

# ANALYSIS OF ROASTING TEMPERATURE AND TIME EFFECTS TO THE QUALITY OF THE ROASTED SEEDS OF SIBETANESE SNAKE SKIN FRUIT

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**Abstract.** : Sibetan is one of the villages in Karangasem Regency. Snake skin fruit in this area has a peculiarity with the name of sugar snake skin fruit. Snake skin fruit plants are one of the seasonal plants, however the fruits also can be harvested in particular months. Dealing with the post-harvest handling for Sibetan Village area, it has been done a lot of product innovations such as making chips, pasta and raw materials of canned fruit sent to the outside of the island. The price for each kilogram of this snake skin fruit species is relatively expensive; it is up to Rp.15.000,00 when it is not in its harvest season, but during harvest season when there is abundant amount of this fruit, the price will be drastically reduced to Rp.500, 00 even unsold. This spurred the creativity of the community to process the snake skin fruit to be materials that have higher selling value. The existence of third parties who are interested to buy the flesh of the fruit as raw material to produce canned food makes the price of the fruit more stable; Rp.2.000,00 for each kilogram. However, this raises the amount of waste from snake skin fruit that has not been utilized, such as the seeds. One of the efforts done in many areas is to make them as raw materials for beverage. The test result obtained from roasting the seeds of snake skin fruit shows that temperature and time affect the quality of the roasted seeds, it can be seen from the colour and aroma compared to the roasted coffee beans. At 80 ° with a time of 40-50 minutes, the cinnamon category was obtained, the light category at 100 ° with 40-50 minutes of roasting, and the French category at 120 ° with 40-50 minutes of roasting.

**Keywords :** Roasting, Seeds, Snake skin fruit, Sibetan

## 1. Introduction

### 1.1 Background

In the development of agriculture, there are two main pillars integrating with each other. According to Baroh [1], one of them is secondary agriculture (down-stream agriculture/ agribusiness) as an activity to increase the additional value of agricultural products. One way to increase the additional value of an agricultural commodity is to relate agriculture to the industry/processing or services in agricultural field. In Indonesia, there are many kinds of agricultural commodities which later on can be processed to be qualified and high-valued products, one of them is the snake skin fruit. Snake skin fruit is one of the favorite fruitful plants and has a good prospect to be cultivated. Snake skin fruit (*Salacca edulis* L) is a tropical fruit originally from Indonesia which has been spread throughout the archipelago.

In the previous research, it had been designed a tool or machine to facilitate the process of production or processing the snake skin fruit seeds to be raw material for beverages. This processing activity has been done since long time ago by Sibetan villagers to tackle the overproduction of snake skin fruit during its harvest season which can lower the selling price. The machine designed and given to the villagers has facilitated them in the production process of the snake skin fruit seed powder which had been always produced by applying traditional method. There are several things needed to be studied and researched again in order to improve the quality of the snake skin seed

powder produced and to overcome the excessive post-harvest production to increase the income of Sibtan villagers.

In a research conducted by I Made Anom Adiaksa in 2015, it had been made a processing machine of snake skin fruit seeds to facilitate the processes of breaking and roasting the seeds to produce raw materials for beverage as a substitution for coffee. In that research, it had not been done yet the analysis of the roasting machine designed to get the quality of the roasting result. In a research in 2016, based on the planned roadmap, it would be done the analysis of the roasting machine. The quality of the roasted snake skin fruit seeds is almost as good as the expectation, in which the taste, aroma, and colour are almost the same as the roasted coffee beans. A research is needed to be conducted again in order to be able to produce the qualified roasted seeds as expected.

## 1.2 Research Problems

Based on the result of the previous researches about the designing of a machine that processes the snake skin fruit seeds to be a raw material for beverages, it is needed to be done a test for the roasting result, therefore the problems of this research can be formulated as follows:

- Are there any effects of roasting temperature to the quality of the roasted snake skin fruit seeds?
- Are there any effects of roasting time to the quality of the roasted snake skin fruit seeds?

## 1.3 Research Objectives

Looking at the result of the seeds roasting before, this research is expected to be able:

- To obtain the temperature needed;
- To obtain the time needed;
- To obtain the colour of the roasting result to decide the types.

## 1.4 Literature Review

Coffee roasting method really determines the taste and aroma of coffee. Roasting coffee in a proper way is indicated by skilled roasters will produce high-qualified coffee powder marked with tasteful flavor and enjoyable aroma. Roasting process is usually done at atmospheric pressure, using hot air or combustion gasses as heating media. Heat is also obtained by making contact between rice coffee and hot metal surface after the preliminary treatment to remove the water content [2].

The perfection of coffee roasting is affected by two main factors, they are heat and time. The range of roasting temperature for the light level of roasting/ light brown colour is from 190 to 195°C and from 200 until 205 °C for the medium level/ dark brown colour. The duration of roasting varies from 7 until 30 minutes depending on the type of tool and the quality of coffee. Roasting process can be done openly or closed. Closed roasting is applied by many factories or industries of coffee powder production to make the roasting process faster. Closed roasting will make the coffee powder taste a little bit sour because water and some kinds of volatile acids are retained. However, the aroma will be stronger since the coffee-scented chemical compounds do not evaporate much. Besides, the coffee will be spared from odor pollution from outside such as odor of fuel or gas resulted from incomplete combustion process. The roasting temperature affects the characteristic of flavor from the coffee extract. The degree of roasting is seen qualitatively from the colour of the roasted coffee. For example, the light roast, medium roast, and dark roast. The colour of the roasted coffee also affects the loss percentage of the elements inside the coffee, for light roast it is approximately 3-5 % loss, for the medium roast it is approximately 5-8 % loss, and for the dark roast it is approximately 8-14% loss (including the content of water in rice coffee) [3].



Picture 1: The coffee roasting quality seen from the colour

This clearly shows that the composition of chemical substances in coffee, whether it is volatile or non volatile, is affected by the degree of roasting. The chemical compounds of coffee which is damaged during the roasting process are chlorogenic and trigonelin acids. The level of the damage is proportional to the degree of roasting. The roasting temperature in general is as follows [4]:

- Light Roast (sufficiently roasting, from 190°C-195°C)
- Medium Roast (medium roasting, from 200°C-205°C)
- Dark Roast (black roasting, higher than 200°C)

The duration of the roasting varies from 7 up to 30 minutes depending on the type of tool and the quality of the coffee powder. Roasting is finished when the aroma and the taste expected. This is indicated from the changing of the colour of the seeds from greenish to dark brown, brownish black and pure black. The roasting degree is seen through the changing of the roasted coffee beans colour. The samples are taken periodically from a roasting cylinder through sampling hole. The roasting process is stopped when the roasting degree of the coffee beans has been met through the comparison of the colour to the colour of standard sample. Brightness value is a measurement reflected back by an object when it is given irradiation with a certain length of wave. The colour of rice coffee beans is green before the roasting process [5].

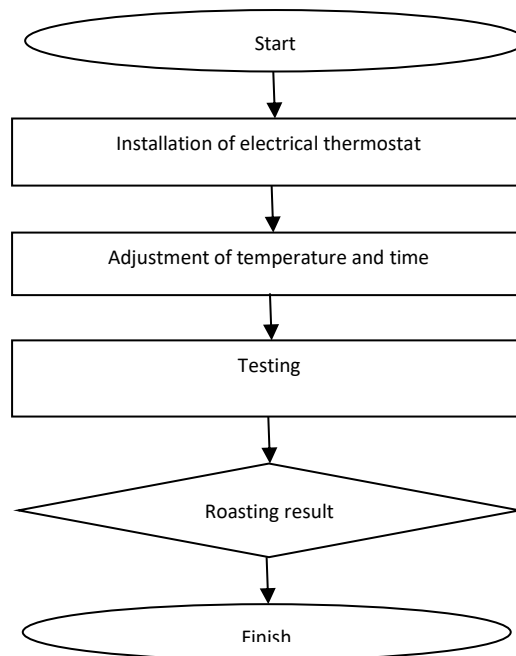
The roasting degree is usually done under atmosphere pressure. As the heating media, it is used hot air or combustion gasses. Heat is also obtained from contact between rice coffee and hot metal surface. After the preliminary treatment to remove the water, roasting process is usually started at a temperature of 200°C. The proper duration to roast coffee is approximately 30 minutes. It will be got the unexpected flavor if the roasting duration is longer than that. The physical change of the coffee beans during the roasting process is technically important as well. The expansion of the coffee beans is caused by the decrease of density as the function of the degree and speed of the roasting process [6].

Technically, the roasting machine has to be able to control the temperature needed, heat leveling for all materials, and can be heat resistant. In this coffee industry, machines are usually in big size to meet the production capacity. The capacity of the roasting machine is between 1 until 100 kilograms with the process done.

## 2. RESEARCH METHOD

### 2.1 Method of Implementation

Based on the scheme of snake skin fruit seed in picture 3.1, it is needed to conduct a research on the roasting temperature and time (duration) of dried snake skin fruit seeds to obtain the quality expected. The implementation method in this research is as follows:



Picture 2: Method of Implementation

### 2.2 Method of Testing

The test is carried out by changing the variable of roasting temperature and time. The amount of roasted snake skin fruit seeds is a fixed variable. The condition of the dried seeds is considered the same, given the same treatment as well. The roasting result will be observed and compared to the roasting result of coffee as shown in picture 2.4. The planning of the temperature applied is 60<sup>0</sup>, 80<sup>0</sup> 100<sup>0</sup>, 120<sup>0</sup> with the roasting duration of 20 minutes, 30 minutes, 40 minutes, 50 minutes based on the medium of roasting (sufficient roasting with the maximum temperature of 195<sup>0</sup>) and the good duration for the process is 30 minutes.

### 3. Result and Discussion

The test is carried out in a mechanical laboratory to facilitate the implementation of reparation in case of damage to the test equipment. The test is repeated three times for each sample with the weight of 2 kg because of the limitation of the raw material of the test; that is the seeds of Sibatnese snake skin fruit. The seeds are chopped/ crushed first with a machine designed in the previous research. The destroyed seeds then are dried by drying them using sun light for 4 hours, 3 times. The dried seeds are considered to be the same in case of the drought level and then stored in the shade.

Before entering the snake skin fruit seeds into a roasting machine, it is preheated the cylinder by starting the engine and setting the temperature according to the test plan. After the temperature of the cylinder space is reached, it is inserted the shredded seeds into the roasting cylinder. The engine is switched off and the shredded seeds are removed after the completion time.

Table 1. Test result in the temperature of 60°C

No	Sample	Time	Result
1	A	20	The entire shredded seeds are not yet cooked
2	A	20	
3	A	20	
4	A	30	The entire shredded seeds are not yet cooked
5	A	30	
6	A	30	
7	A	40	The entire shredded seeds are not yet cooked
8	A	40	
9	A	40	
10	A	50	The entire shredded seeds are not yet cooked
11	A	50	
12	A	50	



Picture 3: The test result in the temperature of 60°C and the duration of 20, 30, 40, and 50 minutes

Based on the first picture, the result is not similar to the roasted coffee beans as comparison.

Table 2. Test result in the temperature of 80°C

No	Sample	Time	Result
1	B	20	The entire shredded seeds are not yet cooked
2	B	20	
3	B	20	
4	B	30	The entire shredded seeds are lightly cooked, have brownish colour and coffee scent
5	B	30	
6	B	30	
7	B	40	The entire shredded seeds are cooked, have brown colour and coffee scent
8	B	40	
9	B	40	
10	B	50	The entire shredded seeds are cooked, have brown colour and coffee scent
11	B	50	
12	B	50	



Picture 4: The test result in the temperature of 80<sup>0</sup> C and the duration of 40 and 50 minutes

Based on picture 1, it is obtained the test result in such temperature that there are some results similar to the roasted coffee beans as comparison; in this case that is the cinnamon type, based on the colour of the roasted shredded snake skin seeds.

Table 3. Test result in the temperature of 100<sup>0</sup> C

No	Sample	Time	Result
1	C	20	The entire shredded seeds are not yet cooked
2	C	20	
3	C	20	
4	C	30	The entire shredded seeds are lightly cooked, have brownish colour and coffee-scented
5	C	30	
6	C	30	
7	C	40	The entire shredded seeds are cooked, have brown colour and coffee-scented
8	C	40	
9	C	40	
10	C	50	The entire shredded seeds are cooked, have brown colour and coffee-scented
11	C	50	
12	C	50	



Picture 5: The test result in the temperature of 100<sup>0</sup> C and the duration of 40 and 50 minutes

Based on picture 1, it is obtained the result which has similar characteristics with the roasted coffee beans as comparison; in this case that is the light type (seen from the colour of the roasting result of the snake fruit shredded seeds).

Table 4. Test result in the temperature of 100<sup>0</sup> C

No	Sample	Time	Result
1	D	20	The shredded seeds are lightly cooked, have brownish black colour and coffee-scented
2	D	20	
3	D	20	
4	D	30	The shredded seeds are lightly cooked, have brownish black colour and coffee-scented
5	D	30	
6	D	30	
7	D	40	The shredded seeds are lightly cooked, have blackish colour and charcoal-scented
8	D	40	
9	D	40	
10	D	50	The shredded seeds are lightly cooked, have blackish colour and charcoal-scented
11	D	50	
12	D	50	



Picture 6: The test result in the temperature of 120° C and the duration of 40 and 50 minutes

By looking at picture 1, the condition of the results obtained is nearly the same as the roasted coffee beans as comparison; in this case it is the French type based on the colour of the roasting result of shredded snake fruit seeds.

#### 4. CONCLUSION

Based on the research, it can be concluded that:

- a. Roasting temperature and time (duration) affect the quality of the roasted snake skin fruit seeds based on the colour and the aroma compared to the roasted coffee beans.
- b. The test result obtained in the temperature of 80° and roasted for 40-50 minutes belongs to cinnamon category, the result obtained in the temperature of 100° and roasted for 40-50 minutes belongs to light category, and the result obtained in the temperature of 120° and roasted for 40-50 minutes is appropriate to french category.

#### REFERENCES

- [1] Afrida Amalia Siregar , 2012, *Analisis Nilai Tambah Pengolahan Salak*, Jurnal Fakultas Pertanian, Universitas Sumatera Utara.
- [2] Noname. 2016. BPP Jambi. Available at: [www.bppjambi.info/](http://www.bppjambi.info/) Accessed on April 5th, 2016.
- [3] Direktorat Gizi Departemen Kesehatan Republik Indonesia., 1979, *Daftar Komposisi Bahan Makanan*. Bharata Karya Aksara, Jakarta.
- [4] Sleman\_Sembada.blogspot.com, *Kopi Buah Salak Pondoh Sleman*, downloaded 14 January 2015
- [5] Noname. 2016. Goldenways Coffe. Available at : [www.goldenwayscoffee.com/](http://www.goldenwayscoffee.com/) Accessed on April 5th, 2016.
- [6] Buckle, KA dan Edward, R.A, 1987., *Ilmu Pangan.*, Terjemahan Hari Purnama dan Adiono. UI Press: Jakarta.