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Effect of The Proportion of Oyster Mushroom and Banana Blossom on the Physicochemical and Organoleptic Properties of Shredded Vegetable

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Abstract: Shredded or floss is one of the ready-to-eat dry food which is usually made from meat. The type of floss that is suitable for vegetarians is shredded vegetable. Shredded vegetable is made from vegetable ingredients which contain lots of fiber that similar to meat fibers such as oyster mushroom and banana blossom. In this study, the manufacture of shredded vegetable made from several proportions of oyster mushrooms and banana blossom was carried out. The results of the analysis of the water content of shredded vegetable ranged from 4.85-5.31%, water activity 0.417-0.465, soluble fiber content 1.06-2.24%, insoluble fiber content 3.13-4.28%, lightness 25.66-29.66, chroma 3.31-6.25, and hue 23.34-62.48. The best treatment for shredded was found in the proportion of oyster mushrooms and banana blossoms with 90:10% (w/w), with an area of 61.1203, the level of preference for color (5.6875), taste (5.3375), aroma (5.3750), and appearance (5.7125).

Keywords: banana blossom, best treatment, oyster mushroom, physicochemical, organoleptic, shredded vegetable.

I. INTRODUCTION

Shredded meat is one of the ready-to-eat dry foods that are favored by people in Indonesia (called “abon”) because it is practical, durable, dry, light, crunchy, and with savory characteristics [1]. Shredded meat is usually made with the basic ingredients of meat mixed with spices and coconut milk. Shredded is included in Intermediate Moisture Food (IMF) products with water activity (Aw) above 0.5 and can be consumed directly and is stable during storage without requiring heat treatment, freezing, or cooling [2], [3]. In general, shredded meat has the characteristics of brown, fibrous, light, has a distinctive odor and has a long shelf life because it is dry with the maximum water content of 7% and the maximum sugar content of 30% [4]. The alternative material to substitute for shredded meat for vegetarians is to combine oyster mushrooms with banana blossoms into vegetable shreds. Vegetable shredded is shredded with raw materials using vegetable ingredients that have a lot of fibers such as oyster mushrooms and banana blossom [5]. In this research, the two ingredients will be combined with different proportions to get the product with the best results. The vegetable shredded raw material used in this research was oyster mushroom. Oyster mushroom is a food ingredient with a short shelf life and is easily damaged [6]. Oyster mushrooms have a high nutritional composition and are good for the body, rich in protein and low in fat. Oyster mushrooms include food that is easily damaged like other types of vegetables. Oyster mushrooms have a delicious taste and good texture like meat [7].

Based on oyster mushrooms, vegetable shredded has a selling price that is not too expensive so that it can be consumed by all groups of people, including vegetarians. In the vegetable shredded oyster mushroom, other ingredients can be added to add variety to the shredded. An additional ingredient used in vegetable shreds was banana blossom. The banana blossom is one part of the banana plant that is still underutilized. In addition to the low price, banana blossoms have nutritional compositions [8] that are beneficial to the body such as protein (12.05%), carbohydrates (34.83%), fat (13.05%) [9], and high fiber quite high (18.44%) [10]. Banana blossom also has fiber that is almost similar to meat fiber. As in [11], reported that the combination of 25% banana blossom, and 75% chicken meat has the preferred organoleptic parameters and has high antioxidant activity with a value of 53.74%. The banana blossom used in the study was the banana blossom of the kepok banana type (*Musa paradisiaca* formatypica). The kepok banana blossom has the advantage of absorbing water due to its fiber content which is not too low and not too high. The part of the banana blossom used was the white part of the skin from the middle to the inside. Based on preliminary research, the manufacture of vegetable shreds with a proportion of banana blossoms more than 60% produces vegetable shreds that were less preferred because the use of banana blossom of more than 60% produces a sweeter taste so that consumers do not like it. In this study, the proportions of oyster mushrooms and banana blossoms were used with a ratio of 100:0%

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(w/w), 90:10% (w/w), 80:20% (w/w), 70:30% (w/w), 60:40% (w/w), and 50:50% (w/w), this product is called shredded oyster mushroom banana blossom (SOMBB) or "*abon jamur tiram-jantung pisang*". This study aims to determine the effect of differences in the proportions of oyster mushrooms with banana blossoms on the physicochemical characteristics (moisture content, color, fiber soluble and insoluble) and organoleptic properties (taste, color, aroma, and appearance) of vegetable shreds.

II. Material and Methods

A. Materials

The materials needed in this research are white oyster mushrooms, "kepok" banana blossom, obtained from the local market in Surabaya, refined coconut sugar (ground), granulated sugar, garlic and shallots that have been mashed with a mixer, coriander powder, ground pepper, salt, coconut milk (KARA brand), lemongrass, bay leaf, and kaffir lime leaves, commercial cooking oil, and bottled drinking water. Materials for water content analysis using filter paper. Fiber testing using distilled water, Whatmann filter paper no. 40, 96% ethanol, 78% ethanol, 1N NaOH (pa), 1N HCl (pa), 0.2M phosphate buffer, heat stable-amylase enzyme (Alfa Lab), pepsin enzyme (Alfa Lab), and pancreatin enzyme (Alfa Lab).

The tools used for analysis are analytical balance (Ohaus), weighing paper, horn spoon, 250 mL Erlenmeyer (Scott Duran and Pyrex), glass beaker (Pyrex), 100 mL and 20 mL measuring cups (Pyrex), oven (Memmert), drop pipette, crucible, desiccator, 50 mL funnel, shaking water bath (GFL 1083), furnace (Thermolyne), A_w meter (Rotronic Hygropalm), plastic cup, label, tray, color reader (Konica Minolta CR300) and questionnaire sheet.

B. Methods

The research design used was a Randomized Block Design (RBD) with a single factor, namely the proportion of oyster mushrooms and banana blossoms consisting of 6 levels of treatment, with 4 replications. The test parameter were the physicochemical and the organoleptic properties of SOMBB. Ho's hypothesis was that there was no effect of treatment on the test parameters. Hypothesis testing was carried out using analysis of variance, with a 95% confidence interval. If there was an effect, then it was continued with a post hoc test using Duncan Multiple Range Test (DMRT) with a significance level of 5%. Research on making vegetable shreds with proportions of oyster mushrooms and banana blossoms consisted of six treatment levels, namely N1:100:0% (w/w), N2:90:10% (w/w), N3:80:20% (w/w), N4:70:30 % (w/w), N5:60:40% (w/w), and N6: 50:50% (w/w). The research design can be seen in Table 1.

TABLE 1 Treatment Level

Material (g)	Treatment					
	N_1	N_2	N_3	N_4	N_5	N_6
Shredded oyster mushroom	200	180	160	140	120	100
Shredded banana blossom	0	20	40	60	80	100
Sugar	10	10	10	10	10	10
Refined coconut sugar	20	20	20	20	20	20
Garlic finely	32	32	32	32	32	32
Fine red onion	20	20	20	20	20	20
Coriander powder	6	6	6	6	6	6
Pepper powder	1,2	1,2	1,2	1,2	1,2	1,2
Salt	5	5	5	5	5	5
Lemongrass	12	12	12	12	12	12
Galangal	24	24	24	24	24	24
Bay leaf	2	2	2	2	2	2
Kaffir lime leaves	6	6	6	6	6	6
Coconut milk (mL)	200	200	200	200	200	200
Total	532,2	532,2	532,2	532,2	532,2	532,2

The process of making shredded oyster mushroom - banana blossom includes weighing oyster mushrooms and shredded banana blossom, mixing with 100% KARA coconut milk and vegetable shredded seasoning, standing (10 minutes), frying (120°C, 15 minutes), draining (30 seconds), spinning (5 minutes, speed 3), packaging using glass jars and adding silica gel silica.

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Physicochemical test includes analysis of water content [12], water activity [13], color analysis with KonicaMinolta color reader [14], analysis of insoluble and soluble fiber content [15].

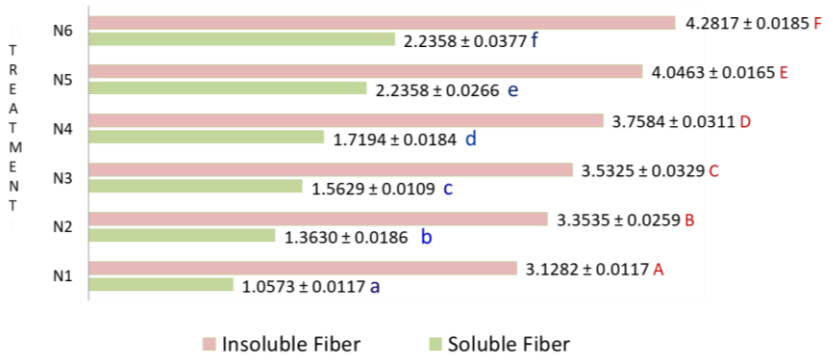
Organoleptic testing of vegetable shreds was carried out using a preference test (hedonic test) [16]. The purpose of the organoleptic test is to determine the level of consumer preference for the taste, color, aroma, and appearance of SOMBB. The number of panelists needed for the organoleptic test is 80 untrained panelists who are from the surrounding community. The samples tested to the panelists were SOMBB under the same conditions. The sample code consists of three random numbers, so that the panelists do not have a certain interpretation. The scale used starts from 1 (dislike very much) to 7 (likes very much).

III. Result and Discussions

A. Analysis of Physicochemical Properties of SOMBB

Analysis of the physicochemical properties of shredded oyster mushroom banana blossom was carried out to determine the effect of differences in the proportion of oyster mushroom with banana blossom on the physicochemical characteristics of vegetable shredded. The physicochemical parameters studied included analysis of moisture content, fiber (soluble and insoluble) content, water activity (Aw) and color.

The principle of testing the fiber content of SOMBB using the gravimetric method. There are two kinds of fiber content in the test, namely soluble fiber content and insoluble fiber content. From Fig. 1, it can be seen that the higher the proportion of banana blossoms added, the higher the soluble fiber content and the insoluble fiber content of the SOMBB. From the analysis of variance on fiber content, it turns out that there was a significant difference between treatments, so that it was continued with the DMRT test with a significance level of 5%, the results were as shown in Fig 1.



Different letters on the bar chart, mean the difference between treatments

Fig. 1. Soluble and insoluble Fiber Content of Shredded Oyster Mushroom with Banana Blossom

From Fig.1 it can be seen that the value of SOMBB insoluble fiber (with rounding) was between 1.06±0.01% to 2.24± 0.038%, while the value of SOMBB soluble fiber was between 3.13±0.0% to 4.28±0.019%. There was an increase in the amount of both insoluble and soluble fiber in SOMBB, along with the increase in the proportion of banana blossom: oyster mushroom. However, when compared with the fiber content in raw materials, there was a difference, this was due to a decrease in the fiber content during processing. This happens because banana blossoms have a higher fiber content, which was 20.47% [17] than oyster mushrooms (3.5%), so that more additions to the proportion of banana blossom can increase the levels of soluble and insoluble fiber in shredded. The results of the study were in line with the research [18] regarding the manufacture of shredded banana blossoms with the addition of tuna, which states that the high fiber content was thought to be due to the large number of banana blossoms used in the treatment where the banana blossom has a high fiber content.

Analysis of water content aims to determine the water content of SOMBB. The water content test was carried out using the thermogravimetric method. The principle of this method is to evaporate the water in the food by heating. The water content will determine the characteristics and shelf life of the product [19],[20]. Based on the results of the study, the average moisture content of shredded banana blossom oyster mushrooms was 4.85 - 5.31% wet basis. According to [4], the maximum water content in shredded meat was 7%, so that the water content of shredded oyster mushroom and banana blossom meets SNI standards. The graph of testing the water content of the SOMBB can be seen in Fig. 2.

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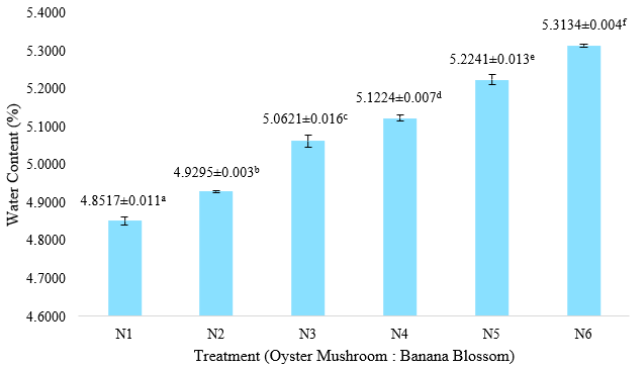
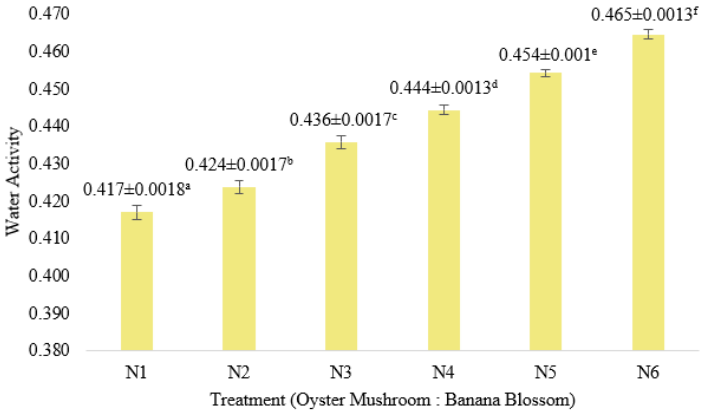


Different letters on the bar chart mean the difference between treatments

Fig. 2. Water Content of Shredded Oyster Mushroom with Banana Blossom

The lowest water content of shredded was found in treatment N1 with water content of 4.85% (oyster mushroom: banana blossom = 100:0% (w/w)). while the highest water content was in treatment N6 with water content of 5.31% (oyster mushroom: banana blossom = 50:50% (w/w)) and significantly different in each treatment. The most influential component was the banana blossom because it has the highest water content (90.2%) [21]. The results of the water content test show that the more the addition of the proportion of banana blossoms, the water content of the shredded will increase. The statement above is supported by the statement of [22], which states that the higher the concentration of banana blossoms, the higher the water content produced in vegetable shredded because banana blossoms have high water content, so they can bind more water.

The principle of water activity aims to determine the water activity of SOMBB. The Aw test for SOMBB was carried out using an a_w meter. Water activity indicates shelf-life and bacterial susceptibility of shelf-stable foods. The Aw value in food products describes the extent to which water availability can be used in chemistry/biochemistry to support the growth of microorganisms [23]. The Aw value that can be grown by mold was 0.75; yeast 0.80; and 0.85 bacteria [24]. Based on the results of the study, the average Aw of shredded banana blossom oyster mushrooms was 0.417-0.465. Water activity of shredded banana blossom oyster mushroom in good value for product storage. From the analysis of variance on water activity, it turns out that there was a significant difference between treatments, so that it was continued with the DMRT test with a significance level of 5%, the results were as shown in Fig 3.



Different letters on the bar chart mean the difference between treatments

Fig. 3. Water Activity of Shredded Oyster Mushroom with Banana Blossom

Based on Fig.3. it is known that the results of the water activity test are significantly different. The higher the proportion of banana blossom, the higher the water activity. Banana blossoms have a higher water content of 90.2% [18], than oyster mushrooms (86-87.5%) [21], so the higher the proportion of banana blossoms, the higher the water activity. The difference in water activity for each treatment did not differ much because of the same processing (frying) process and the proportion ratio between treatments was not too far apart.

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Color testing. Color can affect the perception of product flavor [22], [23]. Color testing of SOMBB was carried out objectively using the Minolta color reader with LAB color model. The results of color testing are as shown in Table 2, below.

TABLE 2. THE VALUE OF THE MEASUREMENT RESULTS OF L*, A*, B*, AND THE CALCULATION OF C* AND H

Treatment	L*	a*	b*	C*	H
N1	29.66	8.56	2.59	6.24	23.34
N2	29.21	8.18	3.44	6.25	23.81
N3	28.48	6.58	4.45	5.48	34.53
N4	27.47	5.52	5.44	5.47	45.48
N5	26.60	4.45	7.62	3.59	55.47
N6	25.66	4.21	10.58	3.31	63.48

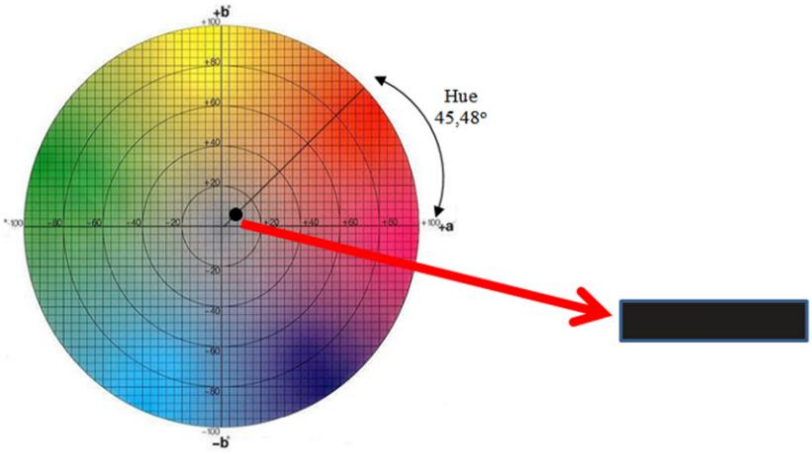

Fig 4. The Color Diagram of Vegetable Shredded Oyster Mushroom with Banana Blossom Treatment (SOMBB) N4 (Oyster Mushroom: Banana Blossom)= 70:30% (w/w)

Based on the analysis data from Table 2, moreover the lightness value ranges from 25.66 to 29.66. The lightness value of shreded vegetable is quite low (<50) and decreases with the increase in the proportion of banana blossom. The banana blossom has a darker color after the steaming process, so the more the proportion of the banana blossom, the darker the shredded color will be. The darker shredded color was due to the higher proportion of banana blossom. Banana blossom has a tannin compound which will change the color of the banana blossom to black [28], so that with the increase in the proportion of banana blossom, the color of the shredded will be darker. The redness value ranges from 4.21-8.56 (red). Shredded oyster mushroom banana blossom has a chroma value between 3.31-6.25. The shredded chroma value decreased with the increase in the proportion of banana blossoms, indicating that the intensity of the shredded color decreased with the higher proportion of banana blossoms. Based on the hue value, the shredded color has a dominant red color in the treatment N1 to N4 with a range of 23.34-45.48. Treatments N5 and N6 have a red-yellow color with hue values of 55.47 and 63.48. The color was formed due to the Maillard reaction that occurs during the frying process.

B. Organoleptic Properties Of Shredded Oyster Mushroom Banana Blossom

Organoleptic testing was carried out to determine the level of consumer preference for the color. taste. aroma. and appearance of the banana blossom mushroom shreds produced. Organoleptic testing was carried out using a hedonic test (liking) with a scale ranging from 1 (very dislike) to 7 (very much like). The higher the value given by the panelists indicates the preference of the panelists on the parameters of the product being tested.

Color Preference test. Color is one of the organoleptic parameters that can affect the perception of product flavor [26]. The average value of organoleptic testing for the color of shredded oyster mushroom with banana blossom ranged from 4.9125 to 5.6875. The average results were analyzed using the ANOVA test ($\alpha = 5\%$). The results of the organoleptic ANOVA test for color preference showed that there was a significant difference between the proportion of oyster mushrooms and banana blossoms. So it was continued with the DMRT (Duncan's Multiple Range Test) differentiating test ($\alpha = 5\%$). DMRT test results can be seen in Fig.5.

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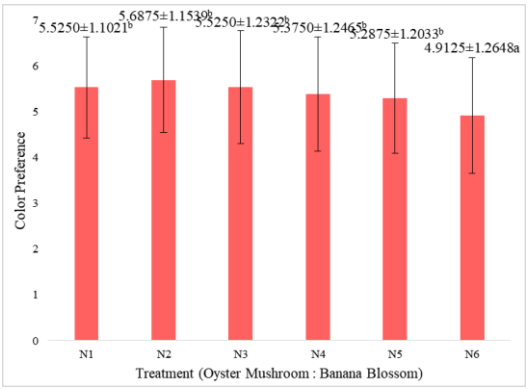
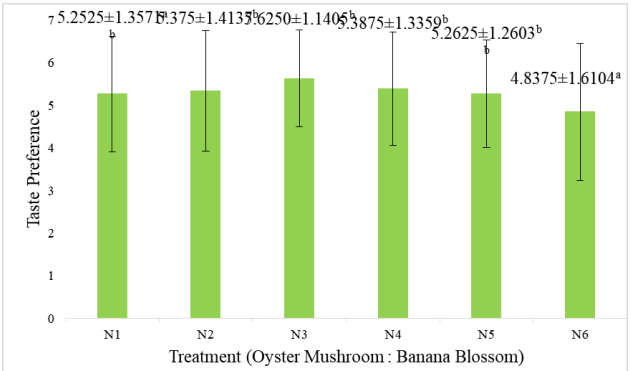


Different letters on the bar chart mean the difference between treatments

Fig 5. The Color Preference of Shredded Oyster Mushroom with Banana Blossom

Based on Fig.5, it is known that the shredded N1, N2, N3, N4, and N5 were not significantly different. The treatment of N6 was significantly different from all treatments. A value of 5 indicates that the panelists rather like shredded oyster mushrooms with banana blossom and a value of 4 indicates that the panelists are neutral. In the proportion of banana blossom 50%, the panelist's preference level was the lowest, due to the darker color of the floss. The higher the proportion of banana blossom, the darker the color of the resulting shredded. This statement was in line with research which states that the more composition of banana blossom to replace chicken meat will cause the color of the shredded meat to be darker [10].

Taste Preference test. Taste is one of the important organoleptic parameters in consumer acceptance of a food product. The average value of organoleptic testing for the taste of shredded oyster mushroom with banana blossom ranged from 4.8375 (neutral-rather like)-5.6250 (rather like-like). Based on Fig. 6, the most preferred treatment by consumers was the N3 treatment shredded because it has a taste that resembles the taste of shredded meat as raw material. The least preferred treatment was the N6 treatment. The N6 treatment was least favored because of its sweeter and sour taste due to the high proportion of banana blossom. The sweet taste was because the banana blossom has a fairly high carbohydrate, and the sour taste is due to tannin compounds [29], so that it was not liked by consumers. A value of 4 indicates that the panelists were neutral and a value of 5 indicates that the panelists rather like shredded oyster mushrooms with banana blossom.



Different letters on the bar chart mean the difference between treatments

Fig 6. The taste preference of Shredded Oyster Mushroom with Banana Blossom

Aroma Preference Test. Aroma is one of the important parameters in organoleptic testing because it can provide results of an assessment of the product regarding the acceptance of a product [30]. According to [31], aroma is a determinant of the delicacy of food and a special attraction. Based on the Anova test with 5% alpha, it was concluded that there was no significant difference between treatments. It was known that the results of organoleptic testing for the aroma of shredded oyster mushroom with banana blossom were not significantly different in all treatments. This was due to the same manufacturing process and the same number of spices used for making shredded meat in all treatments. Besides, the difference in proportions used was not much different, causing the same aroma. A value of 5 indicates that consumers rather like shredded oyster mushrooms banana blossom.

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Appearances Preference Test. Appearance is also one of the important parameters in the organoleptic properties of a food product. Appearance can affect consumer perception of the product. Based on Anova test, it was known that the results of the organoleptic test of appearance preferences was not significantly different. The test results was not significantly different because the results of the shredded oyster mushroom and banana blossom produced were uniform, so they had the same appearance. A value of 5 indicates that consumers rather like shredded oyster mushrooms with banana blossom. The most preferred treatment was the N2 treatment and the least preferred was the N6 treatment.

The best Treatment. Determination of the best treatment aims to determine the most preferred treatment by the panelists as a whole based on organoleptic properties. The best treatment of shredded oyster mushroom with banana blossom proportions was determined based on organoleptic testing with parameters of color, taste, aroma and appearance using the spider web method. The results of organoleptic testing are as shown in Table 3, below.

TABLE 3. ORGANOLEPTIC TEST RESULTS (AVERAGE)

Parameter	Treatment					
	N1	N2	N3	N4	N5	N6
Color (A)	5 .5250^{b}	5.6875^{b}	5.5250^{b}	5.3750^{b}	5.2875^{b}	4.9125^{a}
Taste (B)	5.2625^{b}	5.3375^{b}	5.6250^{b}	5.3875^{b}	5.6265^{b}	4.8375^{a}
Aroma (C)	5.2375	5.3750	5.3750	5.5125	5.4000	5.1375
Appearance (D)	5.3500	5.7125	5.4250	5.4875	5.3750	5.2625

Different letters on the row for each organoleptic value mean the difference between treatments (α = 5%)

From Table 3, the organoleptic test results are plotted into the Excel radar chart or spider web program, which will show the results in Fig. 7, below.

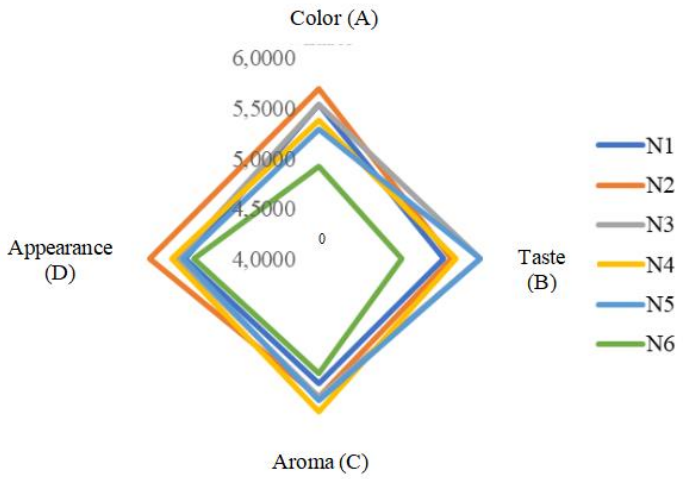

Fig 7. Spider Web Graphics Best Treatment of Shredded Oyster Mushroom Banana blossom

Determination of the best treatment was determined based on the results of the organoleptic test of preference for color (A), taste (B), aroma (C), and appearance (D). The best treatment was determined by the total area of the triangle on the spider web graph using the formula : ½ . a . b . sin α. Calculation of each triangle formed by the two organoleptic parameters (Fig 9.). Then the results are added up to calculate the area for each treatment.

Example calculation for treatment N1,

OAB = ½ . 5.5250 . 5.2625 . sin 90^{o} = 14.5377,
OBC = ½ . 5.2625 . 5.2375 . sin 90^{o} = 13.7812,
OCD = ½ . 5.2375 . 5.3500 . sin 90^{o} = 14.0103,
ODA = ½ . 5.3500 . 5.5250 . sin 90^{o} = 14.7794,
Total area = 14.5377 + 11.9345 + 14.0103 + 14.7794= 57,1085
The calculation results for each treatment are as shown in Table 4.

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TABLE 4. SPIDER WEB AREA

Treatment	Total Area
N1	57.1085
N2	61.1203
N3	60.2225
N4	59.2008
N5	58.7893
N6	50.7525

The spider web of the best treatment can be seen in Fig 9. The total area of the spider web area based on organoleptic testing of shredded oyster mushroom with banana blossom ranged from 57.1085 to 61.1203. From Table 4, it can be seen that the best treatment of organoleptic test results was shredded oyster mushroom banana blossom treatment N2 (oyster mushroom: banana blossom = 90:10% (w/w), with a total area of 61.1203. Panelists' preference score for organoleptic testing including color, taste, aroma, and appearance of N2 was 5.6875 (slightly like); 5.3375 (slightly like); 5.3750 (slightly like); and 5.7125 (slightly like), respectively.

As a new product SOMBB, the value of organoleptic testing from slightly like to like is still understandable. Moreover, it has advantages as a food source of dietary fiber [32]. The suggested consumption per day of dietary fiber is 25-30 g per day sourced from a variety of plant products. Vegetable shredded products, with dietary fiber as bioactive, will be very helpful in fulfilling the nutrients as recommended by American Heart Association [33], as well as to help the diet of Covid 19 patients [34]. Shredded is used as a side dish with rice as the main dish. Shredded as a delicious taste enhancer, as well as a supplier of nutrients other than carbohydrates. Therefore, the selection of shredded oyster mushroom banana blossom as an alternative nutrient enrichment can be achieved.

IV. CONCLUSION

The results of the analysis of the water content of shredded vegetable ranged from 4.85-5.31%, Aw 0.417-0.465, soluble fiber content 1.06-2.24%, insoluble fiber content 3.13-4.28%, lightness 25.66-29.66, chroma 3.31-6.25, and hue 23.34-62.48. The best treatment for shredded was found in the proportion of oyster mushrooms and banana blossoms with 90:10% (w/w), with an area of 61.1203, the level of preference for color (5.6875), taste (5.3375), aroma (5.3750), and appearance (5.7125). Based on the results of this study, it can be followed up with research that links shredded food fiber with other functional properties that support health.

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