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PHYSICAL AND ORGANOLEPTIC CHARACTERISTICS OF TAMARIND PASTE (*Tamarindus Indica L*) WITH MODIFIED ELEPHANT CASSAVA (*Manihot Esculenta*) DERIVATIVE PRODUCT THICKENER

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ABSTRACT

This research was conducted to determine the effect of physical properties on elephant cassava derivative products as a thickener for tamarind paste. This study used a non-factorial completely randomized design (CRD) with 2 treatments, namely types of thickener (modified starch and mocaf) at 5 different concentrations (0%, 1%, 3%, 5%, and 10%) with 3 repetitions. The addition of 10% elephant cassava mocaf flour had the highest value based on the viscosity test with a value of 5624 mPas, in the 10% solubility test the addition of modified starch has a value of 90.47%, the speed with heating at 80℃ ranges from 45-66 seconds and the organoleptic test for taste attributes is 2.04- 2.48.

Keywords: Cassava, Mocaf, Modified starch, Pasta, Tamarind

INTRODUCTION

Tamarind (*Tamarindus indica*) is one of the plants that can be used as traditional medicine, kitchen spices, building wood and one of the potential export commodities. Almost all parts of the tamarind plant can be utilized, such as leaves which are used as seasonings, medicinal and cosmetic ingredients, flowers which are used as a source of honey for honey bee farming, and fruits which are used as seasonings and traditional medicine mixtures.

Elephant cassava (*Manihot esculenta C*) is a superior plant typical of East Borneo which continues to be developed for its utilization. One of them is used as a thickener (Zaini *et al*., 2017). The selection of the type of thickener is based on previous research, namely using thickeners in the form of mocaf flour and starch without fermentation so that in this study using mocaf flour and fermented starch as thickeners.

Mocaf flour (Modified Cassava Flour) is flour made with a modified process through a fermentation process that involves the services of certain microbes or enzymes. During the fermentation process, physical, chemical, and microbiological and sensory changes occur (Dipowaseso *et al*., 2018).

Modified starch is starch that has undergone changes due to physical or chemical controlled treatment so it changed one or more of its original properties. Modified starch has functional properties that are not possessed by natural starch, such as viscous power, emulsion stabilizing power and considerable water absorption so that it is often used in the manufacture of instant food (Erika, 2010).

METHODOLOGY

The research took place at the Laboratory of Processing and Quality Control of Agricultural Products and the Laboratory of Chemistry and Biochemistry of Agricultural Products, Department of Agricultural Products Technology, Faculty of Agriculture, Mulawarman University in May - June 2022.

Materials

The materials used in this research are tamarind obtained from UD. Bintang Jaya Surabaya, elephant cassava obtained from the Faculty of Agriculture Educational Garden Laboratory in Karang Tunggal Village, Tenggarong Seberang District, Kutai Kartanegara, East Borneo, then processed into elephant cassava mocaf flour and elephant cassava modified starch flour, water and tape yeast "harum manis".

Tools

The tools used in this research for making tamarind paste consist of a stove, blender, small pan, OHAUS scales, plastic container, jar, thermometer, spatula, spoon. The tools used for making mocaf flour and modified starch consist of knives, basins of various sizes (large, small) of water, ovens, OHAUS scales, dry blenders, plastic containers, cassava slicing machines, aluminum foil, flour sifters, spoons, and baking sheets. While the tools used in laboratory tests are analytical scales, NDJ-8S digital viscometer, colorimeter, oven, magnetic stirrer, pH-016 pH meter.

Research Design

This research was designed using a non-factorial Completely Randomized Design (CRD) with treatment of thickener types with various concentrations. Experimental research aimed to test the physical characteristics (viscosity, color, solubility, solubility speed and pH).

Table 1. The design in this study is as follows**:**

Types of thickening agents with various concentrations									
M1K1	M1K2	M1K3	M1K4	M1K5	P2K1	P2K2	P2K3	P2K4	P2K5

P = Type of thickener (M1 = Modified elephant cassava flour (mocaf), P2 = Modified elephant cassava starch)
K = concentration (0%, 1%, 3%, 5%, 10%)

The parameters observed in this study were viscosity, solubility, solubility speed, pH color, and organoleptic characteristics. After that, the data obtained will be analyzed using variance analysis (ANOVA) which if it shows a real effect with a confidence level of 5%, then further tests will be carried out using the Smallest Real Difference (BNT) test. As for the multiple comparison Organoleptic test using the test, the data obtained will be transformed using the Method of Succive Interval (MSI) before the analysis of variance (ANOVA). The function of transforming data using MSI was to convert ordinal data into interval data by changing the cumulative proportion of each category change to the value of the standard normal curve.

Research Steps

1. Making Modified Elephant Cassava Flour (Mocaf Flour) (Amri & Pratiwi 2015)

Elephant cassava used in this study was obtained from the Faculty of Agriculture Educational Garden Laboratory in Karang Tunggal Village, Tenggarong Seberang District, Kutai Kartanegara, East Borneo. The process of processing elephant cassava modified mocaf flour (fermentation) is that the cassava is peeled and washed thoroughly using running water, then thinly sliced. After that, tape yeast 0.5% of the volume of water is added and soaking is carried out for 24 hours, after 24 hours then washed. Then, drying is done using an oven with a temperature of 60 ºC for 20 hours and mashed using a dry blender and sieved using an 80-mesh sieve.

2. Preparation of Fermented Elephant Cassava Starch (Amri & Pratiwi 2015)

Elephant cassava used in this study was obtained from the Faculty of Agriculture Educational Garden Laboratory in Karang Tunggal Village, Tenggarong Seberang District, Kutai Kartanegara, East Borneo. As for the processing of elephant cassava starch, namely, cassava is peeled and washed thoroughly using running water, cassava slicing with a chopper machine, then cassava is blended with a mixture of water 1: 2, namely 300 grams of cassava slice and 600 ml of water, then filtered to take the starch, after which the juice is added with tape yeast as much as 0.5% of the water volume and precipitated for 24 hours. After 24 hours, the water was changed and soaked for 4 hours. The starch obtained was then dried by oven for 20 hours at 60oC. The dried starch was pulverized using a dry blender.

3. Tamarind Puree Making

The process of making tamarind puree was done with several stages, namely the preparation of ingredients weighing, sorting tamarind, mixing ingredients and mashing. Sorting tamarind by separating the pulp and tamarind seeds. Then the tamarind meat was added as much as 100 g and 300 ml of water or a ratio of 1: 3. Then pulverization is done using a blender. After that, it is filtered using a sieve until puree is obtained.

4. Tamarind Paste Making

Tamarind paste is obtained by processing tamarind puree with a mixture of two types of thickeners with concentrations of 1%, 3%, 5%, 10% and control. Tamarind puree was weighed as much as 100 grams and mixed with starch thickener and modified flour according to concentration and then cooked over low heat until it reached a temperature of 60ºC for 6 minutes. after that the tamarind paste was transferred into a sterilized glass jar. The finished tamarind paste is ready for viscosity test, solubility test, solubility speed, color, pH test, and organoleptic.

Methods

The parameters tested were physical properties including viscosity (Yanwar, 2019), solubility (Anema *et al*. 2006), color (Haryanto, 2016), solubility speed (Manab, 2008) and pH (Setiawan *et al*., 2013), as well as organoleptic tests (Andriyani, 2020).

Analysis Procedures

1. Physical Property test

a. Viscosity Measurement (Digital Viscometer NDJ-8S) (Yanwar, 2019)

The sample was weighed as much as 50 grams and then placed in a beaker glass. The rotor used is rotor number 4 according to the viscosity of the sample with each rotation speed (RPM) 0.3, 0.6, 1.5, 3, 6, 12, 30, and 60 or Auto. Record the test results with each Rotor at each RPM getting the results of how many mPas at what percentage. Valid data that can be used is percentage data between 10-100%. So if it is below 10% the data cannot be used / invalid.

b. Solubility (Anema *et al*. 2006)

Weighed tamarind paste as much as 1 gram and then put into a measuring flask containing 100 mL of water until the paste dissolves. After that, it was filtered using filter paper, then the filter paper that had been used was moved into a porcelain cup that had been weighed. Then put into the oven with a temperature of 105 °C for 1 hour, after the first drying the sample was put into a desiccator for 15 minutes and dried for the second time with a temperature of 105 °C for 30 minutes and put back into the desiccator for 15 minutes after drying. Solubility can be calculated by the formula:

$$\%Solubility = 1- \frac{(w2-w1)}{w} X\ 100\%$$

Description:
W = sample weight (g)
W1= filter paper weight (g)
W2 = weight of filter paper + sample after drying (g)

c. Color Test (Haryanto, 2016)
Color testing using Colorimeter CS-10 (CHN Spec Technology). Tamarind paste samples were placed on the cover glass and positioned close to the colorimeter lens. Then set the color measurement by pressing the button on the colorimeter (L+ = lighter, L- = dark, a+ = red, a- = green, b+ = yellow; b- = blue). The data that appears from the colorimeter is then calculated the color ∆*Eab using the colormine delta-e-calculator website version colormine.org [59], the calculation was done one by one by comparing the control sample with the sample treated with a ratio of 1%, 3%, 5%, 10% according to the replication and L*, a*, b*.

d. Solubility Speed Test (Manab, 2008)
The solubility speed test was carried out with heating and without heating. Without heating, namely using room temperature, then the sample was dissolved with distilled water at a concentration of 1% (b/v). Then the sample was stirred using a magnetic stirrer at a speed of 1000 rpm, then calculated the length of time the sample dissolved in water using a Stopwatch. Using heating is to put distilled water into a measuring cup then heat it to a temperature of 80ºC and then dissolve the sample using a magnetic stirrer at a speed of 1000 rpm and calculate the time using a stopwatch.

e. pH test (Setiawan *et al*., 2013)
The pH test uses a pH meter, to determine the pH value, first clean the electrode using distilled water. Then calibration is carried out using buffer solutions 4 and 7. pH testing is carried out by dipping the tip of the electrode in tamarind paste and then reading the test results (Mehran, 2015).

2. Multiple Comparison Organoleptic Test (Andriyani, 2020)

The organoleptic test in this study used a differentiation test (multiple comparison method) with a total of 25 untrained panelists. Standard untrained panelists who have never done training only follow the instructions given then can be based on gender etc. The multiple comparison test was used to determine how much thickener to add to the tamarind paste product without causing a detectable difference in flavor and determine the difference between the 2 samples. The multiple comparison test was conducted by comparing 4 samples labeled with a random three-digit number code with one standard sample (R). Then, panelists were asked to state on a scale the degree of difference. Testing attributes in this test include color, aroma, texture, viscosity and taste (Prabowo *et al*., 2022).

The tested product is tamarind paste using 9 rating scales, namely 9 = very different, 8 = very different, 7 = different, 6 = somewhat different, 5 = neutral, 4 = somewhat not different, 3 = not different, 2 = very not different, 1 = very not different. Each panelist is given a tray containing one sample using a 5% concentration marked R (as a differentiator). The use of 5% concentration as R (differentiator) is the best concentration from previous research from Agricultural Product Technology students in 2016 (Prabowo *et al*., 2022).

Some steps that need to be prepared before conducting organoleptic testing include:

a. Panelist Selection

As a general requirement to become a panelist is to have sensitivity to the basic flavors (sweet, salty, sour, bitter and umami) needed, have attention and interest in the product to be tested, namely tamarind paste. Selection of panelists begins with collecting data from prospective panelists first, after the data is collected, it is continued with an interview to find out the background of prospective panelists and their health conditions by asking questions directly. Then, the screening stage is carried out to determine the seriousness, openness, honesty, and knowledge of prospective panelists in knowing the sensory acuity of basic flavors (sweet, salty, sour, bitter and umami). Each panelist will be given a sample to be tested with 4 testing criteria (color, aroma, taste and texture). Then prepare tools and materials such as mineral water, five plastic cups and covers, five 500 mL measuring cups with covers, cups for gargling, scales, 5 compounds namely sucrose (sugar), citric acid, NaCl (salt), caffeine, MSG (umami), label paper and organoleptic test forms.

b. Sample Preparation

Starting with preparing materials and tools that will be used in the form of tamarind paste products, clear cups, drinking water, label paper, tissue, spoons, stationery and multiple comparison test form sheets. Samples in the form of tamarind paste used have a uniform temperature and are filled into clear cups with the same volume and provide a three-digit code of random numbers on each sample to facilitate panelists in testing. Next, prepare the samples in the testing booth with complete tissue, drinking water and a small spoon and the samples are arranged in the testing booth randomly.

c. Multiple Comparison Test Implementation

Panelists were advised to have breakfast and wait for 1 hour before testing after eating sweets, smoking, eating and soft drinks. Before entering the organoleptic room, panelists do not use perfume and lipstick when testing, then wash their hands with soap without strong odor. Panelists conducted the test in a room with sufficient lighting and good air circulation. The multiple comparison test determines how much thickener is added to the tamarind paste product without causing detectable differences in flavor. The multiple comparison test is conducted by comparing 4 samples labeled with a three-digit random number code with one standard sample (R) and then the panelists are asked to state on a scale the level of difference. For data analysis, the multiple comparison test will be transformed into numbers, with numbers increasing according to the level of difference from the tamarind paste product test results.

RESULTS AND DISCUSSION

1. Physical characteristics

The average physical test of tamarind paste with the addition of mocaf thickener and modified starch with different concentrations can be seen in Table 2.

Table 2.Average Physical Test of Tamarind Paste with the Addition of Elephant Cassava Mocaf Thickener and Modified Starch.

Analysis	Treatment									
	MIK1 (0%)	**M1K2 (1%)**	**M1K3 (3%)**	**M1K4 (5%)**	**M1K5 (10%)**	**S2K1 (0%)**	**S2K2 (1%)**	**S2K3 (3%)**	**S2K4 (5%)**	**S2K5 (10%)**
Viscosity (mPa.s)	2027±814.8^{bc}	3698±515.6^{ab}	3617±428.6^{ab}	3996±0.00^{ab}	5624±2819.8^{a}	2027±814.8^{bc}	3270±1257.5^{ab}	3715±487.3^{ab}	3996±0.00^{ab}	4877±1526.5^{a}
Solubility (%)	90.93±0.35^{c}	90.77±0.21^{bc}	90.63±0.15^{ab}	90.67±0.06^{ab}	90.37±0.12^{a}	90.97±0.15^{cd}	90.83±0.15^{bc}	90.73±0.15^{ab}	90.53+0.25^{ab}	90.47±0.21^{a}
S.S.W.H	62.00±2.00^{a}	92.00±1.73^{ab}	94.33±1.15^{ab}	96.33±1.53^{ab}	181.7±1.53^{bc}	61.67±1.53^{ab}	92.00±1.73^{a}	94.33±1.15^{ab}	96.67±0.58^{ab}	177.0±2.00^{bc}
S.S.W.H.T80◦C	45.00±0.00^{e}	59.00±0.00^{d}	61.00±1.00^{c}	61.33±0.58^{b}	64.33±0.58^{a}	45.00±0.00^{e}	59.67±0.58^{d}	59.33±0.58^{c}	63.67±1.53^{b}	66.00±1.00^{a}
pH	2.82±0.00^{cd}	2.84±0.01^{cd}	2.84±0.01^{bc}	2.84±0.03^{b}	2.87±0.02^{a}	2.81±0.01^{cd}	2.83±0.00^{cd}	2.85±0.02^{bc}	28.73±2.84^{ab}	2.86±2.84^{a}
L*	72.96±1.11	69.87±7.34	72.41±9.72	74.36±7.32	71.98±6.19	72.96±1.11	73.95±5.11	69.86±8.42	75.45±4.87	69.84±5.78
a*	3.31±0.19	4.99±2.01	3.39±2.44	3.52±1.55	4.76±1.76	3.31±0.19	3.85±2.03	4.40±1.94	2.38±1.01	5.51±1.56
b*	11.64±0.21	16.34±5.42	12.48±7.81	11.88±5.68	16.09±6.33	11.64±0.21	12.42±6.76	14.68±6.58	7.43±4.10	20.12±3.62
∆*Eab Colour	0.00±0.00	7.58±7.91	9.54±5.96	15.96±12.64	8.39±2.68	0.00±0.00	7.43±4.00	8.71±5.69	6.65±5.02	10.18±5.81

Description:
Data (mean ± standard deviation). Data on the line followed by the same letter indicates that it is not significantly different at the 5% level.
M = Mocaf and S = Starch
S.S.W.H= solubilization speed without heating and S.S.W.H.= solubilization speed with heating temperature.

a. Viscosity

Viscosity is one of the factors that affect the quality of the paste because this can affect the viscosity of the product, a factor that can affect the viscosity of the paste is the use of thickeners. Elephant cassava modified starch and elephant cassava mocaf flour are one of the thickeners that contain amylose and amylopectin which can increase viscosity (Aprilyan *et al*., 2015). This is because the content of amylose and amylopectin undergoes a gelatinization mechanism. Gelatinization occurs because starch granules expand during the heating process so that the paste will thicken.

The highest viscosity is in the addition of modified starch with a value of 5624 mPa's at a concentration of 10% while the viscosity of the addition of mocaf is lower with a value of mPa's at a concentration of 10%. In previous research (Prabowo *et al*., 2022) the lowest viscosity value was found in the control sample 2.45 Pa.s and the highest viscosity was found in tamarind paste with the addition of cassava starch thickener with a concentration of 5% 8.58 Pa.s. This is because natural flour has an ammonium content. This is because natural flour has amylose levels ranging from 20.34-21.73% (Pasca *et al*., 2021) and starch 17% and 83% (Wahyu, 2017).

b. Solubility.

Solubility is one of the factors that can affect several physical and chemical reactions in pasta products. The more soluble a pasta product is, the better the quality of the pasta product so that its use is easier (Purwanto *et al*., 2013).

It can be seen that the average solubility of tamarind paste ranges from 90.37% - 90.97%. In the provision of 2 types of modified starch thickeners and mocaf, it can be seen that it is getting higher. This is due to the use of the same amount of tamarind raw material in the form of puree in each treatment and the temperature used during gelatinization tends to be the same. In previous research (Prabowo *et al*., 2022) at concentrations of 3% and 5% addition of thickening agents, the solubility of tamarind paste did not experience a significant difference compared to the addition of 1% thickening agents for both cassava flour and cassava flour. Changes in solubility occur due to the amylose and amylopectic content of the thickener and the gelatinization temperature used in the processing process. In research (Ningrum 2017), it was also mentioned that the addition of thickeners with different concentrations to keluwak paste had no effect because the raw materials, the content of thickeners and the gelatinization temperature were the same so that the properties of the products produced were not much different.

c. Solubility Speed

To measure a solubility speed there are two methods, namely without heating and using heating. The solubility speed test is calculated from the time the paste product is put into water until it is completely dissolved and counted using a stopwatch (Matanari *et al*, 2020). It can be seen that the average solubility speed without heating tamarind paste is 62-181 seconds and it can be seen that the average solubility speed with 800C heating tamarind paste is 45-66 seconds.

This is because modified starch is hydrophilic or easily soluble in water (Muin *et al*., 2017) and mocaf is also easily soluble in water due to its high amylose content, so that the ability of starch granules to absorb water increases (Yulifianti *et al*., 2017). It can be seen that the solubility speed time with heating is faster than without heating, this is because the heating temperature can accelerate the soluble paste. The lowest solubility time is very good to choose, because the lower the solubility time, the easier it is to dissolve in water (Ramadhani, 2016). In previous research (Prabowo *et al*., 2022) cassava flour has a better time to break the paste this is because temperature, solute size, solvent volume and stirring speed affect it.

d. pH

pH is a measure of the hydrogen ion concentration of a solution. The pH measurement is used to measure if the solution is acidic or basic. If a solution has the same number of acid and base molecules, then the pH is considered neutral (Susanto *et al*., 2017). Factors that affect the pH of tamarind paste products are raw materials, the use of Food Additives and reactions in the product that occur during pasta making.

The results of the pH test can be seen that the average tamarind paste is 2.82 - 2.87. This is due to the organic acid content in the acid and what affects the acidity level is the total acid content in the material (Fitriana, 2018). Factors that affect the pH value of the paste include the basic ingredients and the type of thickener used. Based on Rukmana's test results (Rukmana, 2005) the pH of tamarind is 2.50, in tamarind there are organic acids such as tartaric acid, carbonic acid, oxalic acid, succinic acid, citric acid and quinic acid. Tartaric acid is the dominant organic acid found in tamarind at 8-16%.

e. Color

Color is a characteristic that determines the acceptance or rejection of a product by consumers. Color is also a factor that plays a very important role in food, because of the first impression on food ingredients (Asmaraningtyas *et al*., 2014).

1) L*(Lightness)

The L* reading value expresses the brightness of the sample between black (0) and white (100). The highest L* value was 74.36±7.32 at 5% concentration and the lowest was 69.87±7.34 at 1% concentration. The highest L* value was 75.45±4.87 at 5% concentration and the lowest was 69.84±5.78 at 10% concentration. The reading of L* (lightness) shows that all tamarind paste samples have a brightness level that is not too high.

2) a*(Redness Level)

The a* reading value expresses the green-red level, i.e. the sample is between green with a value of (-) and red with a value of (+). The highest a* value was 4.99±2.01 at 1% concentration and the lowest was 3.31±0.19 at 0% concentration (control). The highest a* value was 5.51±1.56 at 10% concentration and the lowest was 2.38±1.01 at 5% concentration. The results of a* (redness) readings show that all tamarind paste samples have a red color.

3) b*(Yellowness)

The b* reading value expresses the blue-yellow level, i.e. the sample is blue with a value of (-) and yellow with a value of (+). The highest b* value was 16.34±5.42 at 1% concentration and the lowest was 11.64±0.21 at 0% concentration (control). The highest b* value was 20.12±3.62 at 10% concentration and the lowest was 7.34±4.10 at 5% concentration. The reading of b* (yellowness) shows that all tamarind paste samples have a yellowish color.

4) Δ*Eab Color

The reading value of Δ*Eab, namely color difference, can be defined as a numerical comparison between the color of the sample and the standard. This calculation shows the difference between two colors to identify inconsistencies and help users control the color of their products more effectively (Colormine.org and Color analysis, 2015). Table 1 shows the highest value of 15.96, namely 5% concentration of elephant cassava mocaf flour thickener and in table 2 shows the lowest value of 6.65, namely 5% concentration of elephant cassava modified starch thickener.

In the reading results on the color L *, a * and b * showed no significant effect on all treatments with the addition of modified starch thickeners and mocaf with different concentrations on tamarind paste. Changes in the color of tamarind fruit occur since the post-harvest process due to enzymatic and non-enzymatic reactions in tamarind pulp. The occurrence of mailard reaction is the main factor of non-enzymatic color formation due to the reaction between amino acids and reducing sugars that form dark color components (Huastiany, 2016). Discoloration of tamarind fruit produces materials with low L* color readings and positive a* and b* values which can be defined by a dark brown color.

In the reading results on the color Δ*Eab showed no significant effect on all treatments with the addition of thickening agents modified elephant cassava pat and elephant cassava mocaf flour with different concentrations on tamarind paste. At a concentration of 1% elephant cassava mocaf flour thickener has a color change value of 7.58 with the control, while in elephant cassava modified starch 7.43 with the control. At a concentration of 3% elephant cassava mocaf flour thickener has a color change value of 9.54 with the control, while the elephant cassava modified starch has a color change value of 8.71 with the control. At a concentration of 5%, elephant cassava mocaf flour thickener has a color change value of 15.96 with the control, while the elephant cassava modified starch has a color change value of 6.65 with the control. At a concentration of 10%, the elephant cassava mocaf flour thickener has a color change value of 8.39 with the control, while the elephant cassava modified starch has a color change value of 10.18 with the control.

2. Multiple Comparison Organoleptic Test

The average organoleptic test of tamarind paste with the addition of mocaf thickener and modified starch with different concentrations can be seen in Table 3.

a. Color

Based on the results of variance analysis, it shows that tamarind paste has no significant effect on the thickener given. This shows that the average level of distinction of the color of tamarind paste with the addition of two types of thickeners and different concentrations ranges from 2.17-2.44, which is somewhat different and different. Tamarind paste with the addition of thickeners with a concentration of 10% gives the highest value which means it has a different color from the control. Basically, the brown color of tamarind paste is due to enzymatic and non-enzymatic activities in tamarind fruit during the post-harvest process and the occurrence of maillard reactions (Rini, 2016).

b. Aroma

The results of variance showed that tamarind paste had no significant effect on the thickener given. This shows that the average level of differentiation of the aroma of tamarind paste with the addition of two types of thickeners and different concentrations ranges from 2.28-2.49, which is somewhat different and different. Tamarind paste with the addition of thickener with 3% concentration gives the highest value which means it has a different aroma from the control. The distinctive aroma of tamarind is due to the content of volatile compounds contained in tamarind fruit. Volatile compounds contained in tamarind fruit are 2-phenyl acetaldehyde which forms a honey-like and fresh aroma as well as fruit and 2-furfuryl which forms a caramel aroma (Pino *et al*., 2004).

Table 3. Average Organoleptic Test of Tamarind Paste with the Addition of Elephant Cassava Mocaf Thickener and Modified Starch

Analysis	**Perlakuan**									
	MIK1 (0%)	**M1K2 (1%)**	**M1K3 (3%)**	**M1K4 (5%)**	**M1K5 (10%)**	**P2K1 (0%)**	**P2K2 (1%)**	**P2K3 (3%)**	**P2K4 (5%)**	**P2K5 (10%)**
Colors	2.32±0.25	2.25±0.23	2.07±0.55	2.39±0.52	2.44±0.07	2.17±0.05	2.15±0.09	2.30±0.52	2.39±0.25	2.17±0.05
Aroma	2.37±0.16	2.48±0.07	2.35±0.21	2.39±0.23	2.37±0.37	2.33±0.11	2.45±0.45	2.49±0.52	2.39±0.23	2.28±0.21
Texture	2.40±0.27	3.06±0.17	2.71±0.53	2.46±0.24	2.37±0.13	2.69±0.55	3.13±0.47	2.71±0.26	2.89±0.25	3.80±0.38
Viscosity	2.45±0.19	2.81±0.09	2.52±0.43	2.58±0.50	2.58±0.34	3.12±0.63	3.18±0.33	2.49±0.49	2.78±0.33	2.83±0.28
Taste	2.09±0.05bc	2.15±0.05bc	2.45±0.13a	2.21±0.09ab	2.15±0.13bc	2.41±0.1ab	2.48±0.07a	2.30±0.30ab	2.23±0.26ab	2.15±0.05bc

c. Texture

The results of the variance showed that tamarind paste had no significant effect on the thickener given. This shows that the average level of distinction on the texture of tamarind paste with the addition of two types of thickeners and different concentrations ranges from 2.06-3.13, which is somewhat different and different. Tamarind paste with the addition of thickeners with a concentration of 1% gives the highest value, which means it has a different texture from the control. This is because testing the texture of tamarind paste is done using the sense of touch so that the higher the concentration added, the thicker the tamarind paste and produces tamarind paste that is easily sticky to the hand.

d. Taste

The results of the variance characteristics show that tamarind paste has a significant effect on the thickener given. This shows the average level of differentiation in the taste of tamarind paste with the addition of two types of thickeners and different concentrations ranging from 2.04 - 2.48. This is due to the use of the same amount of tamarind fruit in the form of the same puree in all treatments. The distinctive fresh sour taste of tamarind fruit is due to the content of volatile compounds hexadecanoic acid and limonene contained in tamarind fruit (Pino *et al*., 2004). In organoleptic testing of flavor attributes, panelists provide a level of difference, this is because each panelist has a different taste intensity. The level of sensitivity of one's tongue also affects one's ability to taste flavors.

CONCLUSION

The addition of thickening agents in the form of elephant cassava derivative products, namely modified elephant cassava starch and elephant cassava mocaf flour, has a significant effect on physical tests, namely viscosity, solubility speed without heating and with heating. In organoleptic tests, multiple comparisons have a significant effect on attributes (taste), and have no significant effect on physical tests, namely solubility, pH and color and in organoleptic tests, multiple comparisons have no significant effect on attributes (color, aroma, viscosity and texture).

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