Ice Cream Cone Product Development Based on Purple Sweet Potato (Ipomoea batatas L.) (Study Substituted Purple Sweet Potato Flour and Baking Time).

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ABSTRACT

This study aims to dcidee the subtitution of the use of purple sweet potato flour and baking time in making of ice cream cones and knowing consumer acceptance of ice cream cone purple sweet potato. Experiments using Least Significance Different (LSD) consisted of 2 factors. The first factor is the subtitution for purple sweet potato flour (P) and the second factor is baking time (W). The P factor has 4 levels, namely 100%, 75%, 50%, and 25%. The W factor has 3 levels, namely 20 minutes, 25 minutes, and 30 minutes. Parameters of observation based on yield, thickness, fracture, resistance of ice cream cone, water content test, protein content, and reducing sugar content. The best treatment results were followed by organoleptic tests using a hedonic scale (color, flavor, taste, and texture) carried out by 30 semi-trained panelists. Physical and chemical data were analyzed by ANOVA variance (α = 0.05) and if significantly different continued with LSD test (α = 0.05). The selection of the best treatment used the Multiple Attribute method. Organoleptic data were analyzed by Friedman test (α = 0.05). The best treatment results were obtained subtitution of 75% purple sweet potato flour with 20 minutes baking time. The best treatment has characteristics of water content of 4.07%, yield of 0.98%, fracture of 0.67N, thickness of 2.67mm, resistance of cone 85 minutes, protein content of 27.4656 mg/L, reduced sugar content of 3.8931 mg/L, and organoleptic test results with a scale of 1-5 were obtain on average color 3.73, flavor 3.57, taste 3.57, and texture 2.97.

Keywords: Purple Sweet Potato Flour, Quality of Ice Cream Cone, Wheat Flour

ABSTRAK

Penelitian ini bertujuan untuk menentukan subtitusi penggunaan tepung ubi jalar ungu dan waktu pemanggangan pada pembuatan cone es krim yang tepat serta mengetahui penerimaan konsumen terhadap cone es krim ubi jalar ungu. Percobaan menggunakan Rancangan Acak Kelompok (RAK) terdiri dari 2 faktor. Faktor pertama yaitu subtitusi tepung ubi jalar ungu (P) dan faktor kedua waktu pemanggangan (W). Faktor P memiliki 4 taraf, yaitu 100%, 75%, 50%, dan 25%. Faktor W memiliki 3 taraf, yaitu 20 menit, 25 menit, dan 30 menit. Pengamatan berdasar rendemen, ketebalan, daya patah, ketahanan cone es krim, uji kadar air, kadar protein, dan gula reduksi. Hasil perlakuan terbaik dilanjutkan dengan uji organoleptik menggunakan skala hedonik (aroma, warna, tekstur dan rasa) dilakukan oleh 30 panelis semi terlatih. Data fisik dan kimia dianalisis dengan sidik ragam ANOVA (α=0,05) dan jika berbeda nyata *dilanjutkan dengan uji BNT (α=0,05). Pemilihan perlakuan terbaik menggunakan metode Multiple Attribute. Data organoleptik dianalisis dengan uji Friedman (α=0,05). Hasil perlakuan terbaik didapatkan pada subtitusi tepung ubi jalar ungu 75% dengan waktu pemanggangan 20 menit. Perlakuan terbaik memiliki karakteristik kadar air 4,07%, rendemen 98,7%, daya patah 0,67N, ketebalan 2,67mm, ketahanan cone 85 menit, kadar protein 27,4656mg/L, kadar gula reduksi 3,8931mg/L, serta hasil uji organoleptik dengan skala 1-5 diperoleh rerata warna 3,73 aroma 3,57, rasa 3,57, dan tekstur 2,97.*

Kata Kunci: Kualitas Cone Es Krim ,Tepung Ubi Jalar Ungu, Tepung Terigu

INTRODUCTION

Ice cream cone products are usually made from wheat flour, so ice cream cones become products that depend on the need for flour. Based on data from the Indonesian Flour Association (APTINDO) in 2017 Indonesian wheat imports rose by around 9%, which was 11.48 million tons from the previous year. According to APTINDO (2013), the use of wheat flour by the largest industry is by traditional industries (UKM) by 63.6%, then by modern large industries by 31.8% and for households by 4.6%. Reducing dependence on wheat flour can be done by using tuber based flour as a substitute for wheat flour. Purple sweet potato can be processed into flour which can be used as a substitute for wheat flour in making ice cream cone products because ice cream cone made from 100% wheat flour is less able to sustain ice cream in a long time, so it is expected to substitute purple yam flour able to extend time to hold ice cream.

Purple sweet potato flour per 100g has a carbohydrate content of 83.81g, protein 2.7g, and 4.72g fiber, while the content of wheat flour is 77.3g carbohydrate, 8.9g protein, 1.3g fat, 16g fat and iron 1,2g. Nurdjanah and Yuliana (2013) explained that purple sweet potato flour had anthocyanin content in the 63% -15 mg / 100 g Ayamurasaki variety that could be used as a source of antioxidants. Purple sweet potato flour also has advantages over wheat flour, which is high in fiber. According to Suprapti (2009), the low protein or gluten content of sweet potato flour can be used as the main ingredient in making ice cream cones because in making ice cream cones do not require the development of flour using gluten.

Purple sweet potato producing areas can be found on the islands of Sumatra, Java and Papua. The consumption data of Indonesian people as local food from sweet potato is around 164.17 cal / capita / day (Suprapti, 2009). According to Ginting et al. (2011), implementation in direct consumption is still limited, such as steamed or fried, purple sweet potato yields which are generally marketed in fresh condition. Processed products from purple sweet potato to flour have the opportunity to substitute 10% to 100% wheat flour.

MATERIALS AND METHODS

Ingredients

This research uses the main ingredients which are purple sweet potato flour, flour, and egg white, margarine, refined sugar, salt, and commercial cone additives.

Materials

Digital Scale Kitchen Scale HL-4350, basin, pan, mixer Cosmos type CM-1579, cone cup molds, Memmert UN 55 53L oven brands, paper cups, 0.8mm thick PP plastic bags Petromax brand, wiratech type sealler brand FS 300 Iron, and Star Lion brand jars to store ice cream cones. Caliper term and fruit hardness tester brand Lutorn type FR-5120.

Methods

The study was designed using Randomized Block Design (RBD). The study consisted of two factors, the first is the substitution of purple sweet potato flour (P) has 4 levels (100%, 75%, 50%, and 25%) and the second factor is the roasting time (W) has 3 levels (20 minutes, 25 minutes, and 30 minutes). This factor results in 12 combinations of settings, then repeated twice as many as 24 treatments will be obtained.

Research Procedure

1. Flour is weighed according to the experiment namely purple sweet potato flour: wheat flour (100%: 0%, 75%: 25%, 50%: 50%, and 25%: 75%)
2. Mixed with egg white (18% w / w or equal to 18g), refined sugar (20% w / w or 20g) and salt (2% w / w or 2g), margarine (40% w / w or 40g)), then stir using a mixer until it is homogeneous
3. Put the previously weighed flour mixture into the mixture that has been made and stirred again for 2 minutes.
4. Put the dough into a ± 30g cup of dough and flatten according to its shape with a thickness of ± 0.5-1mm.
5. Cone dough is baked at 1500C with the time according to the settings.
6. Cone that has been removed is removed from the oven and then cooled to room temperature then the cone is released from the mold.

Observation Parameters

The parameters discussed for the ice cream cone include chemical analysis with water content (Kumalasari, 2013), protein content and reducing sugar levels (Sudarmaji, 2003), and physical analysis tests that contain levels calculations (Hussain et al., 2006), test cone damage, ice cone resistance test (Aprilliana, 2010), and product yield calculation (AOAC, 2005). Multiple observation methods (Zeleny, 2003). Organoleptic tests were then performed using the preferred level method (hedonic scale) using 30 panelists semi-satisfied with the parameters of color, aroma, and taste (Winarno, 1997 in Prayoga et al., 2015), texture (Purnomo, 1995 in Prayoga et al., 2015) .

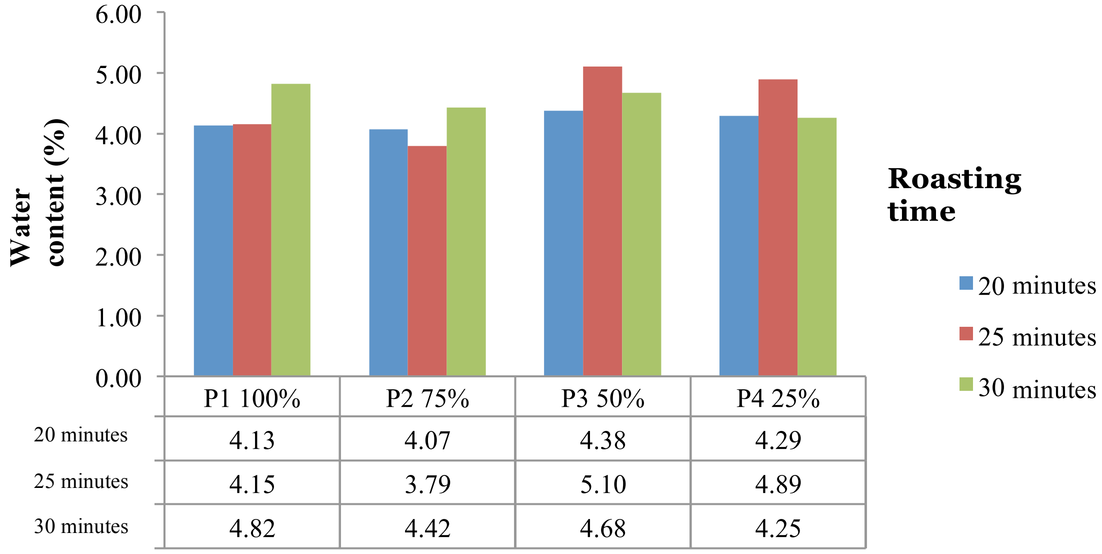
Data analysis

Data were analyzed using analysis of variance (ANOVA). If the results of the analysis of variance fingerprints are different then a 5% significant LSD test is performed. Then the general election is conducted using Multiple Attributes. Organoleptic test assessment using scoring methods on a scale of 1-5 includes taste, aroma, color, and texture. Organoleptic data were further analyzed using the Friedman test.

RESULTS AND DISCUSSION

Water Content of Ice Cream Cone

The results of analysis of variance (ANOVA) of water content at the level of α = 0.05 difference between the substitution of purple sweet potato flour and roasting time as well as the interaction there was no significant difference in air content. The histogram of the effect of purple sweet potato flour substitution and the time of roasting of the ice cream cone can be seen in **Figure 1.**



	P1 100%	P2 75%	P3 50%	P4 25%
20 minutes	4.13	4.07	4.38	4.29
25 minutes	4.15	3.79	5.10	4.89
30 minutes	4.82	4.42	4.68	4.25

Figure 1. Histogram of Inter Treatment Water Content

When the air roasting has evaporated, get the remaining water content only water needed in the product and the average yield The water content in the biscuits is included in the category of water that is done. At the time of baking starch gelatinized and will bind the air, then the air supply will be evaporated. The reduced water content in baked products causes the dough to turn crispy (Williams, 2001), although the statistics are not significantly different (p> 0.05). At the time of solid biscuit baking will be reduced because of the gas bubbles and air vapor formed. This relates to the swelling process of the starch gelatinization process and gluten denaturation during heating (Chevallier et al., 2000). According to Affandi (2007), biscuits during baking at temperatures of 160oC - 200oC air content of 1-4%. Air content in biscuits is a type of water contained in the constituent materials.

Rendemen

The results of analysis of variance (ANOVA) are displayed at the level of α = 0.05 because of the significant difference in the contribution of flour used because of the sig value. <0.05 but at the time of roasting was not significantly different at each administration. The existence of a significant difference in the proportion factor then the LSD test (the Smallest Significant Difference) of 5%. BNT further test results make ice cream from purple sweet potato flour substitution factors seen in **Table 1.**

Table 1. Subsequent Test Results of the BNT Ice Cream Cone Yield

Purple sweet potato flour substitution	Average yield of rendemen	BNT 5%	Notation
25%	87,17	1,878	a
50%	87,43	1,878	a
75%	87,66	1,878	a
100%	89,56	1,878	b

Note: The same notation signifies insignificance between preparations

In Table 1. the mean rendering improved the increase from the 25% substitution treatment to the 100% substitution treatment of purple sweet potato flour. The highest average yield in the proportion of 100% purple sweet potato flour is 89.56%. Based on the results of the analysis, the higher the substitution of purple sweet potato flour, the higher the average yield obtained.

Can be adjusted by fiber content in raw materials. Where purple sweet potato flour has 4.72% fiber content (Susilawati and Medikasari, 2008) greater than 2.5% wheat flour (Sunarsi et al, 2011). Rahmawan (2006) states that the yield will be reduced during the roasting process because the use or use of air in cookie dough will be evaporated and produce heavier cookies that are lighter than the dough.

Thickness

The results of analysis of variance (ANOVA) thickness at the level of α = 0.05 were not significantly different between the substitution of purple sweet potato flour and the roasting time on the thickness of the ice cream cone. Histogram of the effect of purple sweet potato flour substitution and roasting time on the thickness of the ice cream cone in **Figure 2.**

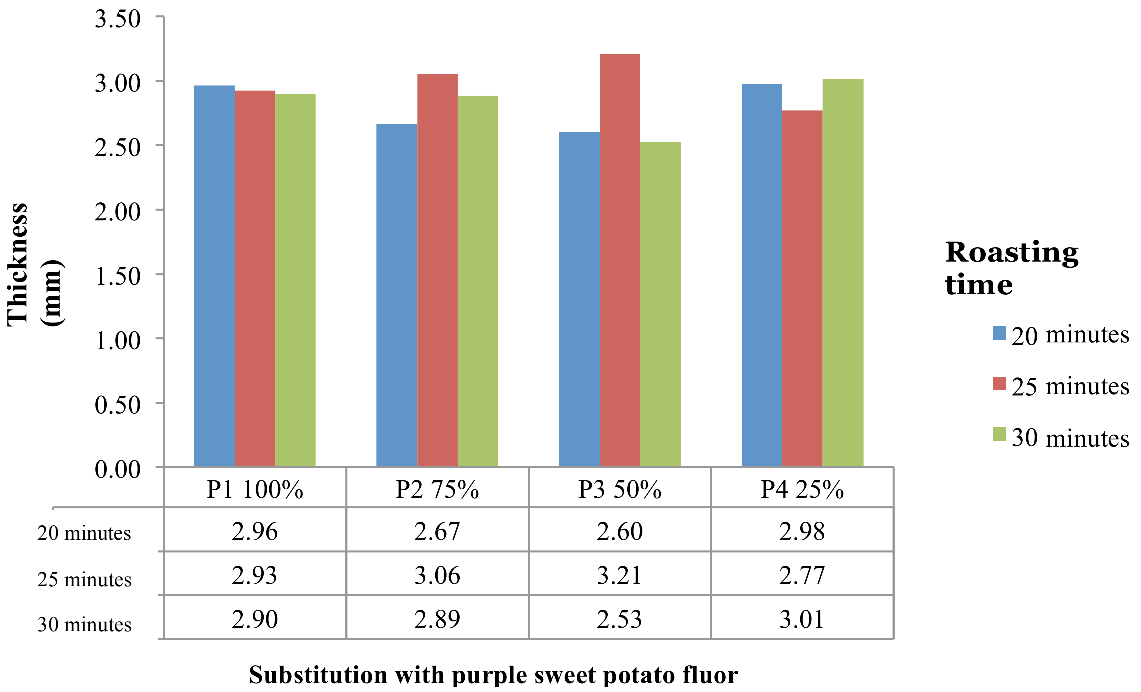


Figure 2. Histogram of Inter-Treatment Ice Cream Cone Thickness

Substitution of purple sweet potato flour and roasting time that were not significantly different also resulted in interactions that were not significantly different. One of the thickness factors that caused no significant difference between the cases resolved. According to (Chevallier et al., 2000), the process of evaporation of water content in food can be hampered due to cases of hardening while hardening biscuits on the hardening surface. Cases of hardening occur because the roasting process is carried out at high temperatures. The thicker the biscuits the longer the baking time will be used. According to Nugroho (2007) the thickness of the wafer biscuits made from liquid and thin dough ± 1-4 mm.

Broken Cone Ice Cream

The results of analysis of variance (ANOVA) of the destructive power at the level of α = 0.05 proved that the significance value was not significantly different between the substitution of purple sweet potato flour and the roasting time on the breaking power. The histogram of the effect of purple sweet potato flour substitution and roasting time on the destructive power of the ice cream cone can be seen in **Figure 3.**

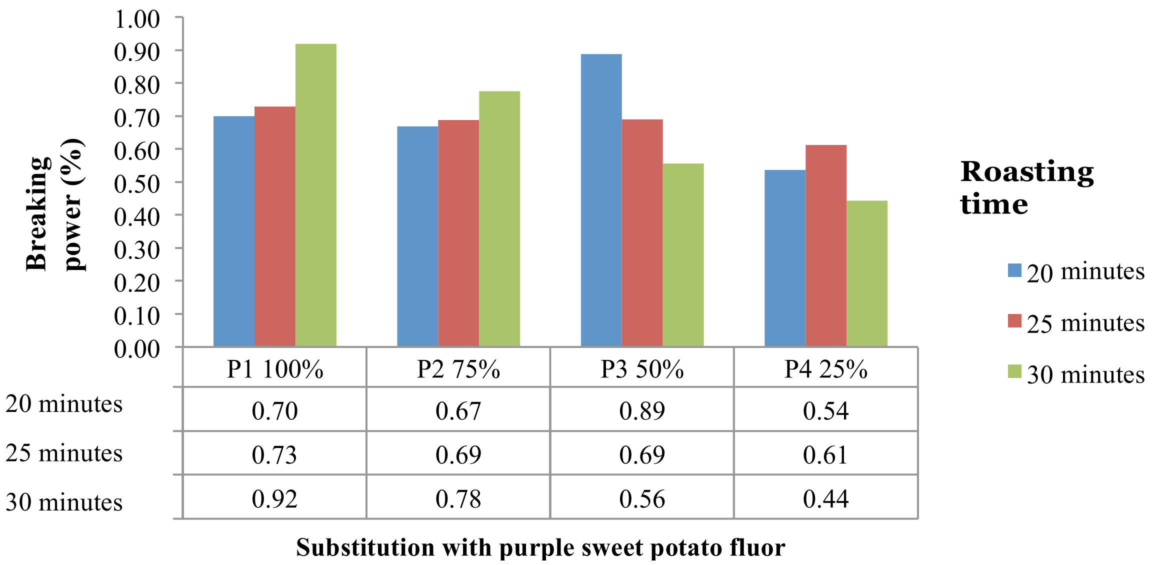
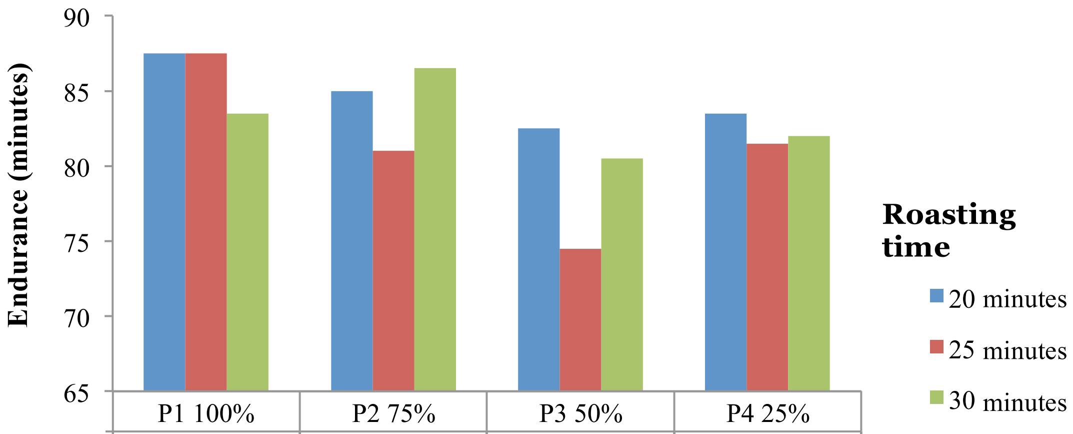


Figure 3. Histogram of Interagency Treatment

The average destructive power of the purple sweet potato cone changes between 0.44N to 0.92N. This result is not much different from commercial cones that have a mean of 0.62N. According Widyastuti, et al (2015) crispness will be of high value if the power is damaged in low-value foods. The results of testing the protein content of purple sweet potato flour used were 42.9309 mg / L (0.0042%) and reducing sugar levels of 1.5832 mg / L (0.00015%), the results of the study were compatible with small bands with flour quality standards purple sweet potatoes and the choice to give orientation to the product is also small. In addition, the flour used is soft flour with a low protein content of around 8% - 9.5%. Doughs that contain low protein will not form gluten which causes easy breaking and not crunchy (Syarbini, 2013). Based on the amylose content, amylose in sweet potato flour is higher than wheat flour. High amylose content in starch will produce a crispy ice cream cone, because during roasting amylose will create a three-dimensional structure of hydrogen bonds between molecules that causes air to produce and produce strong dough, according to different statistics ($p > 0.05$) (Meyer in Purwitasari, 2001).

Endurance of the Ice Cream Cone

The results of analysis of variance (ANOVA) of ice cream cone at $\alpha = 0.05$ indicate the significance value was not significantly different between purple sweet potato flour substitution and time of roasting on the resistance of ice cream cone. The histogram of the effect of the proportion of flour and baking time on the resistance of the ice cream cone can be seen in **Figure 4.**



	P1 100%	P2 75%	P3 50%	P4 25%
20 minutes	87.5	85	82.5	83.5
25 minutes	87.5	81	74.5	81.5
30 minutes	83.5	86.5	80.5	82

Substitution with purple sweet potato fluor

Figure 4. Histogram of the Interaction Treatment Ice Cream Cone

The cone resistance in sustaining ice cream can be changed by its thickness and breaking strength. According to Nindyarani et al., (2011) the amylopectin in starch increases the process of blooming (puffing) which increases thickness, while the amylose content in flour can increase the breaking power. At the time of gelatinization, amylose produces a hard and solid product. The more dense the structure of the cone product, the longer it will take the ice cream cone to soft or leak because the air will be difficult to penetrate the cone pores. The structure of the product is also determined by the composition of the fiber. According to Winarno (2004) the higher fiber composition will produce a harder texture on the product.

Selection of the Best Treatment

The best treatment was obtained when substituting purple sweet potato flour was 75% and the roasting time was 20 minutes using the multiple attribute method (Zeleny, 2003). The best results can be seen in **Table 4.2.**

Table 2. Best Treatment

Parameter	Ideal Value	Best Sample
Moisture Content	Minimum	4,07%
Yield	Maximum	98,7%
Thickness	Minimum	2,67mm
Breakability	Minimum	0,67N
Resistance	Maximum	85,00 minutes

Based on Table 2 is the best sample found in the substitution of purple cassava flour 75% and within 20 minutes has a water content quality that meets SNI 2973-2011 standards below 5% which is 4.07%. The yield produced in the best test was 89.7%. Furthermore, the destructive power of ice cream cones has the best treatment results at 0.67N. The lower the value of the damaged power the product will be more easily broken and the value of crispness will be higher. The thickness value obtained is 2.67 mm, the higher the thickness value, the crispness is lower. Furthermore, the resistance of the ice cream cone obtained 85 minutes, which means the ice cream cone has a good form of resistance for use for more than 1 hour. The best amount of protein and reducing sugar from the best selection cone were 27.4656 mg/L (0.0027%) and 3.8931 mg/L (0.00038%), respectively.

Organoleptic Analysis

A. Color

Friedman test results on the color of the ice cream cone obtained Chi-Square (count) = 0.429, Chi-Square (table) = 3.841 and Asymp sig. = 0.513> 0.05. These results indicate that Friedman between purple sweet potato cone and commercial cone was not significantly different. Read more about the color of the purple sweet potato cone by 3.73 and the commercial cone of 3.60 by panelists agreeing to the color of the purple sweet potato cone and commercial cone that correspond to the same amount as those who wish to be free. Brownish purple color on the purple sweet potato cone can still be accepted by panelists. The brownish purple color produced apart from the raw material of purple sweet potato flour with a substitution of 75% also affects because there is a maillard and caramelization reaction at the time of roasting. Sucrose caramelization occurs in the sugar content which is heated continuously until it reaches its melting point (Winarno, 2004).

B. Aroma

Friedman test results on the aroma of ice cream cone obtained Chi-Square (count) = 3,200, Chi-Square (table) =

3,841 and Asymp sig. = 0.074> 0.05. Based on Friedman's results, the purple sweet potato cone and the commercial cone were not significantly different. Read more about the aroma of purple sweet potato cone by 3.57 and commercial cone of 3.10 can be approved by panelists against the aroma of purple sweet potato cone and commercial cone that corresponds to the same amount as those who want to be free to like. The substitution of purple sweet potato flour 75% has an influence on the aroma of the cone product produced, which is the typical aroma of purple sweet potato. The panel gives a higher value to the purple sweet potato cone. The addition of purple sweet potato flour to the manufacture of the purple sweet potato cone raises a slightly distinctive aroma of sweet potato. According to Turelanda et al. (2016), this distinctive and fragrant purple sweet potato aroma is caused by the content of the heated starch.

C. Flavour

Friedman test results on the taste of ice cream cone obtained Chi-Square (count) = 5,000, Chi-Square (table) = 3.841 and Asymp sig. = 0.025 <0.05. Potato chips between the purple sweet potato cone and the commercial cone are significantly different. Read more about the taste of the purple sweet potato cone by 3.57 and the commercial cone of 3.00 by panelists agreeing to the taste of the purple sweet potato cone and the commercial cone is relatively neutral to like. Substitution of purple sweet potato flour 75% gives the result of the taste of the cone product produced. According to Mahmudatussa'adah (2014), a descriptive analysis of the distinctive taste of purple sweet potato flour produces sweetness, flour taste, caramel flavor, bitter taste and bitter taste.

D. Texture

Friedman test results on the texture of the ice cream cone obtained Chi-Square (count) = 15.385, Chi-Square (table) = 3.841 and Asymp sig. = 0,000 <0.05. Based on Friedman's results, the purple sweet potato cone and the commercial cone were significantly different. Get an edge over the texture of the purple sweet potato cone by 2.97 and the commercial cone of 4.03. The results from these averages can be agreed by panelists who are relatively unhappy with the texture of the purple sweet potato cone and relatively like the commercial cone. The substitution of purple sweet potato flour 75% influences a coarser texture and still feels flour. According to Rahmawan (2006), crispy cookies by the way when bitten by a cookie will be easily destroyed or not. Cookies that have a good texture and fine grain and do not taste rough and have a flour taste in the mouth. Crunchiness from biscuits can also be used by other ingredients such as water, sugar and eggs.

CONCLUSIONS

The best substitute for sweet potato flour in making ice cream is 75% which is able to butter ice cream for 85 minutes. The best ice cream cone controller has an average moisture content of 4.07%, yield of 98.7%, thickness of 2.67mm, destructive power of 0.67N protein content of 27.4656mg / L and reducing sugar content of 3.8931mg / L. Results of Consumer Value the ice cream cone uses a hedonic scale on the color, aroma and taste parameters, the average value of the sweet potato cone is relatively neutral to like, whereas the texture parameter of the sweet potato cone does not like it.

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