

Organoleptic Characteristics of Banana Flakes Based on Maturity Level of Banana (*Musa Paradisiaca*) CV. Ambon

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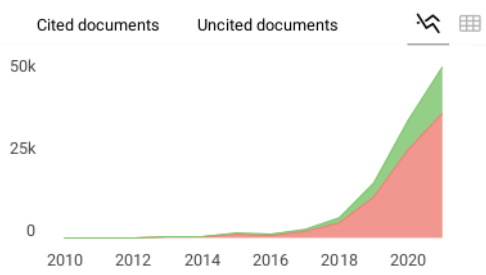
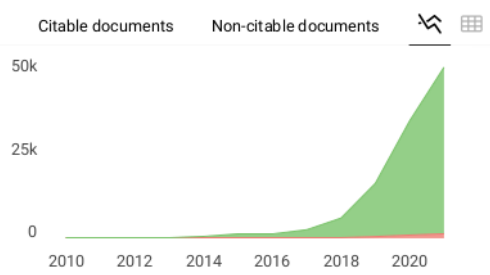
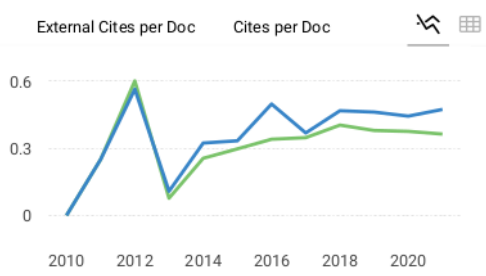
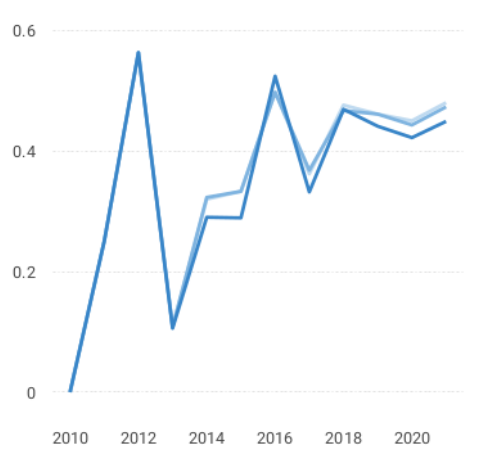
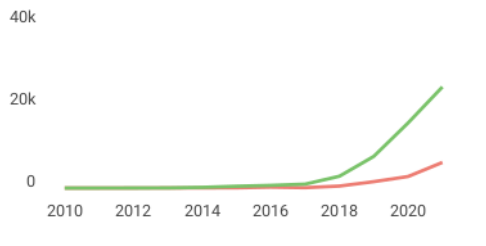
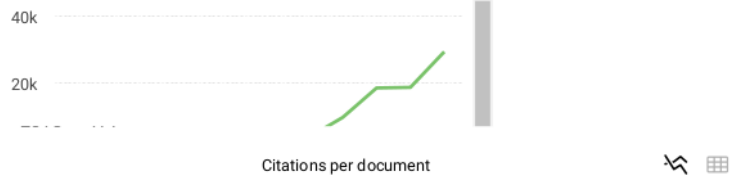
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Organoleptic Characteristics of Banana Flakes Based on Maturity Level of Banana (*Musa Paradisiaca*) CV. Ambon

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Abstract. Bananas are rich in minerals such as potassium, magnesium, iron, phosphorus, and calcium, contain vitamins A, B6 and C and contain serotonin which is active as a neurotransmitter for intelligence. Bananas can be processed into semi-finished products or finished products. One of the semi-finished products from bananas is Banana Flour. Banana flour is an alternative to banana preservation because bananas are perishable fruits. Banana flour can be made from unripe bananas and ripe bananas. The types of breakfast cereals that are most consumed or preferred by consumers are products in the form of breakfast drinks, extruded products and flakes. Flakes belong to the cereal milk food group. The purpose of this study was to determine the organoleptic characteristics of banana flakes made from banana flour with different ripeness levels of bananas. The research methodology included organoleptic test with the hedonic test method on a scale of 1-7, with a total of 30 panelists. The test parameters carried out include color, taste, aroma, hardness, crunchiness and overall acceptance. The results showed that the sample a1b3 (ripe banana flour, 25 minutes of roasting) was the most preferred by the panelists, with test values for color 5.40, taste 5.90, aroma, 5.63, hardness 5.50, crispness 5.67, overall admission of 6.07.

1. Introduction

Bananas are one of the most widely consumed fruit types in Indonesia, both in fresh and processed forms. The development of banana-based products continues to be carried out considering that bananas are a perishable fruit. One of them by making it into banana flour. Banana flour can be made from ripe or unripe bananas. The characteristics of the ripeness level of bananas that are processed into banana flour are also different, especially when viewed from the organoleptic characteristic. The most significant distinctive organoleptic parameters especially taste and smell, so that it can be used in the processing of various types of food that use flour (rice flour, wheat) in it [1]

Banana flour is produced from the process of grinding dried banana slices. Making bananas into banana flour will facilitate marketing, preserve bananas and expand the use of banana flour. The bananas that will be made into flour are bananas with a maturity level of ripe, whose skin is still green and the flesh is still hard [2]. Banana flour can be made from young bananas and unripe bananas. The principle of manufacture is drying in the sun or using a dryer, then milled and then filtered using a 100 mesh filter. Ripe banana flour has a high water content of 9.08%, carbohydrate content of 82.81% and protein content of 4.84% [3]. However, ripe banana flour has poor physical properties such as low yield, hygroscopic properties, and a more brown color than unripe banana flour due to enzymatic browning during the milling process.

Unripe banana flour has advantages such as the color produced is good, namely white and gray and has a carbohydrate content of 70.7% - 78.99% with a water content of 6.26% [4]. One type of banana that is widely available in Indonesia is the Ambon banana. Ambon bananas have a strong taste characteristic, so Ambon bananas are often consumed both fresh and processed. One of the processed



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Ambon banana products developed by the Center for Appropriate Technology Research - BRIN is Banana Flakes. According to Nurjanah [5], the types of breakfast cereals most consumed or preferred by consumers are products in the form of breakfast drinks, extruded products and flakes. All of these products are instant products where the preparation time is less than 3 minutes. Flakes are included in the cereal milk food group. According to Indonesian standard number 01-4270-1996, the definition of cereal milk is instant powder made from powdered milk and cereal with the addition of other foods and or without permitted food additives.

2. Methodology

2.1. Materials

The materials used in this study including ripe banana flour, unripe banana flour, sugar (®Gulaku), chicken eggs, baking powder (® koepoe – koepoe) and skim milk were purchased commercially. Aquadest is used for WAI and WSI analysis.

2.2. Research stages

In this study, the research method using a Randomized Block Design (RAK) with a factorial pattern (3 x 3) and 3 repetitions. The variables used are the maturity level of banana flour (A) with 3 levels and baking time (B) with 3 levels. Determination of the selected product is done by chemically analysing the sample including water content, Water Absorption Index (WAI) and Water-Soluble Index (WSI) of each group. The results of chemical analysis obtained for each treatment is carried out using a scoring test with a score range of 1 - 6. After getting the selected product in each group, then sensory analysis is carried out.

2.2.1 Analysis

The analytical response used is the sensory response to the tested product consisting of 6 attributes including color, taste, aroma, hardness, crispness, and overall acceptance. The method used in the test is hedonic test using 30 panellists, with hedonic test criteria can be seen in (Table 1).

Table 1. Criteria for the hedonic scale

Hedonic Scale	Numeric scale
Really like	7
Like	6
Kinda like	5
Neutral	4
Kinda don't like it	3
Do not like	2
Very dislike	1

2.2.2 The process of making banana flour and banana flakes

The following is a flow chart of the process of making ripe and unripe banana flour and banana flakes, as you can see in Figure 1,2 and 3.

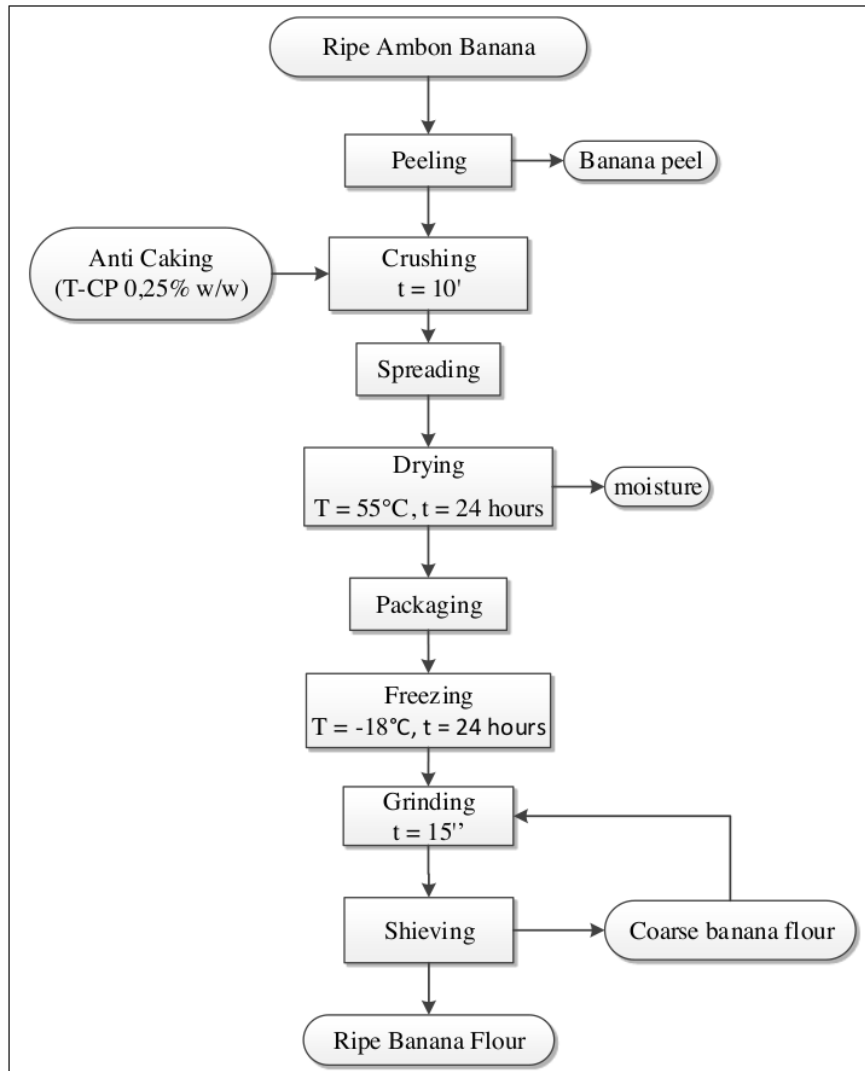


Figure 1. Flowchart of making ripe banana flour

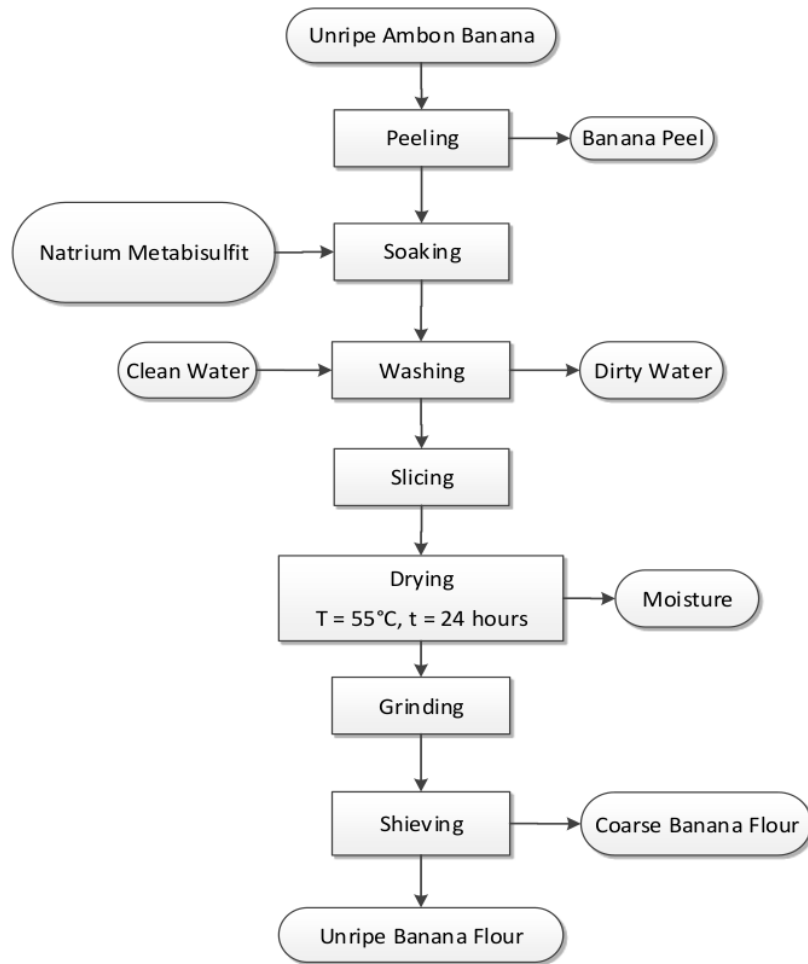


Figure 2. Flowchart of making unripe banana flour

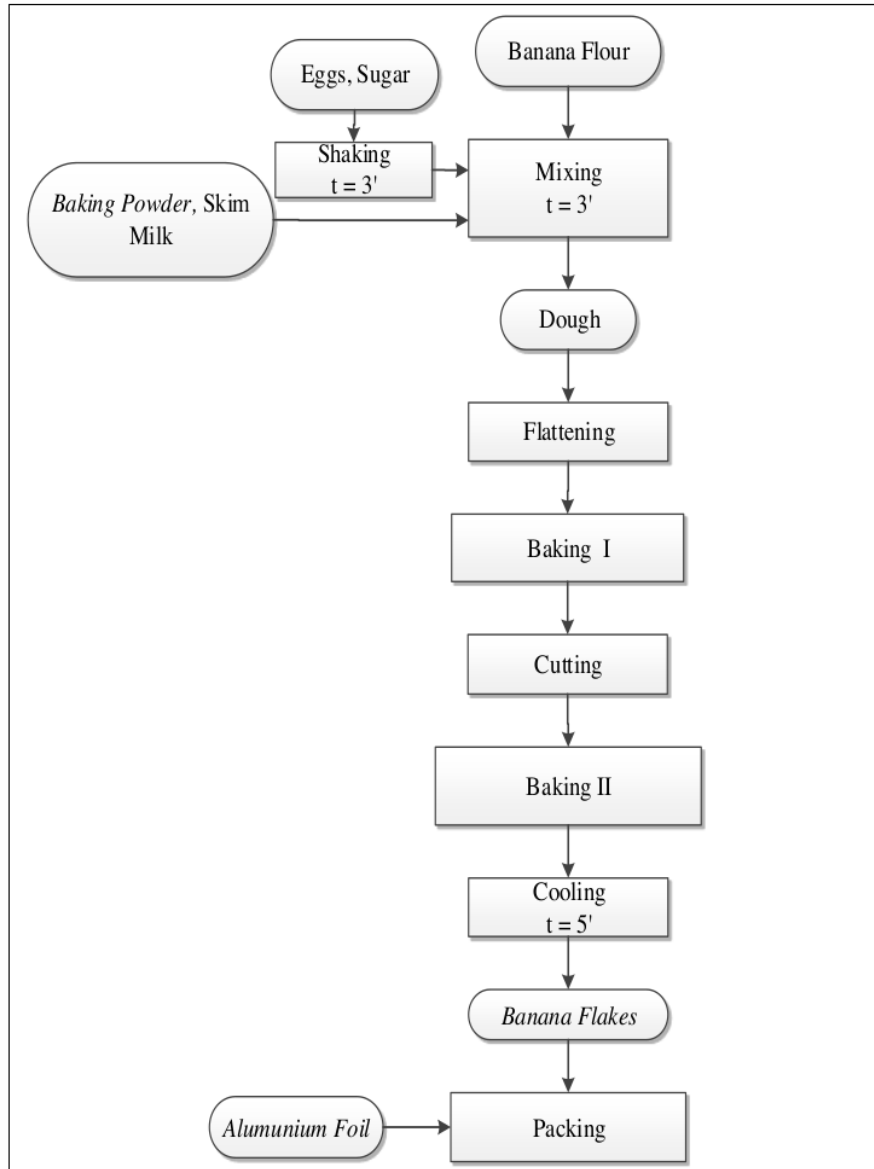


Figure 3. Flowchart of making banana flakes

3. Result and discussion

The results of the analysis of water content, WAI (Water Absorption Index) and WSI (Water-Soluble Index) of all samples, then a scoring test was carried out. From the results of the scoring test, the best 3 samples from each group were A1B3, A2B2, A3B2. The results of the scoring test can be seen in Table 2.

Table 2. The best sample based on the scoring test

Treatment	Water content	WAI	WSI	Total
A1B1	2	1	2	5
A1B2	4	2	4	10
A1B3	6	2	6	14
A2B1	1	3	1	5
A2B2	4	6	4	14
A2B3	4	5	3	12
A3B1	5	1	3	9
A3B2	6	3	5	14
A3B3	6	6	6	18

Note: A1B1=ripe banana flour, 15 min; A1B2=ripe banana flour, 20 min; A1B3=ripe banana flour, 25 min; A2B1=unripe banana flour, 15 min; A2B2=unripe banana flour, 20 min; A2B3=unripe banana flour, 25 min; A3B1=mixed banana flour, 15min; A3B2=mixed banana flour, 20 min; A3B3=mixed banana flour, 25 min

3.1. Aroma (Flavor)

The results of organoleptic tests on the aroma of flakes showed that the type of Ambon banana flour and baking time had an effect, this can be seen in Table 3.

Table 3. Results of organoleptic tests on the aroma of banana flakes

Ambon banana flour maturity level (A) and baking time (B)	Average value	Level 5%
A2B2	1,94	a
A3B2	2,21	b
A1B3	2,42	b

Note: The average value marked with the same letter shows no significant difference at the 5% level according to Duncan's further test.

The aroma of food is formed mainly during the baking process, freshly baked food has a very pleasant aroma which quickly disappears upon cooling and storage. The use of ripe Ambon banana flour as raw material for making flakes gives a better smell compared to mixed banana flour and banana flour, where for the treatment of banana flour for 20 minutes based on preference has the lowest average value, while for the treatment of banana flour ripe for 25 minutes has the largest average value. According to [6] aroma and flavor are the main factors that bananas are widely consumed. Chemically, the aroma and flavor of bananas are caused by the presence of volatile components that are received by the alpha receptor. More than 150 volatile components are present in bananas, especially the isoamyl and isobutyl ester groups together with 2-pentanone [7]. Various compounds give rise to different aromas, where enzymatic and non-enzymatic browning reactions also produce strong odors, for example the formation of furfural and maltol in the Maillard reaction [8]. Protein in foodstuffs also affects the aroma of foodstuffs. With heating, the protein in food will change and form compounds with other ingredients, for example with amino acids resulting from changes in protein with reducing sugars that form the aroma of food [9].

3.2. Taste

The results of organoleptic tests on the taste of banana flakes showed that the maturity level of Ambon banana flour and baking time had an effect, this can be seen in Table 4.

Table 4. Results of organoleptic tests on the taste of banana flakes

Ambon banana flour maturity level (A) and baking time (B)	Average value	Level 5%
A2B2	2,01	a
A3B2	2,39	b
A1B3	2,52	b

Note: The average value marked with the same letter shows no significant difference at the 5% level according to Duncan's further test.

Based on the results of Duncan's further test in Table 4, it shows that the type of Ambon banana flour and the baking time on the taste of the A2B2 treatment were significantly different from the A3B2 and A1B3 treatments, the A3B2 treatment was significantly different from the A2B2 treatment, as well as the A1B3 treatment was significantly different from the A2B2 treatment.

Flavor and taste are defined as stimuli evoked by the ingested material, mainly perceived by the senses of taste and smell, as well as other stimuli such as touch and acceptance of the degree of heat in the mouth. Taste is a sensation that is formed from the combination of ingredients and their composition in a food product that is captured by the sense of taste. Taste according to the quality attributes of a product is usually an important factor for consumers in choosing a product [10]. It is known that there are four basic tastes, namely sweet, sour, salty, and bitter. The concept is actually just a simplification, the stimulation received by the brain due to electrical stimulation that is transmitted from the taste cells is actually very complex. It is known that sweetness comes from compounds of 51 sugars such as sucrose, bitter by quinine, salty by salt, and sour by various types of acids. The taste of food products in general does not consist of only one taste but is an integrated combination of various kinds to give rise to the taste of a whole food [11]. Factors that affect taste are chemical compounds, temperature, and interactions with other flavor components. Various chemical compounds give rise to different tastes. The sour taste is caused by proton donors, the salty taste is produced by inorganic salts, the sweet taste is also caused by aliphatic organic compounds and the bitter taste is caused by the alkaloids. Interaction with other components can certainly affect the value of a product's taste [8].

The taste that appears in the product is caused by the presence of ingredients in the product such as banana flour, sugar, eggs, milk and baking powder. It can be seen that the use of ripe banana flour is better than mixed banana flour or mixed banana flour. Where the use of ripe banana flour has a higher level of preference, this shows that ripe banana flour with a baking time of 25 minutes increases the preference for flakes. The more ripe the banana, the sweeter the taste due to the high sucrose content. During the ripening process of bananas, starch is converted into sugar through an enzymatic process where there is a decrease in starch content from 20-30% to 1-2% [12] followed by an increase in the amount of sugar content, especially sucrose to more than 10% by weight of fresh fruit [13].

3.3. Color

The results of the organoleptic test on the color of the flakes showed that the maturity level of Ambon banana flour and baking time had an effect, this can be seen in Table 5.

Table 5. Results of organoleptic tests on the color of banana flakes

Ambon banana flour maturity level (A) and baking time (B)	Average value	Level 5%
A2B2	1,98	a
A3B2	2,39	b
A1B3	2,42	b

Note: The average value marked with the same letter shows no significant difference at the 5% level according to Duncan's further test.

Based on the results of Duncan's further test in Table 5, it shows that the type of Ambon banana flour and the baking time of the color in the A2B2 treatment were significantly different from the A3B2 and A1B3 treatments, while the A3B2 treatment was not significantly different from the A1B3 treatment. But treatment A3B2 significantly different from treatment A2B2.

According to [14], color is the most important quality attribute. Even though a product has high nutritional value, good taste and good texture, if the color is not attractive, it will cause the product to be less attractive. Flakes contain protein and sugar derived from the main raw materials and supporting materials. The possibility of protein and sugar content, the occurrence of a browning reaction during baking. Where for treatment of banana flour mixture for 20 minutes based on preference for flakes has the lowest average value while for treatment of mixed banana flour for 25 minutes has the largest average value. In general, when food is dried, the color of the material will turn brown due to a non-enzymatic browning reaction. This reaction occurs due to baking at high temperatures so that the sugar caramelization reaction occurs into glucose and fructose.

In addition, the color of the flakes is influenced by the Maillard reaction, namely the amino groups of proteins found in ingredients such as banana flour, eggs and milk with the carbonyl groups of reducing sugars found in banana flour and sugar. Browning reaction is defined as the reaction of an amino group on an amino acid, peptide or protein with a hydroxyl group on a sugar, resulting in the formation of a brown nitrogen polymer or melanoidin [10]. The color of the product, apart from being a sufficient factor in determining quality, can also be used as an indicator of whether or not the mixing method or processing method can be marked by the presence of a uniform and even color [8].

3.4. Crispness

The results of the organoleptic test on the crispness of the flakes showed that the maturity level of Ambon banana flour and baking time had an effect, this can be seen in Table 6.

Table 6. Results of organoleptic tests on the crispness of banana flakes

Ambon banana flour maturity level (A) and baking time (B)	Average value	Level 5%
A2B2	2,17	a
A1B3	2,47	b
A3B2	2,50	b

Note: The average value marked with the same letter shows no significant difference at the 5% level according to Duncan's further test

Based on the results of Duncan's further test in Table 6. shows that the type of Ambon banana flour and baking time on the crispness of the A2B2 treatment were significantly different from the A3B2 and A1B3 treatments, while the A3B2 treatment was not significantly different from the A1B3 treatment, as well as the A1B3 treatment was not significantly different with treatment A3B2 but significantly different from treatment A2B2.

The crispness of breakfast food products is an important factor. In the processing of breakfast foods such as flakes, raw materials are often added, both those that have not been modified or starch that has

been modified. According to Muchtadi et al [15], starch has an important role for the manufacture of flakes because it can affect the texture. The effect was mainly due to the ratio of amylose and amylopectin in starch. Amylopectin is known to stimulate the development process (puffin), so that flakes derived from starch with a high enough amylopectin content will be porous, crispy and crunchy, where for the treatment of unripe banana flour to stir for 20 minutes based on preference for flakes in terms of crunchiness has an average value. The lowest average while for the treatment of mixed banana flour for 25 minutes has the largest average value. Changes that occur during the process of making flakes are starch will be gelatinized and mild hydrolysis may occur, browning reactions occur which may be caused by interactions between protein and sugar, caramelization and dextrination processes occur as a result of baking at high temperatures so that crispy flakes are produced due to water reduction which is quite high.

3.5. Hardness

The results of organoleptic tests on the hardness of banana flakes showed that the maturity level of Ambon banana flour and baking time had an effect, this can be seen in Table 7.

Table 7. Organoleptic test results on hardness of banana flakes

Ambon banana flour maturity level (A) and baking time (B)	Average value	Level 5%
A2B2	2,12	a
A1B3	2,44	b
A3B2	2,47	b

Note: The average value marked with the same letter shows no significant difference at the 5% level according to Duncan's further test.

Based on the results of Duncan's further test in Table 7. shows that the type of Ambon banana flour and baking time on the hardness of the A2B2 treatment was significantly different from the A3B2 and A1B3 treatments, while the A3B2 treatment was not significantly different from the A1B3 treatment, as well as the A1B3 treatment was significantly different from the A1B3 treatment but treatment A2B2 not significantly different from treatment A3B2.

According to Muchtadi et al [15], starches with high amylose content, for example starch from tubers, tend to produce hard flakes because the development process occurs in a limited manner, where for the treatment of banana flour it kneads for 20 minutes based on the hardness of the flakes in terms of crispness has the lowest average value while for the mixed banana flour treatment for 25 minutes it has the largest average value.

3.6. Overall

The results of organoleptic tests on overall banana flakes showed that the maturity level of Ambon banana flour and baking time had an effect, this can be seen in Table 8.

Table 8. Results of organoleptic tests on overall of banana flakes

Ambon Banana Flour Maturity Level (A) and Baking Time (B)	Average Value	Level 5%
A2B2	2,17	a
A3B2	2,39	b
A1B3	2,56	b

Note: The average value marked with the same letter shows no significant difference at the 5% level according to Duncan's further test.

Based on the results of Duncan's further test in Table 8. It shows that the type of Ambon banana flour and the baking time of overall in the A2B2 treatment were significantly different from the A3B2 and

A1B3 treatments, while the A3B2 treatment was not significantly different from the A1B3 treatment, as well as the A1B3 treatment was significantly different with A2B2 treatment but not significantly different from A3B2 treatment. This indicates that based on the organoleptic assessment of flakes, the flakes product in treatment A1B3 (25 minutes ripe banana flour) had the highest average value in terms of preference.

4. Conclusion

Based on the results of the study, it can be concluded that the treatment selected according to organoleptic results in each group with attributes of taste, color, aroma, crispness, hardness and overall is a flakes product with treatment A1B3 (ripe banana flour, baking time 25 minutes).

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