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Impact adding tapioca to fruit leather characteristics of *Timun suri* (*Cucumis melo* L.)

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Abstract
That is a post-harvest problem of *timun suri*, abundant of produce but less optimal in utilization. In this research we studied the effect of reduction of cucumber water and adding of tapioca (filler) to chemical, physical and organoleptic characteristics of fruit *Cucumis melo* L. Factorial Random Complete Design was used, i.e. two factors, concentration of reduction of cotton pulp water (30%, 40%, and 50%) and the concentration of tapioca addition (filler) (control, 0.25%, 0.5%, 0.75%, and 1%) with three replicates for each treatment. The parameters used are texture, color, and hedonic test. The results showed reduction of cucumber pulp water significantly affected the texture, color (lightness, chroma, and hue) fruit leather. The concentration of tapioca addition (filler) has a significant effect on texture, color of fruit leather while the interactions of cucumber pulp water reduction and the addition of real filler to the texture. The results of the hedonic test show that the mean scores for texture, color, flavor, and taste are 3.08, 2.40, 2.60 and 2.40, respectively. Fruit leather A1B3 (30% reduction of cucumber porridge water, 0.75% sizing agent) is the best treatment based on hedonic test with 1022,27 gf texture, color for (lightness 55,77%, chroma 12,51%, and hue 86, 00º).

Keywords: *Cucumis melo* L., characteristic fruit leather, tapioca

Introduction: Background

Timun suri (Cucumis melo L.) is a large agricultural commodity produced in South Sumatera. Besides being easy to plant the product has a distinctive flavor, and thick flesh. Abundant cucumber fruit harvest has not been followed by optimal utilization. Most people take advantage of cucumbers in simple form, including as ice fruit and *kolak* (one of local foods in Medan). *Timun suri* also contains a number of good nutrients such as carbohydrates, proteins, vitamins and minerals (including vitamin C and potassium, calcium and phosphorus) (Hayati *et al*., 2008) [7, 10]. In addition, this fruit also has a fresh type and taste, a distinctive flavor and thick fruit flesh.

However, *timun suri* classified fruits that have the properties easily damaged because of its high water content and thin fruit skin. This damage is accelerated by poor harvest handling. In recent years, technological product development efforts made from raw cucumber has been done such as making nata de *mentimun suri* (Lidiasari and Syafutri, 2007) [11], cucumber flour (Prasetyo *et al*., 2008) [13], wet noodles (Effendi *et al*., 2008) [4], cucumber seed syrup (Primasadi *et al*., 2008), edible starch composite cotton starch material (Panggabean *et al*., 2008) as well as candy jelly (Lidiasari and Hayati, 2008) [7, 10]. Therefore, it is necessary to develop cucumber processing into food product as one of product diversification effort to add economic value of cucumber.

One of diversification of processed cucumber product that can be done is cucumber processing into fruit leather. Fruit Leather is a product made by drying the fruit pulp into thin sheets that are elastic like skin with moisture content 10% to 15% (Erni and Lestari, 1995) [5]. Drying can be done by drying naturally with the use of sunlight or using a heating oven at a temperature of 50 to 60º C. Fruit leather can have a shelf life of up to 12 months, when stored in good condition (Octavia *et al*., 2009) [12]. Processing of fruit leather requires additional ingredients, such as filler (filler) with relatively low water content. Fillers function to attract water and provide a distinctive color and form a dense texture. Some filler that can be used for fruit leather are tapioca, pectin, and CMC (Carboxyl Methyl Cellulose). In this study, buttock starch used fillers because they have high amylopectin and are easy to obtain. In addition to fillers, processing leaf fruit also requires citric acid and sugar. Citric acid serves as a flavor enhancer. According to Kristiani (2000), the addition of sugar in the manufacture of leaf fruit can help heat transfer during drying, improve aroma, improve texture and taste. Provision of sugar concentration of 15% to produce the best texture on the manufacture of mango leather (Arianto, 2008) [2].

In relation to the high water content in *timun suri*, then in this research is the process of pressing the cucumber pulp to reduce the water content of the material. Too much moisture content in the leather dough will produce leather that is too soft. Characteristics of fruit leather resulting from cucumber surya with water cucumber reduction factor and addition of filler were studied in this research.

Methodology

The research was conducted in Agricultural Chemistry Laboratory of Agricultural Technology Department, Agricultural Faculty of Quality University, November to December 2015.

Materials used in this research are: 1) Cucumber Suri from Indralaya, 2) Tapioca seal farmer, 3) Citric Acid, 4) Sugar seaweed; and the tools used are: 1) aluminum foil, 2) blender brand Philips, 3) petri dish, 4) aluminum cup, 5) measuring cup 6) crucible porcelain 7) baking pan, 8) muffle furnace, 9)

analytical balance Lurton GM-300P), 10) oven (brand Memert, 11) stainless blades 12) scales 13) Chroma meter (Minolta brand), 14) Texture analyzer (Brookfield brand), 14) Gloves, 15) spatula, 16), and 17) spoons.

This research uses Randomized Completely Randomized Design (RALF) with 2 treatments that is percentage reduction of water content of cucumber pulp and concentration of addition of filler. Each treatment was repeated three times, with the following details:

Table 1

Reduce cucumber pulp water (A)	The concentration of addition of the filler (B).
A1 = 30 % of the total weight of cucumber slurry	B0 = tapioca 0% (control)
A2 = 40 % of the total weight of cucumber slurry	B1 = tapioca 0.25% (w/ w)
A3 = 50 % of the total weight of cucumber slurry	B2 = tapioca 0.50% (w/ w)
	B3 = tapioca 0.75% (w/ w)
	B4 = tapioca 1% (w/ w)

The workings of fruit leather processing used in this study are modifications from Arianto (2009), with the following steps:

1. Cucumber selected elephants that are ripe that characterize with yellowish fruit skin and a fragrant odor.
2. Cucumber fruits first washed, peeled, and cut into size 2cm x 2 cm.
3. The cucumber fruit is then crushed by using a blender to get the fruit pulp with no addition of water.
4. Fine fruit pulp was then taken as much as 500 grams, and was subjected to extortion for water reduction according to treatment (30%, 40% and 50%) of the total weight of the fruit pulp by using a clean napkin cloth.
5. Reduced fruit pulp weighed 80 grams for each treatment.
6. The fruit pulp was added with sugar as much as 20% by weight of slurry (80 g), citric acid 0.3% and tapioca starch ingredients as per treatment (0%, 0.25%, 0.5%, 0.75% and 1%) and then stirred with a mixer.
7. Fruit pulp poured into a petri dish that has been coated by aluminum foil.
8. The fruit pulp is heated for ± 23 hours with a temperature of 500 C.

The parameters observed in this study were Texture analyzer (Faridah *et al*., 2006), color (Chromameter) (Munsell, 1997), hedonic test.

Results and Discussion

A. Texture

The texture of the fruit leather shows the softness of the resulting cucumber fruit leather. The texture of fruit cashew fruit leaf is about 895.47 gf up to 1269,87 gf. The highest texture values were in the A3B4 treatment (50% turbidity slurry, 1% filler), while the lowest texture value was in the A1B0 treatment (30% reduction in the water of the cotton slurry, the 0% filler). Texture measurements in this study using a texture analyzer. The mean value of texture measurement for each treatment is presented in Figure 1.

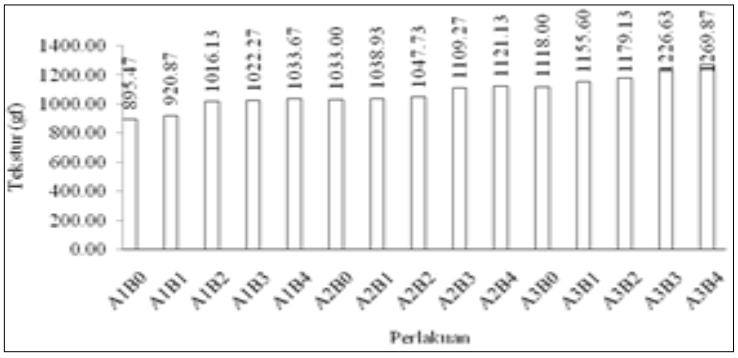

Fig 1: Mean Texture Value (gf) Fruit Leather Cucumber Suri.

The diversity analysis showed that the reduction of cucumber surge water, the addition of filler was significant, and the interaction between the two was not significant while the interaction of the two treatments had no significant effect on the resulting cucumber fruit leather texture value. BNJ further tests the effect of reduction of cucumber pulp water on the ingredients are presented in Table 1.

Table 1: BNJ Advanced Test of Water Reduction Effect Cucumber Pulp to Texture Value (gf) Fruit Leather Cucumber Suri.

Threatments	Texture Average (gf)	BNJ 5% = 62,97
A1	977,66	A
A2	1070,11	B
A3	1189,85	C

Description: The numbers followed by the same letter in the same column show the different treatment is not real (5%).

Further test of BNJ (Table 1) shows that the texture of cucumber leaf fruit leaf at treatment A1 (reduction of 30% cucumber water) is significantly different from treatment A2 (reduction of 40% cephalup water) and A3 (reduction of 50%). Fruit leather with 50% cucumber porridge slurry has a higher texture value than a 40% and 30% reduction in cucumber porridge water. High texture values indicate a harder or more chewy fruit leather texture. The lower number of lower cucumber pulp water drops will result in higher cucumber fruit leaf vegetables with higher moisture content. High moisture content will produce a soft texture indicated by a lower texture value. Conversely, low cotton leaf fruit leather yields a harsh texture which is indicated by a high texture value. Further test results of BNJ effect of concentration of addition of filler material to fruit leather texture is presented in Table 2.

Table 2: Further test of BNJ effect of concentration of addition of filler material to texture (gf) fruit leather cucumber suri.

Threatments	Texture Average (gf)	BNJ 5% = 96,02
B0	1015,49	A
B1	1038,47	Ab
B2	1081,00	Ab
B3	1119,39	B
B4	1141,56	B

Description: The numbers followed by the same letter in the same column show the different treatment is not real (5%).

Further tests of BNJ (Table 2) shows that the treatment of B4 (1% filler) was significantly different from B0 (0% filler) and was not significantly different from the other treatments. The value of the fruit leather texture increases with the increasing concentration of filler added to the fruit leather. This is because without the addition (control) will increase the water content of fruit leather thus making the dough softer and reduce the value of leather texture produced. The use of tapioca as a filler with a high concentration, will make the texture value to increase.

B. Colors

Color is the first sensory trait observed when consumers see food products (Winarno, 2004) [18]. Food color can be an indicator of product quality. The color of the foodstuff is affected by the condition of the foodstuff surface and its ability to reflect, spreading, absorbing and continuing the visible light. Color measurement is done by means of Chromameter include color component in lightness, chroma and hue quantities.

1. Lightness

Lightness is the degree of color brightness of a product with a scale of 0 (black) to 100 (white), where the greater the lightness value means the brighter the product and the decrease in lightness value causes the product to become darker. The average lightness value of the cucumber leaf fruit leaf ranged from 50.40% to 57.73%, where the highest value was in the A1B0 treatment (30% turbidity slurry, 0% filler) of 57.73%, while the value the lowest was in the treatment of A3B4 (reduction of 50% cephalup pulp, 1% filler) by 50.40%. The average value of lightness fruit leaf cucumber surfer can be seen in Figure 2.

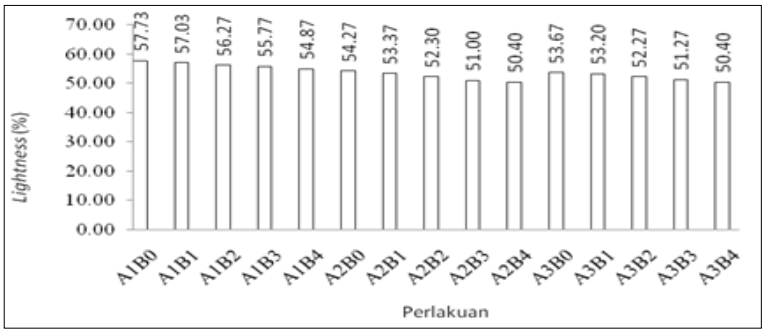

Fig 2: Mean Lightness Value (%) Fruit Leather Cucumber Suri

The results of the diversity analysis showed that the reduction of cucumber surge and the addition of the filler had a significant effect on the lightness value of the cucumber leaf fruitness. While the interaction of both effect is not real. Further test results of BNJ at the 5% level of treatment of reduction of cucumber pulp are presented in Table 7.

Table 7: Further Test of BNJ Effect of Reduction of Cucumber Water Pulp to Lightness (%) Fruit Leather *Timun Suri*

Threatments	*Lightness* (%) Average	BNJ 5% = 0,31
A1	52,16	A
A2	52,33	A
A3	56,33	B

Description: The numbers followed by the same letter in the same column show the different treatment is not real (5%)

A further test of BNJ (Table 7) at 5% indicates that treatment A1 (30% reduction in cucumber water) has a significant effect on A2 treatment (40% surge water reduction), and has no significant effect on A3 treatment (reduction of slurry water 50% cucumber). The lightness value on the reduction of cucumber suro water is 50% lower than the reduction of 40% and 30% cucumber porridge water. The results showed that the more treatment of reduction of the cucumber water of the cucumber surge in the color of the cucumber fruit leaf surge decreased as the dark cucumber leaf fruit darkened. BNJ further test results influence the concentration of the addition of filler material to the lightness of fruit cucumber leather surfer is presented in Table 8.

Table 8: Further test of BNJ effect of addition of filler material to lightness of fruit cucumber leather suri

Perlakuan	Rerata *lightness* (%)	BNJ 5% = 0,47
B4	51,89	A
B3	52,68	B
B2	53,61	C
B1	54,53	D
B0	55,22	E

Description: The numbers followed by the same letter in the same column show the different treatment is not real (5%)

Further test of BNJ (Table 8) at 5% indicates that B0 (filler 0%) treatment has significant effect on other treatment. The lightness values on the addition of 1% filler were lower than the addition of 0.75%, 0.5%, 0.25% and 0% fillers. The results showed that the more treatment of the addition of filler material of the color of the fruit leather cucumber suri is increasing as the dark cucumber leaf fruit darkens.

2. Chroma

According to Winarno (2004) chroma is a parameter that shows the intensity of a color. The higher the value of chroma the intensity of the resulting color the stronger. The average value of chroma fruit leather cucumber suri ranged between 10.67% to 17.27%, where the highest value was found in the A3B4 treatment (50% turbidity slurry, 1% filler) of 17.27% and the lowest value was in the A1B0 treatment (reduction of cucumber water %, filler 0%) of 10.67%. The average value of chroma fruit leaf cucumber suri can be seen in Figure 3.

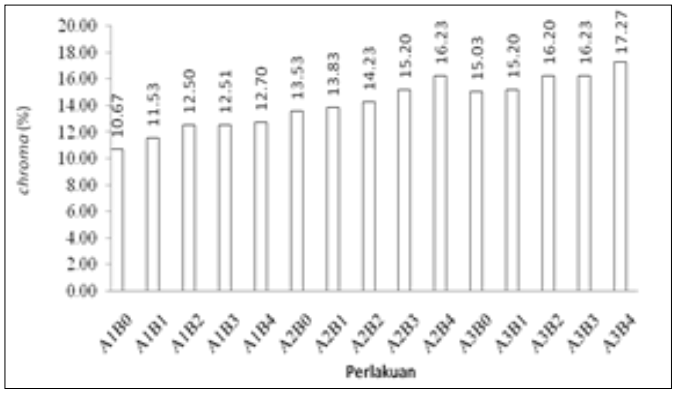

Fig 3: The average value of chroma fruit leaf cucumber suri

The result of the diversity analysis showed that the reduction of the cucumber water pulp, the concentration of the addition of the filler had a significant effect on the value of chroma fruit leaf cucumber, while the interaction of the two treatments had no significant effect. Further test results of BNJ at the 5% level of treatment of reduction of cucumber pulp are presented in Table 9 Table 9. Further test of BNJ effect of reduction of cucumber water pulp to chroma (%) fruit leaf cucumber suri

Table 9: Further test of BNJ effect of reduction of cucumber water pulp to chroma (%) fruit leaf cucumber suri

Threatment	Average *chroma* (%)	BNJ 5% = 0,62
A1	11,98	A
A2	14,61	B
A2	15,99	C

Description: The numbers followed by the same letter in the same column show the different treatment is not real (5%)

A further BNJ test (Table 11) at a 5% level indicates that all treatment of water reduction of cucumber pulp is significantly different. The chroma value on the reduction of cucumber water was 30% lower than that of 40% and 50%. Chroma value inversely proportional to the value of lightness because when the color of a product darkens, the intensity of the color is stronger. The result of lightness study results can be seen that the more reduction of the cucumber water cucumber, the color of the cucumber leaf fruit leaf becomes darker because the intensity of yellow color in the cucumber surge leaf fruit is stronger, causing the increase of chroma fruit leaf cucumber suri value. Further test results of BNJ effect of concentration of addition of filler material to chroma fruit leucon cucumber is presented in Table 10.

Table 10: BNJ Advanced Test of addition effect filler material to chroma (%) fruit leather cucumber suri

Threatment	*Lightness* Average (%)	BNJ 5% = 0,95
B0	13,08	A
B1	13,52	Ab
B2	14,32	B
B3	14,65	Bc
B4	15,40	C

Description: The numbers followed by the same letter in the same column show the different treatment is not real (5%)

Further tests of BNJ (Table 10) showed that B4 treatment (1% filler) had significant effect on B0, and had no significant effect on treatment. Chroma in the addition of 0% lower fillers compared with the addition of 0.25%, 0.5%, 0.75%, and 1% fillers. The results showed that the higher concentration of the addition of filler material causing the cucumber fruit surge intensity of the color of the stronger.

3. Hue

High value of hue fruit leather cucumber was found in A3B4 treatment (50% reduction in cucumber pulp, 1% filler) 88,800 and the lowest value was in A1B0 treatment (reduction of 30% cucumber water, 0% filler) equal to 85,100. The average value of Hue fruit leather *timun suri* dapat seen in Figure 4.

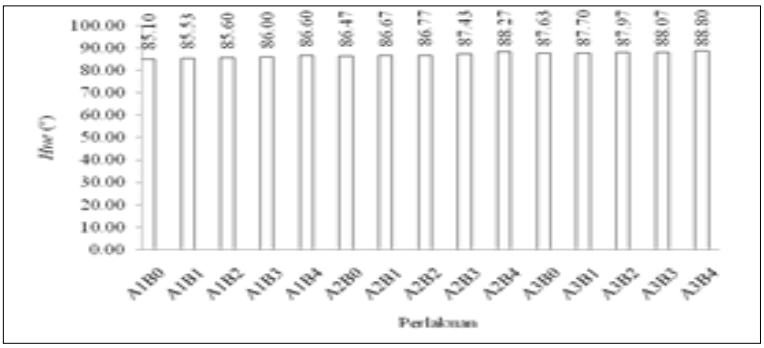

Fig 4: The average value of hue (^{0}) cucumber leaf fruit leaf.

The results of the diversity analysis showed that the reduction of the cucumber surge water treatment, the concentration of the filler had a significant effect on the hue cucumber leaf cucumber, while the interaction of the two insignificant treatments was not real. The results showed that the dominant color in the cucumber leaf fruit leaf is Yellow (900). The yellow color of the cucumber fruit leaf is caused by carotenoid pigments contained in the cucumber fruits. According to Anonymous (2006), yellow to orange fruits contain lots of carotenoids, bioflavones and vitamin C. Further test results of BNJ at the 5% level of reducing cucumber pulp water treatment are presented in Table 11.

Table 11: Further tests of BNJ effect of reduction of cucumber pulp water to hue (º)

Threatments	Aveerage *chroma* (%)	BNJ 5% = 0,46
A1	85,77	A
A2	87,12	B
A2	88,03	C

Description: The numbers followed by the same letter in the same column show the different treatment is not real (5%)

A further BNJ test (Table 11) at a 5% level indicates that all treatment of cucumber slurry water reduction is significantly different. The ºhue value on the reduction of the cucumber water was 30% lower than the reduction of 40% and 50% cucumber porridge water. Further test results of BNJ effect of concentration of addition of filler material to chroma fruit leaf cucumber surplus is presented in Table 12.

Table 12: BNJ further test effect of addition of filler to hue (º) fruit leather *timun suri*

Threatments	Average *lightness* (%)	BNJ 5% = 0,95
B4	51,89	A
B3	52,68	B
B2	53,61	C
B1	54,53	D
B0	55,22	E

Description: The numbers followed by the same letter in the same column show the different treatment is not real (5%)

Further tests of BNJ (Table 12) show that the addition of concentration of filler material is significantly different. Value hue on the addition of 1% less filler material than the addition of 0.75%, 0.5%, 0.25%, and 0% fillers. The results showed that the higher concentration of addition of the filler cause the fruit leather *timun suri* intensity of the weaker color.

C. Hedonic Test

Sensory tests use a favorite test (hedonic). The parameters observed include the color, flavor, taste and texture of the cucumber leaf fruit leaf.

1. Color

Color organoleptically different from the concept of color in physics, organoleptically color is physio-psychological phenomenon which is the result of human eye response to visible light rays of light at wavelength 380-770 nm (Soekarto, 1985). The hedonic test of color states that the A1B3 treatment (30% reduction in cucumber porridge water, 0.75% filler) has the highest score with value of 3.00, whereas the A3B1 treatment (50% reduction in the cucumber water absorption, 0.25% filler %) has the lowest value 2.08. The value of consumer acceptance of the color of cucumber leaf fruit leather can be seen in Figure 5.

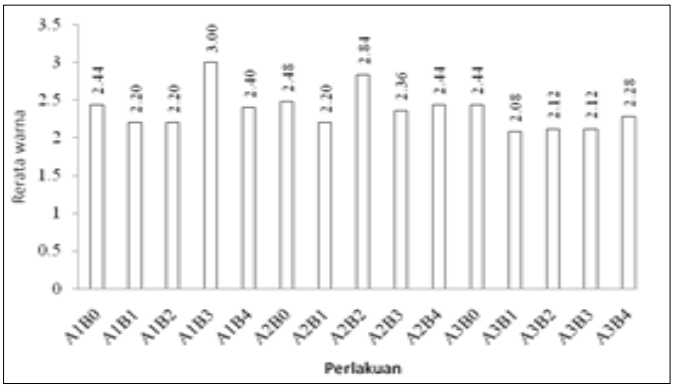

Fig 5: Average hedonic test for parameters color cucumber leaf cucumber.

The results of the organoleptic test showed that the preferred cucumber fruit leather samples were cucumber fruit leather with A1B3 treatment (reduction of 30% cucumber pulp water and 0.7s5% filler). The color of leaf cucumber fruit leaf is caused by the addition of filler with concentration (1%) which resulted in browning process due to warming reaction. So the resulting color is darker than other treatments. Friedman Conover's further test of the interaction of the form with the concentration of the addition of the filler to the receipt of the color of the cucumber leaf fruit leaf is presented in Table 13.

Table 13: Further test Friedman Conover panelist acceptance of the

color of cucumber leaf fruit leaf

Threatments	Cotton Pulp Water (%)	BNJ 5% = 0,20
A1B0	172	A
A1B1	172,5	Ab
A1B2	173	Ab
A1B3	181,5	Ab
A1B4	181,5	Ab
A2B0	185	Ab
A2B1	185,5	Ab
A2B2	190,5	Ab
A2B3	205	Ab
A2B4	214,5	Ab
A3B0	219	Ab
A3B1	224,5	B
A3B2	229	b
A3B3	244,5	b
A3B4	267,5	b

Description: The numbers followed by the same letter in the same column mean different is not real, if followed different letters mean very different real

Based on the hedonic test of color almost all treatments are favored by panelists. The result of the hedonic test that the most preferred cucumber fruit leather samples are cucumber fruit leather with A1B3 treatment (reduction of 30% cucumber water with 0.75% filler). This is in line with the physical analysis of the color of cucumber leaf fruit leather that has a hue value ranging from 85.10 º to 88.80 º which means the dominant color in the cucumber leaf fruit is yellow or yellow.

2. Aroma

The aroma of food is one of the factors that determine the delicacy of food associated with indrea olfactory. The delicious aroma of food gives it the charm of a food consumed (Soekarto, 1985). The hedonic test against aroma states that the A1B0 treatment (30% cotton water retention, 0% filler) has the highest score with a value of 2.84 A1B0 treatment (40% surge water surge reduction, 0% filler) has the lowest value of 2.40. The value of panelist acceptance of aroma cucumber fruit leaf aroma can be seen in Figure 6.

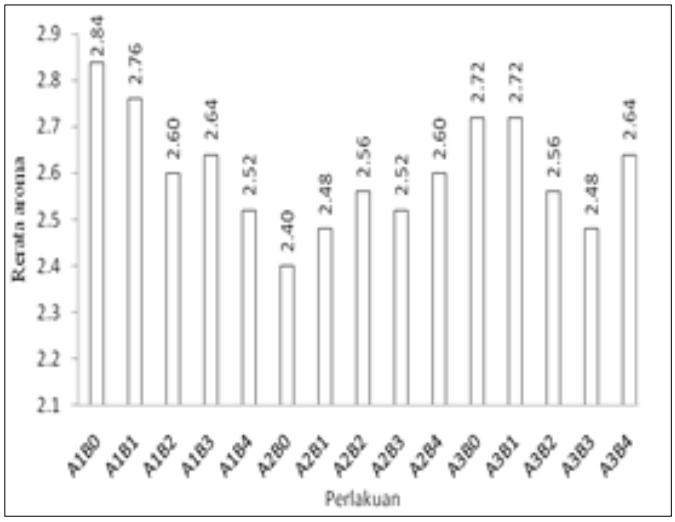

Fig 6: Average hedonic test for parameters aroma of cucumber leaf fruit leather.

Friedman Conover test results show that the critical value of T is smaller than F table so that it can be concluded that all samples of cucumber fruit leather until treatment have the same scent. This is due to the distinctive aroma of cucumber fruits and covering the scent of fillers. Typical cucumber aromas occur when the ripe fruit is primarily caused by aliphatic alcohol esters and short chain fatty acids. According to Jennings and Sevenants (1964) in de Man (1997), the smell and taste of food can be attributed to the presence of one or several compounds that give rise to the impression of certain foods if only kissed. Such a compound is called the compound smell of the donor and the compound present in the cucumber that is the 2-trans-6-cis-known liver (Forss *et al*., 1962 in de Man, 1997).

3. Texture

The average hedonic grade value given by the panelists to the texture states that the A2B2 treatment (40% reduction in cotton porridge water, 0.5% filler) has the highest score with a value of 3.36, while the A3B2 treatment (50% cucumber porridge water reduction, 0.5% filler) has a low of 2.36. The value of consumer acceptance of the texture of fruit leather *timun suri* can be seen in Figure 7.

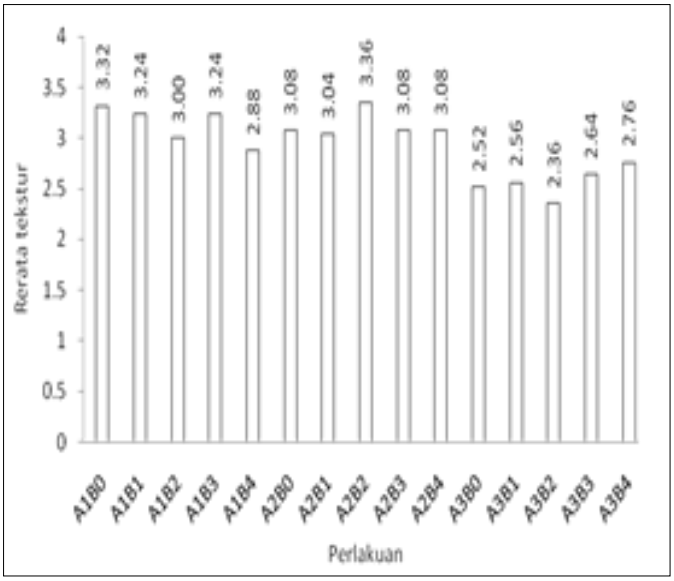

Fig 7: Average hedonic test for parameters texture fruit leather *timun suri*.

The texture of the cucumber leaf fruit leaf with A2B2 treatment is favored by panelists because the texture of leaf cucumber fruit leaf is not too hard, but not too tough than in other samples. This is due to the reduction of cucumber pulp water and the concentration of the addition of a filler which is a concentration that is considered ideal to produce a cucumber surge leaf favored by the panelists rather than other treatments. Friedman Conover test results show that the critical value of T is smaller than F table so that it can be concluded that all samples of cucumber fruit leather samples have the same texture. Panelists prefer the texture of the A1B3 treatment (30% reduction in cucumber porridge water, 0.75% filler) because the resulting texture is not easily broken, broken, and not too hard.

4. Flavor

The mean score of hedonic quality score given by panelists to

taste indicates that A3B4 treatment (50% cotton turbid water reduction, 1% filler) has the highest value with 2.92 values, while A1B4 treatment (reduction of 30%, 1% filler) has the lowest value of 2.36. Value consumer acceptance of the flower cucumber fruit leaf taste can be seen in Figure 8.

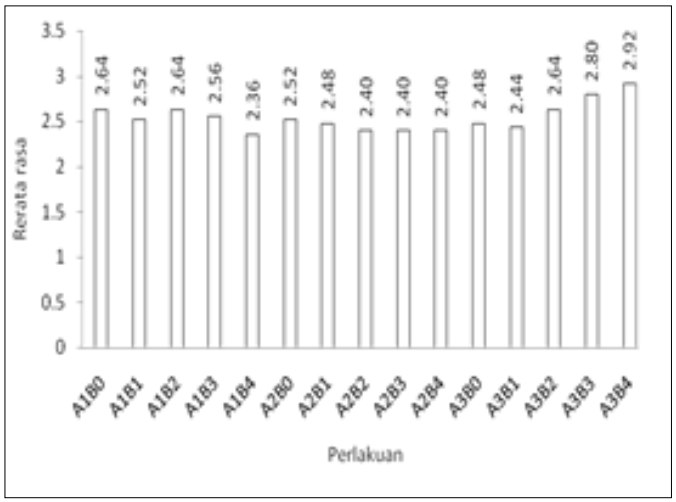

Fig 8: Average hedonic test for parameters flavor of cucumber leaf fruit leaf

The favorite cucumber fruit leaf flavor is most favored by panelists, namely cucumber fruit leaf with A3B4 treatment (50% cucumber pulp water reduction and 1% filler). The value of panelist acceptance of this cucumber fruit leather flavor taste, it is considered not so significant, because the results are not different between the treatment of one with the other treatment. However, when examined further, from the two most favorite cotton leaf fruit leather is the taste of cucumber fruit leather that is not too sweet, namely with cucumber fruit leather suri with a concentration of 0.5% filler.

Conclusion

The conclusions obtained from the results of this study are as follows:

1. Reduce cucumber fungus water effect on texture, color (lightness, croma, and hue), while the concentration of filler additions significantly affect texture, moisture content, ash content, color (lightness, croma, and hue).
2. Fruit leather with 30% cucumber water surge reduction, 0.75% filler is the best treatment with texture of 1022,27 gf, color for (lightness 55,77%, chroma 12,51%, and hue 86,00º), and test hedonic texture 3.24, flavor 2.56, aroma 2.64, and color 3.00.
3. The mean values of hedonic test results for best treatment were 3.08 for texture, 2.40 for taste of 2.60 for aroma, and 2.44 colors.

Acknowledgments

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