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EFFECT OF SUBSTITUTION OF PACET PURPLE SWEET POTATO PASTE ON THE ORGANOLEPTIC PROPERTIES OF CAKE, COOKIES, AND BREAD

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ABSTRACT

The production and productivity of sweet potatoes in Indonesia continues to increase from year to year, but their use and consumption is still very limited. Mojokerto is the largest sweet potato producer city in East Java Province; Pacet District is one of the centers of purple sweet potato production. Frozen pasta is an intermediate product so sweet potatoes can be stored for a longer time. The research aimed 1) to determine the effect of substitution of purple sweet potato paste on organoleptic quality of cake, cookies, bread which includes color, aroma, taste, texture, and level of preference. 2) to know the criteria for cake, cookies, bread with the substitution of the best purple sweet potato paste, based on the level of preference. This research was classified as experimental research, with 3 treatments of the substitution rate of purple sweet potato paste, which are cake products with 60% (X1), 70% (X2), and 80% (X3); cookies with 40% (X1), 50% (X2), 60% (X3); bread with 10% (X1), 20% (X2), 30% (X3). Data collection used the observation method through organoleptic tests. Samples were assessed by 25 trained panelists. Organoleptic test data were analyzed by a single ANOVA test. The effect of the best treatment is known through the most chosen products by the panelists based on their level of preference. The results were: 1) the substitution of purple sweet potato paste had an effect on the organoleptic quality of cake including color and texture, but did not have a significant effect on aroma, taste and level of preference. The most preferred product of the panelists, which was X2, had organoleptic properties of having quite purple color, the aroma of purple sweet potato, the taste of purple sweet potato, smooth and hollow texture; 2) The substitution of purple sweet potato paste had an effect on the organoleptic quality of cookies including aroma, taste, texture and level of preference, but did not have a significant effect on color. The most preferred product of the panelists, which was X1 had the organoleptic properties of having purplish brown color, quite similar aroma to purple sweet potato, similar taste to the purple sweet potato, and smooth and crunchy texture. 3) The substitution of purple sweet potato paste had an effect on the organoleptic quality of bread including color, taste, and level of preference, but did not have a significant effect on aroma and texture. The most preferred product of panelists, which was X3, had organoleptic properties of having quite purple in color, quite similar aroma to purple sweet potato, similar taste to the purple sweet potato, and texture that was quite smooth and quite porous.

Keywords: Pacet, Substitution, Sweet potato paste, *Cake, Cookies, Bread*

1. INTRODUCTION

Sweet potato in Indonesia is not yet considered an important commodity, while the potential and benefits of sweet potato as an alternative food is very large, especially in improving human nutrition, and food security through a food diversification program (Ginting et al, 2014). The production and productivity of sweet potatoes in Indonesia continues to increase from year to year, but their utilization and consumption is still limited. So far, sweet potatoes are only limited to be processed as raw materials for sauces and traditional foods, such as boiled/fried sweet potatoes, compote, *getuk*, *timus*, and chips, so that their image is often considered inferior. (Ginting, 2014). Average consumption of sweet potato national consumption level in 2011 wasvery small, which was 2.5 kg/cap/year, when compared to wheat which was 3.2 kg/cap/year, and rice which was very high at 87.6 kg/cap/year . Indonesian people rely heavily on flour and rice as staple foods (Hardono, 2014)

If viewed from an economic point of view, the productivity of sweet potato is higher compared to

rice and cassava. Sweet potatoes with a harvest period of 4 months can produce more than 30 tons/ha, depending on the seeds, the nature of the soil and their maintenance. Currently the average national productivity of sweet potato has only reached 16 tons/ha (BPS, 2016). But it is still greater, when compared with the productivity of grain which was 4.5 tons/ha or cassava with 8 tons/ha, even though the harvest period is longer than the sweet potato harvest (Hasyim and Yusuf, 2008). The choice to socialize sweet potatoes is not an option without reason. Moreover (1) based on the agro-climate in most parts of Indonesia, sweet potato also (2) has high productivity, so it is profitable to cultivate. The other reasons are (3) containing nutrients that have a positive effect on health (prebiotics, dietary fiber and antioxidants), and (4) its potential use which is quite extensive and suitable for food diversification programs

East Java is one of the centers of sweet potato production. In the period 2013-2015 East Java was ranked as the third largest sweet potato production, after Papua and West Java (BPS, 2016). In 2013 East Java contributed 393,199 tons of sweet potato production, or 11.9% of the total national production. In 2014 and 2015 it was amounted to 312,421 and 350,516 tons, increasing to 12.1% of total national production. The sweet potato productivity in East Java from year to year has also increased, which is 205.44 quintals/hectare in 2013, 231.71 quintals/hectare in in 2014, and 274.23 quintals/hectare in in 2015 (BPS 2016).

Mojokerto City is the largest sweet potato producing city in East Java Province, with a production of 76138.6 tons, and a productivity level of 281.3 quintals/hectare (BPS East Java, 2013). Mojokerto has an agroclimate that is suitable for sweet potato cultivation, resulting in abundant yields. Pacet District is one of the centers of sweet potato production (BALITKABI, 2016), and there are leading industrial sectors for small industries and home industries that produce processed products made from sweet potatoes (BAPPEDA of East Java, 2013). Pacet District is the right location for developing sweet potato-based products, as an effort to strengthen the economy of society and local food security.

The cropping pattern of farmers in Pacet District is to plant rice fields, with cropping pattern of rice-rice-sweet potatoes. Farmers plant sweet potatoes once a year by previously planting rice twice. The selling price of sweet potatoes from farmers is set at Rp. 1,100 - 1,200/kg, but this price is fluctuated. The price of sweet potatoes is very much determined by the market mechanism. If there is an abundant supply, the price will decrease, while if the supply decreases the price will make a correction (BAPPEDA of East Java, 2013).

Agricultural products are generally seasonal, perishable and voluminous, so farmers are almost always in a weak bargaining position when dealing with traders (markets). Common problems faced in the effort to utilize carbohydrate-based food commodities to become staple food in the midst of modern society are post-harvest management and markets. Storage of fresh harvest yields faces the risk of high damage. Therefore, processing technology that converts fresh products into semi-finished products such as flour and ready-to-eat processed products that are more durable can be a contribution to saving crop yields. The application of food processing technology will provide economic added value (Widowati, 2011).

Frozen pasta is an intermediate product so the sweet potatoes can be stored for a longer time. Sweet potato pasta is steamed sweet potato which is mashed/milled and stored in frozen conditions, then can be processed into a variety of food products (Ginting et al, 2014). Producing processed sweet potato paste is indeed more beneficial because of the high yield of the product, simple equipment used, ability to maintain the quality of nutritional compounds and nutrients that are beneficial to the human body (Yasni et al, 2009).

One of the conditions experienced by farmers is the declining price of sweet potatoes during the harvest. Post-harvest handling is very important, when the price goes down the approach that can be taken is to process sweet potato into a variety of products that can be stored, and have a high selling value (BAPPEDA of East Java, 2013). Sweet potato paste is an intermediate product that can be stored in frozen conditions, and is used as a raw material for

diversifying sweet potato-based products. This research was conducted to determine the effect of sweet potato substitution on cake, cookies and bread products by measuring the product orgenoleptic properties and the level of preference of panelists.

2. RESEARCH METHOD

a. Research Design

The experimental design used in this research was a single variable design, that is, all factors remain the same except for the treatment to be compared. The treatment given was the substitution of purple sweet potato paste on a cake of 60, 70, 80% (Ginting et al., 2012), on cookies of 40, 50, and 60 % from the weight of flour (Padmaja et al, 2011), and on bread of 10, 20, 30 % % from the weight of flour (Bonsi et al, 2014). The experimental design is presented in table 1 and the prescription formulation of the research is presented in table 2.

Table 1. Experimental Design

(X) Free variable	(Y) Dependent variable				
	Organoleptic properties (Sensory Quality)				Levels of Preference
	Ya	Yb	Yc	Yd	Yf
X1					
X2					
X3					

Remarjs :

Independent variables (X):

X1 : substitution of purple sweet potato paste of 60 (cake), 40 (cookies), 10 (bread)%/weight of flour

X2 : substitution of purple sweet potato paste of 70 (cake), 50 (cookies), 20 (bread)%/weight of flour

X3 : substitution of purple sweet potato paste of 80 (cake), 60 (cookies), 30 (bread)%/weight of flour

Dependent variables (Y):

Ya : color

Yb :aroma

Yc : taste

Yd : texture

Ye : level of preference

b. Procedure for Making Purple Sweet Potato Paste

The steps of pasta processing include washing, peeling off and rewashing, slicing, heating, cooling, and storing the paste in cold or frozen temperatures, canned, or packed in aseptic packaging (Troung, 2010). Purple sweet potato paste is used by substituting wheat flour for cake, cookies, and bread products.

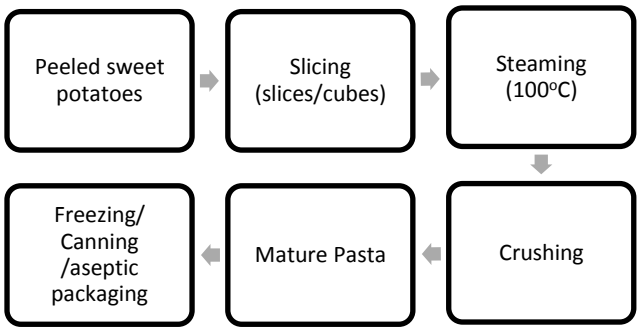

Figure 1. Cassava Paste Production Process
Source: Truong, 2010

c. Data Collection

This research used an observation method through organoleptic testing. Organoleptic tests were conducted by 25 trained panelists. The panelists acted as sensory analysis instruments and expressed their responses to the properties of the material being tested. Criteria for evaluating organoleptic tests were color, aroma, taste, texture and overall level of preference. The panelists filled in the statement by giving a check mark (✓) by choosing the answers provided by the researcher about the description of the final results of cake, cookies, and bread.

d. Data Analysis

Statistical analysis used SPSS version 16.0, shapiro wilk test for data normality, levene's test for data homogeneity, one way ANOVA test followed by LSD test to determine differences between treatment groups. Statistical tests were carried out with a confidence level of 95%.

3. RESULTS AND DISCUSSION

From the results of statistical tests, the data were normally distributed, and the data variance was homogeneous on all variables. To determine the effect of substitution of sweet potato paste, it was followed by a one way ANOVA test and continued with the LSD test.

Table 2. Distribution of Acceptance for Cake, Cookies and Bread.

Product	Characteristics	Average of Acceptance Score			One-Way ANOVA Test
		X1	X2	X3	
Cake	Color	2,24[c]	2,84[b]	3,80[a]	0,000
	Aroma	3,24	3,60	3,64	0,074
	Taste	3,40	3,64	348	0,388
	Texture	3,08[b]	3,72[a]	3,80[a]	0,000
	Level of Preference	3,36	3,56	3,48	0,409
Cookies	Color	1,60	1,64	1,76	0,624
	Aroma	2,92[b]	3,08[b]	3,48[a]	0,003
	Taste	2,32[c]	2,96[b]	3,56[a]	0,000
	Texture	3,64[a]	2,88[b]	1,44[c]	0,000
	Level of Preference	3,64[a]	2,76[b]	1,20[c]	0,000
Bread	Color	3,08[b]	3,28[b]	3,52[a]	0,036
	Aroma	2,88	3,12	2,88	0,214
	Taste	2,48[c]	3,00[b]	3,48[a]	0,000
	Texture	3,04	3,20	3,36	0,362
	Level of Preference	2,68[b]	3,04[a]	3,44[a]	0,004

Remarks:
The letters next to the numbers indicate a difference if the letters are different, based on the LSD test on α=0,05
X1 : substitution of purple sweet potato paste of 60 (cake), 40 (cookies), 10 (bread)%/weight of flour
X2 : substitution of purple sweet potato paste of 70 (cake), 50 (cookies), 20 (bread)%/weight of flour
X3 : substitution of purple sweet potato paste of 80 (cake), 60 (cookies), 30 (bread)%/weight of flour

a. Color

The color in question is the color of the cake, cookies, and bread products with substitution of purple sweet potato paste. From table 2, the ANOVA-One Way test results show that there was a difference in color acceptance of the cookies (p value = 0,000) and bread (p value = 0,036), while the cookies had no difference (p value = 0,624). Furthermore, to find out the effect of substitution of purple sweet potato paste in each treatment group was followed by the LSD test.

The LSD test results on the acceptance of cake color, showed that there was a difference reatment between t X1 and X2 with a value of p = 0.001 (p <0.05), treatment between tX1 and X3 with a value of p = 0,000 (p <0.05), and treatment between tX2 and X3 with a value of p = 0,000 (p <0.05). In cake color, substitution of purple sweet potato paste gave an acceptance value of less purple color with substitution of 60% (X1 product). In X2 product, cake with substitution of purple sweet potato paste was 70%, having a value of acceptance of color that was quite purple. In X3 product, cake with substitution of purple sweet potato paste was 80%, having a value of acceptance of color that was purple.

The results of the LSD test on sweet potato cookies showed no significant difference between X1 and X2 treatment (value p = 0.816), X1 and X3 (value p = 0, 353), X2 and X3 (p value = 0.485), with p value > 0.05. Substitution of sweet potato pasta was 40%, 50%, and 60% that did not affect the color of cookies. The results of the colors of cookies X1, X2, X3 were purplish brown.

The results of the LSD test on the acceptance of bread color showed that there was a difference between X1 and X3 treatment with a value of p = 0.010 (p <0.05), X2 and X3 treatment with a value of p = 0.010 (p <0.05), while X1 and X2 treatment had no significant difference with the value of p=0.235 (p> 0.05). In the color of bread, substitution of purple

sweet potato paste gave the acceptance value of less purple color with substitution of 10 and 20% (product X1 and X2). In product X3, bread with substitution of purple sweet potato paste was 30%. With a value of acceptance of color that was quite purple.

The substitution of purple sweet potato paste on cake, cookies, and bread produced colors was generally brownish purple. This happens because the properties of the sweet potato itself contains a lot of sap on the skin as a source of phenolase enzymes that cause browning reactions if a wound occurs. Besides the browning process, the high sugar content in sweet potatoes can cause dark colors in the products produced (Suprapto, 2004). Additional ingredients in cake, cookies, and bread like sugar cause the color of the product in general to brown (Putra, 2017).

b. Aroma

The aroma in question is the aroma of the products of cake, cookies, and bread with substitution of purple sweet potato paste. In table 2, the ANOVA-One Way test results show there was a difference in aroma acceptance of cake products (value of p = 0.003), while in cake products (value of p = 0.074) and bread (value of p = 0.214) showed is no difference. Furthermore, to find out the effect of purple sweet potato paste substitution in each treatment group was followed by the LSD test.

LSD test results on aroma of cake showed no significant difference between X1 and X2 treatment (value of p = 0.061), X1 and X3 (value of p = 0.078), X2 and X3 (value of p = 0, 833) with P value > 0.05. Substitution of sweet potato paste that was 60%, 70%, and 80% did not affect the aroma of cake. The results of the aroma of cake X1, X2, X3 had the aroma of purple sweet potato.

The results of the LSD test on the acceptance of cookies of aroma, showed a difference between X1 and X3 treatment with a value of p = 0.001 (p <0.05), X2 and X3 treatment with a value of p = 0.017 (p <0.05), while between X1 with X2 treatment, there was no significant difference with the value of p = 0.330 (p> 0.05). In aroma of cookies, substitution of purple sweet potato paste gave acceptance value of quite purple scent with substitution of 40 and 50% (product X1 and X2). Product X3, which was cookies with substitution of purple sweet potato paste od 60%, had a value of acceptance of the aroma that was similar to purple sweet potato.

The results of the LSD test on aroma of bread showed no significant difference between X1 and X2 treatment (p value = 0.128), X1 and X3 (value p = 1,000), X2 and X3 (p value = 0.128) with a P value > 0.05. Substitution of sweet potato pasta that was 10%, 20%, and 30% did not affect the aroma of bread. The result of the aroma of bread X1, X2, X3 was similar to the aroma of purple sweet potato.

The substitution of purple sweet potato paste on cake, cookies and bread products provided a variety of acceptance of aroma. Aroma is related to volatile chemical compounds (Raharja, 2016). Volatile compound occurs when there is an increase in temperature. Besides that, aroma is also caused because starch in purple sweet potato first breaks into a shorter glucose chain called dextrin, then dextrin is broken down into maltase and broken down again into glucose. The process of starch dextrination the roasting process can give rise to the aroma of purple sweet potato (Krisnawati, 2014). Aroma plays an important role in food production, to enhance taste and increase the attractiveness of these food products (Antara, 2012).

c. Taste

The taste in question is the taste of the products of cake, cookies, and bread with substitution of purple sweet potato paste. In table 2, the ANOVA-One Way test results show that there was a difference in the acceptance of taste of cookies (p value = 0,000) and bread (p value = 0,000), while in cake products there was no difference (p value = 0,388). Furthermore, to determine the effect of substitution of purple sweet potato paste on each treatment group, it was followed by the LSD test.

The LSD test results on the taste of cake showed no significant difference between X1 and X2 treatment (p value = 0.178), X1 and X3 (p value = 0.652), X2 and X3 (p value = 0.367) P value > 0.05. Substitution of sweet potato paste of 60%, 70%, and 80% did not affect the taste of cake. The result of the taste of cake X1, X2, X3 was very similar to the taste of purple sweet potato.

The LSD test results on the acceptance of the taste of cookies showed a difference between X1 and X2 treatment with a value of p = 0.001 (p <0.05), X1 and X3 treatment with a value of p = 0,000 (p <0.05), and X2 and X3 treatment with a value of p = 0,000 (p <0.05). In the taste of cookies, substitution of purple sweet potato paste gave the value of acceptance of taste, which was similar enough to the taste of sweet potatoes with substitution of 40% (product X1). In product X2, which was cookies with substitution of purple sweet potato paste of 50%, had a value of acceptance of taste which was similar to sweet potato. Product X3, which was cookies with a substitution of purple sweet potato paste of 60%, had a value of acceptance of taste, which was very similar to the taste of sweet potato.

The LSD test results on the acceptance of taste of bread showed a difference between X1 and X2 treatment with a value of p = 0.014 (p <0.05), X1 and X3 treatment with a value of p = 0,000 (p <0.05), and X2 and X3 treatment with a value of p = 0.023 (p <0.05). In the taste of bread, substitution of purple sweet potato paste gace a value of acceptance of taste which was less similar to the taste of sweet potato with 10% of substitution (product X1). In product X2, which was bread with substitution of purple sweet potato paste of 20% had a value of acceptance of taste that was quite similar to sweet potato. Product X3, which is cookies with substitution of purple sweet potato paste of 30%, had a value of acceptance of taste that was similar to sweet potato.

The taste that appears in the cake, cookies, bread products with substitution of purple sweet potato in general is sweet and has a similar taste to purple sweet potato. Higher carbohydrate sweet potatoes have sweeter tastes such as purple sweet potato, compared to low carbohydrate ones. The more substitution of purple sweet potato paste on the dough gives a sharper taste of sweet potato (Krisnawati, 2014).

d. Texture

The texture in question is the texture of the cake, cookies, and bread with substitution of purple sweet potato paste. In table 2, the ANOVA-One Way test results showed a difference in the acceptance of texture of the cake product (p value = 0,000) and cookies (p value = 0,000), whereas in bread products there was no difference (p value = 0,362). Furthermore, to find out the effect of substitution of purple sweet potato paste in each treatment group was followed by the LSD test.

The LSD test results on the acceptance of textures of cake showed differences between X1 and X2 treatment with a value of p = 0,000 (p <0.05), X1 and X3 treatment with a value of p = 0,000 (p <0.05), whereas between X2 and X3 treatment there was no significant difference with the value of p = 0.582 (p> 0.05). In the texture of cake, substitution of purple sweet potato paste gave the value of acceptance to the texture which was quite smooth and quite hollow with substitution of 60% (product X1). In product X2 and X3, with 70% and 80% of substitution of purple sweet potato paste, the value of acceptance of the texture was smooth and hollow.

The LSD test results on the acceptance of texture of cookies showed that there was a difference between X1 and X2 treatment with a value of p = 0,000 (p <0.05), X1 and X3 treatment with a value of p = 0,000 (p <0.05), and X2 and X3 treatment with a value of p = 0,000 (p <0.05). In texture of cookies, substitution of purple sweet potato paste gave a value of acceptance of texture that was smooth and crunchy with substitution of 40% (product X1). In product X2, which is cookies with substitution of purple sweet potato paste of 50%, the value of acceptance of the texture was less crunchy. Product X3, which is cookies with substitution of purple sweet potato paste of 60%, the value of acceptance to the texture was not crunchy.

The LSD test results on the texture of bread showed no significant difference between X1 and X2 treatment (p value = 0.475), X1 and X3 (p value = 0.155), X2 and X3 (p value = 0.475) with P value > 0.05. Substitution of sweet potato paste of 60%, 70%, and 80% had no effect on the texture of bread. The result of bread X1, X2, X3 texture was quite smooth and quite porous.

The substitution of purple sweet potato paste gives different value of acceptance for cake, cookies, and bread. Food texture gives sensory signals to consumers. Most of these signals stimulate consumer responses to the good or bad conditions of food. One important role of texture in product success is an

indication of the freshness and stability of food products. The mechanical properties of food textures such as hardness, crunchiness, elasticity, and density are easy indicators of the freshness of food products (Civille, 2010).

e. Level of Preference

The level of preference in question is the level of preference for cakes, cookies, and bread with overall substitution of sweet potato paste. In table 2, the ANOVA-One Way test results show there was a value of acceptance on cookies (p value = 0,000) and bread (Value p = 0,004), while the cake had no difference (Value p = 0,409). Furthermore, to determine the effect of substitution of sweet potato paste in each treatment group was carried out by LSD test.

The LSD test results on the level of preference of cake showed no significant difference between X1 and X2 treatment (p value = 0.186), X1 and X3 (p value = 0.425), X2 and X3 (p value = 0.595) with P value > 0.05. Substitution of sweet potato paste of 60%, 70%, and 80% did not affect the level of preference of cake. The result of the level of preference of cake X1, X2, X3 was preferable. The most chosen cake products, based on organoleptic tests at the level of preference were products X2 (70% of substitution of sweet potato paste) with a mean of 3.56.

The LSD test results on the level of preference of cookie showed differences between X1 and X2 treatment with a value of p = 0,000 (p <0.05), X1 and X3 treatment with a value of p = 0,000 (p <0.05), and X2 and X3 treatment with a value of p = 0,000 (p <0.05). At the level of preference of cookie, substitution of purple sweet potato paste gave the value of acceptance of the level of preference, which was very preferable, with substitution of 40% (product X1). In product X2, which was cookies with substitution of purple sweet potato paste of 50% had a value of acceptance to the level of preference that was less preferable. Product X3, which is cookies with substitution of purple sweet potato paste of 60%, had an acceptance value to the level of preference that was not preferable. The most chosen product of cookies, based on the organoleptic test at the level of preference was product X1 (40% of substitution of sweet potato paste) with a mean of 3.64.

The LSD test results on the level of preference of bread, showed a difference between X1 and X2 treatment with a value of p = 0.023 (p <0.05), X1 and X3 treatment with a value of p = 0.001 (p <0.05), whereas between X2 and X3 treatment there was no significant difference with the value of p = 0.076 (p> 0.05). At the level of preference of bread, substitution of purple sweet potato paste gave the value of acceptance to the level of preference, which is less preferable, with substitution of 10% (product X1). In products X2 and X3, which were bread with substitution of purple sweet potato paste of 20 and 30% had a value of acceptance to the level of preference that was preferable. The most chosen bread products, based on organoleptic tests at the level of preference was product X3 (30% of substitution of sweet potato paste) with a mean of 3.44.

4. CONCLUSION

Based on the results of analysis of organoleptic test data on cakes, cookies, and bread with substitution of purple sweet potato paste, it can be summarized as follows:

1. The substitution of purple sweet potato paste affected the quality of organoleptic cake which included color and texture, but did not have a significant effect on aroma, taste and level of preference. The best cake product, based on the level of preference was X2. Product X2, which was cake with substitution of purple sweet potato paste by 70%, had an average value of color acceptance showing quite purple, the aroma showing similarity to the aroma of purple sweet potato, the taste showing a great similarity to purple sweet potato, the texture showing smooth and hollow, and the level of preference showing preferable.
2. The substitution of purple sweet potato paste had an effect on the quality of organoleptic cookies which included aroma, taste, texture and level of preference, but did not have a significant effect on color. The best cookies product based on the preference level was X1. Product X1, which was a cookie with substitution of purple sweet potato paste of

40%, had an average value of acceptance of color showing purplish brown, aroma showing quite sweet aroma of purple sweet potato, the taste showing quite similarity to purple sweet potato, texture showinf smooth and crunchy, and the level of preference that was very preferable.

3. The substitution of purple sweet potato paste affected the organoleptic quality of bread which included color, taste, and level of preference, but did not have a significant effect on aroma, and texture. The best bread product based on the level of acceptance was X3. Product X3, which was bread with substitution of purple sweet potato paste of 30%, had an average value of acceptance to color showing quite purple, aroma showing quite similarity to purple sweet taste, taste indicating texture of purple sweet potato show that was quite smooth and porous, and the level of preference showing another preference.

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