

2. Material and Methods
The research was conducted at Analisa Kimia Bahan Pangan Laboratory, University of North Sumatera, from July until October. The Garcinia atroviridis local varieties were purchased from farmer at Sembahoe, Deli Serdang, Indonesia. Fresh garcinia fruits were cut into flat of slabs ± 5 mm in thickness. The slab were oven dried using cabinet drier at temperature 50°C about 12 hours, 13
hours, and 14 hours. After drying, the dry gelugur were weighed and analyzed. Analysis consist of moisture content analysis by using oven method [12], ash content analysis using dry ashing method [13], Total Soluble Solid [13], Acid content [14], Vitamin C [15], pH [16], protein content using kjedhl method [12], fat content analysis using soxhlet method [12], crude fiber content [15], and antioxidant analysis using DPPH method [17].

Data analysis using randomized design were analyzed using SPSS version 22 for windows. The data reported in all tables are the average of triplicate observation subjected to one-way analysis of variance (ANOVA). Difference among the ranges of the properties were determinate using the method of Least Significant Diffrence (LSD) tests at 95% confidence level (P<0.01). The best treatment test was then compared with the control treatment T-test. De Garmo was used in determining the best treatment method.

3. Results and Discussion

3.1. Material Analysis (raw, half ripe and ripe)

Table 1. Physical characteristic of gelugur acid based in maturity content

| Maturity level | Weight (g) | Diameter (cm) | High (cm) | field water content (%) |
|----------------|------------|---------------|-----------|-------------------------|
| Raw            | 338.99     | 9.03          | 6.83      | 92.62                   |
| Half ripe      | 360.73     | 9.85          | 7.30      | 93.01                   |
| Ripe           | 447.94     | 10.23         | 6.981     | 93.85                   |

Note: carried out on every 20 pieces of gelugur acid

Table 2. Analysis raw material of gelugur acid

| Characteristic analysis | Maturity level (Raw) | (Half-ripe) | (Ripe) |
|-------------------------|----------------------|-------------|--------|
| Water content (%)       | 89.04                | 89.89       | 90.31  |
| Ash content (%)         | 0.202                | 0.229       | 0.294  |
| Acid content (%)        | 44.7                 | 31.80       | 30.45  |
| Total Soluble Solid (°Brix) | 10                   | 15          | 16.5   |
| pH                      | 1.665                | 1.706       | 1.798  |
| Vitamin C (mg/100g sample) | 45.40               | 37.92       | 37.64  |
| Protein (%)             | 1.04                 | 0.68        | 0.43   |
| Fat (%)                 | 0.557                | 0.574       | 0.623  |
| Crude fiber content (%) | 29.27                | 25.54       | 23.42  |
| Antioxidant (IC50)      | 184.29               | 144.06      | 126.78 |

Table 1 showed that more maturity, higher on weight, diameter and water content. It indicated the effect of maturity can make the higher in weight, diameter, and water content. The transformation from raw to ripe on the fruits, like organic content, sugar and carbohydrate can make the higher water content [18]. The higher drying temperature, the higher water vapour [19], so it had been made the water content of gelugur powder lower. The higher dryer air temperature, the higher ability of material too releasw water from suface [20].

Table 2 showed that based on the level of maturity (raw, half ripe, and ripe) respectively, water content, ash content, soluble solid total, pH, and fat content were tend to increase. Tabel 8 showed that based on level of maturity (raw, half ripe, and ripe) respectively, acid content, vitamin C, protein, crude fiber content and antioxidant were tend to decrease. It showed that the level of maturity had effect on composition of ingredients in gelugur.
3.1.1. Water content
The effect of drying time on water content were shown in Figure I. Figure I showed that drying time a very significant effect on water content. The longer drying time the lower water content in gelugur. Composition of water content in gelugur like free water and bound water can make effect on drying time [21]. The longer drying time, the more ability of material to release water from surface, so water content lower [22].

![Figure I. The effect of drying time on water content](image)

The level of maturity had effect on water content of gelugur. The more ripe of gelugur, the higher water content. The change on gelugur like ripening from raw to ripe can make the higher content, that was caused there were change in composition on physicochemical in fruit like carbohydrate, sugar and organic acid [18].

3.1.2. Ash Content
The longer drying time that used on gelugur, the higher ash content. The time for drying that used can make the higher ash content, because water is released higher [23]. Ash was the result of residual inorganic substances remaining after organic water and materials have been burned. Ash content indicates mineral content.

Ripening on gelugur from raw to half ripe and ripe made the higher ash content. Ash content increases when the level of maturity on fruit increases. During the ripening process, more mineral salts are formed, like phosphorus, calcium and iron [24].

3.1.3. Soluble Solid Total (Brix)

| Parameters                  | Maturity level |
|-----------------------------|----------------|
|                             | K₁ (Raw)       | K₂ (half ripe) | K₃ (Ripe)  |
| Water content (%)**         | 13.7845        | 16.2086        | 19.8882    |
| Ash content (%)**           | 1.9134         | 1.9285         | 2.0286     |
| Total Soluble Solid (°Brix)**| 38.3333        | 40.3889        | 41.5556    |
Table 4. The effect of drying time on parameters

| Parameters                   | Drying time |          |          |          |
|------------------------------|-------------|----------|----------|----------|
|                              | L₁ (12 hours) | L₂ (13 hours) | L₃ (14 hours) |
| Water content (%)**         | 19.0212     | 16.4883  | 14.3718  |
| Ash content (%)**           | 1.9266      | 1.9597   | 1.9842   |
| Total Soluble Solid (“Brix”)** | 35.8333    | 40.4444  | 44       |

The more ripening of gelugur, the higher total soluble solid of dry Garcinia. The ripe Garcinia contain high sugar that caused transformation organic acids into sugar total were dominant component in total soluble solid. Table 4 showed the longer drying time the higher total soluble solid of dry gelugur. The longer drying time the more water and other ingredient degraded. Fitriani reported the longer drying time the lower water content that caused the higher total soluble solid. The escalation of total soluble solid was caused complex component will be modified into simple component, so can make the higher total soluble solid.

4. Conclusions

The level of maturity can make the higher in weight, diameter and water content. The Level of maturity (raw, half ripe, and ripe) respectively, water content, ash content, soluble solid total, pH, and fat content were tend to increase. The level of maturity (raw, half ripe and ripe) respectively, acid content, vitamin C, protein, crude fiber content and antioxidant were tend to decrease. The level of maturity raw and drying time 12 hour produced the best and more acceptable quality of gelugur dry.

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