**PENGARUH KONSENTRASI LARUTAN AIR KAPUR DAN LAMA PERENDAMAN TERHADAP KARAKTERISTIK *FRENCH FRIES* UBI JALAR (*Ipomoea batatas. L)***

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|  | **ARTIKEL** |  |

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***INFLUENCE OF CONCENTRATION AND IMMERSION TIME OF LIME WATER ON CHARACTERISTICS OF SWEET POTATOES FRENCH FRIES (Ipomoea batatas L)***

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***ABSTRACT***

The purpose of this research is to find out concentration of lime water used to produce desired characteristics of french fries and tap the local resources of sweet potato and as a alternative make french fries. Benefit from this research expected to provide information to the public that solution of lime water can be used to replace relatively expensive chemical compound in maintaining tissue cell obstinacy during production process. This research is to provide information about precise the concentration and immersion time of lime water for keeping obstinacy tissue plant cells.

The experiments design used in this study was a randomized design (RBD) with 3 x 3 factorial pattern three times repeated, followed by Duncan's test. Variable of experiments consisted of The concentration of lime water (0 %, 1.5 %, 2.5 %) and long immersion (15 minutes, 30 minutes, 45 minutes).

In main research resulted that concentration of lime water have varying impact on water content, hardness, texture, flavor but it not affected starch content, fiber content, color, appearance and scent. Immersion time gave varying affect to hardness and appearance, but it not affected starch content, water content, fiber content, color, scent, texture, and flavor. Interaction between the concentration of lime water with immersion time only affected the hardness sweet potato french fries product. Based on the results of organoleptic, chemistry and physical analysis showed that the best French fries product can be obtain from 15 minutes immersion time in 2,5% lime water concentration.

Keyword: Frenchh Fries; Sweet Potatoes; Lime Water

**INTRODUCTION**

Plant yams and other so-called alternative food is one plant that is the source of carbohydrates after rice. The crop yield is the consumption of principal or called as a local food source by most people in eastern Indonesia, especially in Papua, West Papua and Maluku provinces, while the other side is only a source of food (Secondary) (Suherman, 2012).

Number of requests processed potatoes are offset by modernization lifestyle make government decision to import potatoes in Indonesia (Andriyanto., et al, 2013).

French fries are usually made ​​from potatoes by frying half cooked then frozen, because it has undergone preliminary cooking, prepare to be consumed more quickly and easily (Anonymous, 2004). Sweet potatoes can also be processed into French fries, of course, shape, color and taste is not the same as the French fries are made ​​from potatoes. Sweet potato french fries can be used as an alternative in addition to French fries potatoes (Anonymous, 2004).

Local resources only occasionally used for regular snacks, besides others use it as a staple food. Generally processed into sweet potato sweet potato fries are usually consumed when it rains accompanied with warm drinks, but with manifold creativities of the nation at this time, often the raw material is processed into a food tubers that have added value to both the value and economic value.

French fries is a snack that is more about appearance, crispness and color. In connection with this it is necessary to improve the quality of French fries, especially in terms of texture and color.

French fries are processed products that show increasingly popular trend in the consumption pattern of the people of Indonesia. Constraints of availability of raw materials (varieties) suitable for making french fries cause most of these products are imported in the form of frozen French fries (Adiyogya, 1999), and therefore to reduce the number of products imported French fries conducted this research into alternative materials that can be used to make French fries products.

Marinade solution concentration and immersion time must be precise to produce standards-compliant French fries. If less will result in a soft texture nor would it be if excess will eliminate French fries proper texture. So that needs to be shredded material concentration and immersion time is right to be able to produce French fries according to the standard.

**METHODOLOGY**

Raw materials used in this study is Sweet Potato (Ipomoea batatas L), White Sweet Potato, Sweet Potato Orange, Purple Sweet Potatoes, lime water, cooking oil, obtained from Lembang Fruit Market and Market Geger Kalong.

The materials used for chemical analysis is 0.1 N Na2S2O3 as a secondary standard solution, 6N H2SO4 to acidic conditions, 50% NaOH, 9.5 N HCl and 30% NaOH to neutralize, concentrated HCl for acidic, 0.1 N NaOH as titrant, 0.1 N HCl as pentiter, zinc powder as a catalyst, forming I2 KI as indicator phenolpthalin and starch solution as an indicator, luff schoorl solution as a source of Cu, and distilled water as the solvent.

The tool used for this research process is the basin as a soak, knife and cutting board to cut the potato, Sanyo brand freezers for freezing potatoes, frying pan and spatula for frozen potatoes, scales to weigh the amount of lime used.

The tools used for the chemical analysis lumpung pestle to crush the sample, pumpkin drinks 100 ml Pyrex brand to dilute the sample, 250 ml Erlenmeyer flask Pyrex brand to store the samples to be titrated, pipette, pipette 10 ml Pyrex brand to shed indicator, burette brands Pyrex and stative for titration, pnetrometer to measure hardness, digital balance to weigh the sample.

The preliminary study was conducted to determine the type of sweet potato that have better outcomes after become French fries from white sweet potato, yellow sweet potato and purple sweet potatoes. French fries are produced in the preliminary study, the response will be conducted by organoleptic observations using hedonic methods by 15 trained panelists, tested parameters are texture, color and flavor are the most preferred. The results of organoleptic test, you will know the best type of sweet potato and sweet potato types will be used as the main raw material in future studies. Sweet potato was selected raw material analysis including gravimetric methods of analysis of water content, starch content schrool luff methods, and fiber content and degestion defatting method.

The main study consisted of treatment design, experimental design, response design.

The design of the study treatment consisted of two factors and 3 levels.

The first factor: Lime Air Concentration (K)

k1 = Concentration 0%

k2 = concentration of 1.5%

k3 = concentration of 2.5%

The second factor: Soaking Lama (L)

l1 = 15 minutes

l2 = 30 minutes

l3 = 45 minutes

The experimental design used in this study is 3 x 3 factorial in a randomized block design (RBD) with three replications.

The design is done in response to the study include: chemical response, physical response and organoleptic response.

Chemical response of the Sweet Potato French fries include:

Water levels Gravimetry method (AOAC, 1995), Levels of Starch with Luff Schoorl method (AOAC, 1995), levels of fiber and Degestion defatting method (Sudarmadji, 1989).

Who conducted the physical response of the level of violence after the sweet potato French fries are fried. This measurement uses pnetrometer tool.

Organoleptic responses made ​​to the sweet potato French fries is the color, aroma, appearance, texture, and taste the most preferred. The method is used in testing the hedonic test using 15 trained panelists, with the assessment criteria can be seen in Table 1 below:

Table 1. Criteria hedonic scale (Test passions)

|  |  |
| --- | --- |
| Hedonic scale | Numerical Scale |
| Really do not like  Do not Like  somewhat like  love  Really like | 1  2  3  4  5 |

Sources : Soekarto (1985)

**RESULTS AND DISCUSSION**

**Preliminary Research Results**

Results of sensory responses of sweet potato French fries to color

Color is one of the factors that determine the quality of foodstuffs. Before the other factors considered visually, the color factor is more influential and sometimes very decisive.

Color is a property of materials that are considered derived from the spread spectrum rays, as well as the nature of the material luster mainly influenced by light rays bounce. Color is not a substance or object but rather a sensation of a person due to the stimulation of a beam of radiant energy that falls into the eye senses. Arising his color is limited by the presence of factor-ray sources, the influence of the material (Kartika, et al., 1988).

Foods containing beta-carotene may prevent diabetes mellitus (Widowati in Yajis 2012), and foods containing beta-carotene may prevent night blindness disease, various cancers (Englberger in Yajis 2012), especially lung cancer (Mayne in Yajis 2012) .

Carotenoids are natural plant pigments that produce red, yellow, orange, and dark green on fruits and vegetables. The colors seen in fruits and vegetables due to the presence of conjugated double bonds of carotenoids which led to a red color (Heriyanto in Yajis 2012).

Table 2. Calculation results type the color Sweet Potato French Fries sweet potato

|  |  |  |
| --- | --- | --- |
| Sweet potatoes | Kind of average value | Real Taraf 5% |
|
| 305 (Yellow sweet potato) | 3,87 | b |
| 198 (White sweet potato) | 2,53 | a |
| 202 (Purple sweet potato) | 2,47 | a |

Description: The average value is marked with the same letter are not significantly different shows at the 5% level according to Duncan's test further.

Types affect the attributes of sweet potato French Fries sweet potato color because each color of the tuber are significant differences in the color white, yellow, and purple. Yellow color is preferred when compared with other colors. Type of sweet potato is used in the production of sweet potato French Fries affect the color of the products which will then affect the response assessment panelists.

Sweet potato mengndung some of which are carotenoid pigments, anthocyanins, tannins, and so on. According Winarno (1997), carotenoids are a group of pigments that are yellow, orange, red. Carotenoids found in chloroplasts (0.5%) together with chlorophyll, especially on the upper surface of the leaf, close to the palisade cell walls. Carotenoids are oil soluble, so the damage carotenoids associated with damage to the fat in food.

Carotenoids in sweet potato are in the skin and tuber flesh. Sweet potato that has pink skin has ß-carotene as carotenoid pigments larger than white-skinned tubers. Carotenoids are also a major pigment of sweet potato tuber flesh that has yellow to orange. Meat color associated with beta carotene contained therein. Yellow sweet potato contains a lot karatenoid which are precursors of vitamin A (Sediaoetoma in Yajis 2012).

Calculation results of variance analysis shows the influence of the type of sweet potato French fries to taste. The test results can be seen in Table 3. In Table 3 it can be seen that the type of sweet potato showed a significant difference between the yellow sweet potato (305) significantly different from white sweet potatoes (198) and purple sweet potato (202) are marked with different letters on the real level. Organoleptic results conducted, showing that the yellow yams that has the highest average score (4.34) among the other samples.

Quality attributes visible sense that French Fries yellow sweet potato, white sweet potato and purple sweet potato showed significant differences, this is because the carbohydrate content varies between yellow sweet potato (32.30 grams), white sweet potato (27, 90 grams) and purple sweet potato (27.64 grams), but it is also because of the sensitivity of different panelists to taste the product.

Table 3. Calculation results the type Sweet Potato French Fries Taste sweet potato

|  |  |  |
| --- | --- | --- |
| Sweet potatoes | Kind of average value | Real Taraf 5% |
|
| 305 (Yellow sweet potato) | 4,34 | b |
| 198 (White sweet potato) | 3,32 | a |
| 202 (Purple sweet potato) | 2,82 | a |

Description: The average value is marked with the same letter are not significantly different shows at the 5% level according to Duncan's test further.

Starch is the main carbohydrate most widely stockpiled in tubers and sucrose are the main forms of carbohydrates are translocated into the process of tuber formation and is also a non-reducing sugar which is the main, so the little yellow sweet potatoes taste sweeter than sweet potatoes white and purple (Tsuno, 2013 ).

Calculation results of analysis of variance for the organoleptic quality of texture attribute indicates that this type of sweet potato does not affect the organoleptic attributes of texture. Data for the calculation of the results of the organoleptic quality of the texture attributes are not significantly different, which is the type of sweet potato showed no significant difference between the yellow sweet potato (305), white sweet potato (198) and purple sweet potato (202) are marked with the letter the same real level.

Texture quality attributes, shows that French Fries yellow sweet potatoes, white sweet potato and purple sweet potatoes were not significantly different, this is because the sweet potato French Fries on the following three types of fried have the same texture that is part of the surface is dry and crisp, while the in mushy. Texture in processed foods is influenced by moisture content, starch content of raw materials, and the frying temperature (Abdillah, 2007).

Abdillah Ketaren in 2007 suggests that frying temperature resulted in parts of the inner surface is dry and soft. Dry surface crust formation occurs as a result of dehydration formed during frying.

 Figure 3. White, yellow and purple sweet potato French *fries*

The conclusion of a preliminary study based on hedonic test against three quality attributes of color, flavor, and texture of sweet potato yellow indicates that the average value of the highest among the three quality attributes tested, and also had the highest carbohydrate content (32.30 grams) compared with white sweet potatoes (27.90 grams) and purple sweet potato (27.64 grams), so the yellow yams are used as raw material in the main study.

Analysis of key raw materials can be seen in the following table:

Table 4. Results Analysis of Raw Materials Yellow Sweet Potatoes

|  |  |
| --- | --- |
| Samples | Results |
| water content | 65,101% |
| Fiber levels | 1,250% |
| Levels of Carbohydrates (Starch) | 19,556% |

(Source: Lab. Balitsa, 2013).

Table 5. Yellow Sweet Potato Nutritional Components in 100 grams

|  |  |  |
| --- | --- | --- |
| No | Nutrition | Results |
| 1. | Cal (cal) | 136,00 |
| 2. | Protein (g) | 1,10 |
| 3. | Carbohydrates (grams) | 32,30 |
| 4. | Water (grams) | 79,28 |
| 5. | Crude fiber (%) | 1,40 |
| 6. | Beta Carotene (SI) | 900 |

(Source: Direktorat Gizi Depkes RI, 1993).

**Main Research Findings**

**Chemical Analysis**

The main study is a continuation of the preliminary study. In the main study the process of making products with sweet potato French Fries that have been selected in the preliminary study. The design is done in response to the main research chemical response include water content, starch content, and fiber content, the physical response of hardness test, and the response organoleptic (color, aroma, appearance, texture and flavor).

Data analysis of variance for the calculation of water content can be seen in the following table:

Table 6. Effect of Water Concentration Against Moisture Lime Sweet Potato French Fries

|  |  |  |
| --- | --- | --- |
| Lime water concentration | Average | Real value 5% |
|
| k1 (0%) | 24,55 | a |
| k2 (1,5%) | 26,76 | a |
| k3 (2,5%) | 29,71 | a |

Description: The average value is marked with the same letter are not significantly different shows at the 5% level according to Duncan's test further.

Data calculation table 6, shows that samples Sweet Potato French Fries were not significantly different between 0% concentration of lime water, lime water concentration of 1.5% and 2.5% concentration of lime water to the water content. This shows there is no significant difference between the concentrations used. According Winarno (1997), all foods contain water in varying amounts, either vegetable or animal food. The water content in food reduces resistance against invading microorganisms food expressed as water activity (aw) is the amount of free water that can be used by microorganisms for growth.

According Petrix in Abdillah (2007), the mechanism of lime as a reinforcement material is dependent on the water in the event of gelatinization gel will evaporate due to an increase in temperature and starch gel urge to get out, so that the emptying of the air cavities in the product. Bind Ca ions will enter water within the material resulting in a decrease in water content.

Ca salt is commonly used as a reinforcement material texture. This is due to the formation of a bond between the calcium with pektat be calcium pektat are not soluble in water (Winarno, 1997).

Lime water is one of the additives that are used to soak food for further processing. Lime water immersion is intended to facilitate further processing. In this case the solution is alkaline lime that is expected to improve the texture of food. Effect of lime concentration on water content due to the lime binding CO2 and water (hygroscopic) to form Ca (OH) 2 and reduces the water content present in foodstuffs (Prayitno, 2002).

Data for the calculation of variance analysis showed starch concentration of lime water, soaking time and the interaction of both, did not significantly affect the starch content of sweet potato French Fries. This is because the starch contained in sweet potato late so no one remains in the bonding material so no big change in the starch content.

Starch is a homopolymer of glucose with α-glycosidic bond. Various kinds of starch are not of the same nature, depending on the length of the chain C, and whether straight or branched chain molecule. When the raw starch incorporated into cold water, the starch granules absorb water and swell. However, the amount of water absorbed and the swelling is limited. The absorbed water can only reach levels of 30% (Winarno, 1997).

Sweet potato starch has a glycemic index of 54 (low). That is, the sweet potato starch is not easily converted into sugar, making it suitable for diabetics. Unlike the carbohydrate nature of the origin of rice and corn are easily converted into sugar (Distan Majalengka, 2012).

High amylose content that will increase the absorption of water but causes reduced starch expands during cooking. Water absorption capacity depends on the type of starch. Absorption capacity of starch derived from stems or tubers larger than the starch grains, therefore, expands the sweet potato starch increases. Another factor that affects the water absorption is the content of amylose-amylopectin, the size and shape of the granules (Widowati in Pradana, 2013).

Data analysis of the results of the calculation of the variance of the crude fiber content showed that the concentration of lime water, soaking time and their interaction, no significant effect on crude fiber content of sweet potato French Fries.

The term dietary fiber should be distinguished from the term coarse fiber commonly used in proximate analysis of food. Crude fiber (crude fiber) is part of the food that can not be hydrolyzed by the chemicals that are used to determine the crude fiber content of sulfuric acid (H2SO4) and sodium hydroxide (NaOH), whereas dietary fiber is the part of food that can not be hydrolyzed digestive enzymes. Therefore crude fiber content is lower than the value of dietary fiber, as sulfuric acid and sodium hydroxide has a greater ability to hydrolyze dietary components compared to the digestive enzymes (Muchtadi et al., 1988).

Sweet potatoes contain fiber is almost double that of the other types of potatoes and has 7 grams of fiber per serving. High fiber content makes the combustion process more slowly. That is, the use of energy from calories more slowly and efficiently than other low-fiber carbohydrates (Pradana et al., 2013).

**Physical analysis**

Units used for hardness using a penetrometer test is mm / sec / gram. It means that the figures show the ability of the needle insertion gauges for piercing materials at certain depths for every second and can be used with heavy loads adjusted, thereby increasing the number of measurement results showing the decrease in hardness of materials or products that are softer (Rina in 2007 Abdillah ).

Table 7. Interactions influence the concentration of lime water and soaking time against violence Sweet Potato French Fries

|  |  |  |  |
| --- | --- | --- | --- |
| **Lime Water Concentration** | **Time Immersion** | | |
| **15 minutes (l1)** | **30 minutes (l2)** | **45 minutes (l3)** |
| **0% (k1)** | 1,88 A  a | 1,66 A  a | 0,75 A  a |
| **1,5% (k2)** | 0,91 AB  a | 0,59 A  a | 0,66 A  a |
| **2,5% (k3)** | 0,64 B  a | 0,57 A  a | 0,40 A  a |

Description: Lowercase read horizontal and vertical directions read large letters, different letters expressed real difference at 5% level test of Duncan.

Table 7 shows that the longer the soaking and the higher concentration of lime water, the higher the level of violence sweet potato French fries produced, but the lime water concentrations between 2.5% and 1.5% was not significantly different, so that more efficient use of water concentration lime 1.5%.

Hardness and tenderness of materials closely related to the maturity level of agricultural materials. Materials that have a low maturity level higher hardness (Listanti in Abdillah 2007).

Harder texture due to the reinforcement material in the appropriate ratio would result in a more rigid material in a certain amount (Apandi in Abdillah 2007).

The addition of reinforcement material (Firming Agent) contribute to improve the robustness of cell networks, the higher the concentration of the reinforcement material generated textures French Fries grew louder. This is due to the higher concentration of reinforcement material, the more crosslinking between calcium and pectin are formed so that when further processing of the cell wall rigidity can be maintained and after experiencing the product will be more crisp frying (Isnaini, et al., 2010).

**Organoleptic Analysis**

Data calculation results of variance analysis showed that the concentration of lime water , soaking time , and their interaction did not affect the color Sweet Potato French Fries . Not the influence of the concentration of lime water , soaking time , and due to the interaction of each color of the tuber was no difference in the color yellow , sweet potato French Fries generated is not significantly different because of the color French Fries generated at each treatment and at the same organoleptic testing time each panelist has a different sensitivity to each color attribute.

Attractive color will give the assumption that food tastes good, compared to a product that has no interesting color though similar in composition. Foods that are less attractive often assumed to have a bad taste ( Isnaini , et al., 2010).

Besides French fries color was affected by temperature and frying time. Paler color will give the impression immature product , while the color is too brown charred impression (Meilianti in Reny, 2002).

Processed foods by frying a more savory, better color, increased nutritional value, and faster cooking times. In addition to functioning as a medium of heat, cooking oil will also be absorbed by the food. Good frying temperature is about 163-196 º C, although sometimes must also consider the fried product (Auliana in Reny, 2002).

Data calculation results of variance analysis showed that the concentration of lime water, soaking time and their interaction did not affect the scent of sweet potato French Fries. This is because when the processing is done frying, so it will lead to the typical aroma of French Fries products are produced, as described by Laily in Reny, 2002, that created distinctive aroma of frying result of degradation of food components by generating heat so volatile components smell the delicious aroma.

Aroma is one of the parameters in determining the quality of a food product. Distinctive scent can be perceived by the sense of smell depends on the constituent materials and ingredients added to the food. Odors (smell) can be defined as something that can be observed with the sense of smell.

Aroma in a food delicacy determine many of these products. Besides testing the aroma in the food industry is considered important because it can be used as a parameter for consumers to merima or not such products and scents can be used as an indicator of the product (Kartika, et al., 1987).

Incidence of aroma in sweet potato French Fries reaction Mailard allegedly due to the cooking process. Mailard desired reaction by causing the smell, aroma and flavor desired (Muchidin in Reny, 2002).

  Data calculation results of variance analysis showed that the concentration of lime water does not affect the appearance of sweet potato French Fries, dipping time affect the appearance of sweet potato French Fries and their interaction did not affect the appearance of the characteristic attributes of sweet potato French Fries.

Table 8. Effect of Immersion length (L) Against Average appearance of Sweet Potato French Fries

|  |  |  |
| --- | --- | --- |
| Time Immersion | Average | Real Value 5% |
|
| l3 (45 minutes) | 10,62 | a |
| l2 (30 minutes) | 10,38 | b |
| ll (15 minutes) | 9,33 | b |

Description: The average value is marked with the same letter are not significantly different shows at the 5% level according to Duncan's test further.

The appearance of a product is one thing to note, because the appearance and taste of the food quality is an important factor so as to give satisfaction to the consumer. The importance of the nutritional value is usually placed after the value of appearance and flavor to suit your taste we expect (Desrosier in Silvia, 2013).

Data calculation results of variance analysis showed that the samples of sweet potato French Fries in real berpengaruuh appearance. This is due to Ca (OH)2 can prevent the occurrence of non-enzymatic browning due to Ca2+ ions bind to amino acids that inhibit the reaction between amino and reducing sugar which causes browning upon heating (Isnaini, et al., 2010).

Potato is a food that contains starch. When cooked, gelatinization process occurs at a temperature of 66°C. When the temperature increases the surface becomes brown and crisp. Occurs due to the formation of a dry surface crust formed by dehydration during frying (Ketaren in Reny, 2002).

Data calculation results of variance analysis showed that the concentration of lime water affect the texture of the sweet potato French Fries, while soaking time and their interaction did not affect the texture of the sweet potato French Fries. The test results can be seen in the following table:

Table 9. Effect of Water Concentration Cretaceous (K) Against Average Texture Sweet Potato French Fries

|  |  |  |
| --- | --- | --- |
| Lime Water Concentration | Average | Real Value 5% |
|
| k1 (0%) | 5,89 | a |
| k2 (1,5%) | 5,83 | ab |
| k3 (2,5%) | 5,89 | b |

Description: The average value is marked with the same letter are not significantly different shows at the 5% level according to Duncan's test further.

Data calculation table 9, the concentration of lime water is not significantly different from 0% to 1.5% concentration of lime water. 1.5% concentration of lime water is not significantly different from the 2.5% concentration of lime water, while significantly different concentrations of 0% to 2.5% concentration of lime water.

Tissue cells perennials primarily due to molecular bonds between free carboxyl groups on the cell wall constituent components, namely pectin. According Winarno (1997) can fade processing plant cell tissue so that the product obtained has the texture tender. This softening is caused by the loss of cell turgor pressure and cell wall degradation and other polysaccharides, to obtain a hard texture can be added to salt Ca.

Walter and Hoover in Ratnasari (2004) stated that the presence of Ca ions will form crosslinks between calcium ions with carboxyl groups of pectin present in the cell wall, forming a molecular network pektat shaped calcium gel that will improve the texture. The greater the molecular network, the lower the solubility of pectin and the stronger the possibility that mechanical disruption of pectin breakdown during processing becomes smaller.

Data calculation results of variance analysis showed that the concentration of lime water affects the taste of sweet potato French Fries, while long immersion and interaction are both not having an effect in terms of taste.

Table 10. Effect of Water Concentration Cretaceous (K) Against Average Taste Sweet Potato French Fries

|  |  |  |
| --- | --- | --- |
| Lime Water Concentration | Average | Real Value 5% |
|
| k1 (0%) | 10,56 | a |
| k2 (1,5%) | 10,07 | a |
| k3 (2,5%) | 9,98 | a |

Description: The average value is marked with the same letter are not significantly different shows at the 5% level according to Duncan's test further.

Taste is a factor that is important from a food product in addition to the appearance and color. Generally food is not only composed of one sense alone, but a combination of a variety of integrated flavors that will cause the taste of the food intact and coherent (Kartika, et al., 1987).

Data calculation results in Table 10, shows that samples of sweet potato French Fries were not significantly different between 0% concentration of lime water, lime water concentration of 1.5% and 2.5% concentration of lime water. This is caused by the taste of sweet potatoes used are relatively equal use yellow sweet potatoes, so the test does not provide an assessment organoleptiknya panelists are too different.

Sense is one of the parameters that determine consumer acceptance of sweet potato French Fries generated. This is in accordance with the opinion of Winarno in Aswan (2011) that generally the food is not only composed of one group feeling alone, but a combination of various flavors are integrated, giving rise to a sense of delicious food. Sense is one of the factors that influence the acceptance of a person to a food. Think in general can be divided into salty, sweet, bitter and sour.

Frying process is the process of cooking food using food in oil or fat fryer kettle (Ketaren in Reny, 2002).

**Selected Product**

Determination of the best treatment is the result of chemical and physical analyzes include moisture content, starch content, and fiber content and hardness of the sweet potato French Fries and organoleptic analysis of sweet potato French Fries on color, aroma, appearance, texture, and taste of the most preferred on the primary research obtained the best treatment refers to the characteristics desired in French Fries sweet potato products. Based on the test results obtained following the best treatment:

Table 11. The average value Organoleptic Sweet Potato French Fries

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sample code | | Taste | | Scent | | Appearance | | Texture | | Color | |
| k1l1 | 3.29 | | a | 3.73 | a | 3.36 | a | 3.20 | a | 3.58 | a |
| k1l2 | 3.11 | | a | 3.71 | a | 3.36 | a | 3.18 | a | 3.42 | a |
| k1l3 | 3.11 | | a | 3.53 | a | 3.16 | a | 3.31 | ab | 3.31 | a |
| k2l1 | 3.31 | | a | 3.64 | a | 3.24 | a | 3.42 | abc | 3.47 | a |
| k2l2 | 3.33 | | a | 3.64 | a | 3.44 | a | 3.40 | abc | 3.44 | a |
| k2l3 | 3.60 | | a | 3.80 | a | 3.16 | a | 3.36 | abc | 3.80 | a |
| k3l1 | 3.96 | | ab | 3.67 | a | 4.02 | a | 3.69 | abc | 3.93 | a |
| k3l2 | 3.62 | | ab | 3.76 | a | 3.58 | a | 3.49 | bc | 4.00 | a |
| k3l3 | 3.27 | | a | 3.62 | a | 3.02 | a | 3.62 | c | 3.51 | a |

Table 12. Average Value Accumulation Test Score Scoring

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sample code | Taste | Scent | Appearance | Texture | Color | Number |
| k1l1 | 1 | 3 | 2 | 1 | 2 | 9 |
| k1l2 | 1 | 3 | 2 | 1 | 1 | 8 |
| k1l3 | 1 | 1 | 1 | 1 | 1 | 5 |
| k2l1 | 1 | 2 | 1 | 2 | 1 | 7 |
| k2l2 | 2 | 2 | 2 | 2 | 1 | 9 |
| k2l3 | 3 | 4 | 1 | 2 | 3 | 13 |
| k3l1 | 4 | 2 | 4 | 4 | 4 | 18 |
| k3l2 | 3 | 4 | 3 | 3 | 4 | 17 |
| k3l3 | 1 | 2 | 1 | 4 | 2 | 10 |

Based on the results of sensory testing, to attribute taste, appearance and texture of the highest value is k3l1 treatment, to scent the highest value is k2l3 treatment, to color the highest value is k3l2 treatment, and the average value of the test is scoring top marks treatment treatment k3l1. so k3l1 superior in organoleptic test results.

Table 13. Sweet Potato French Fries Samples Selected for Chemical Analysis

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Perlakuan | Kadar Air | | Kadar Serat Kasar | | Kadar Pati | |
| k1l1 | 30,32 | a | 2.77 | a | 33,10 | a |
| k1l2 | 30,41 | ab | 4,21 | a | 32,72 | a |
| k1l3 | 28,41 | ab | 3,14 | a | 32,61 | a |
| k2l1 | 26,12 | ab | 3,09 | a | 32,82 | a |
| k2l2 | 27,53 | ab | 5,19 | a | 33,01 | a |
| k2l3 | 26,64 | b | 4,94 | a | 30,16 | a |
| k3l1 | 24,82 | b | 4,97 | a | 31,92 | a |
| k3l2 | 28,43 | b | 4,52 | a | 28,34 | a |
| k3l3 | 20,40 | b | 4,85 | a | 30,06 | a |

Table 14. Sweet Potato French Fries Samples Selected for Chemical Analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Treatment | Water Content | Fiber Content | Starch Content | Number |
| k1l1 | 1 | 1 | 4 | 6 |
| k1l2 | 1 | 4 | 4 | 9 |
| k1l3 | 1 | 1 | 4 | 6 |
| k2l1 | 2 | 1 | 4 | 7 |
| k2l2 | 1 | 4 | 4 | 9 |
| k2l3 | 2 | 4 | 2 | 8 |
| k3l1 | 3 | 4 | 3 | 10 |
| k3l2 | 1 | 3 | 1 | 5 |
| k3l3 | 4 | 4 | 2 | 10 |

Based on the results of chemical analysis, the highest average value obtained k3l1 and k3l3 treatment, because both treatments were not significantly different from the results of water content, starch content, and fiber content so that the test results of chemical analysis is superior k3l1 to be more efficient.

Table 15. Sweet Potato French Fries Samples Selected for Analysis of Physical

|  |  |  |  |
| --- | --- | --- | --- |
| **Lime Water Concentration** | **Immersion Time** | | |
| **15 minutes (l1)** | **30 minutes (l2)** | **45 minutes (l3)** |
| **0% (k1)** | 1,88 A  a | 1,66 A  a | 0,75 A  a |
| **1,5% (k2)** | 0,91 AB  a | 0,59 A  a | 0,66 A  a |
| **2,5% (k3)** | 0,64 B  a | 0,57 A  a | 0,40 A  a |

Table 16. Sweet Potato French Fries Samples Selected for Analysis of Physical

|  |  |
| --- | --- |
| Treatment | Hardness |
| k1l1 | 1 |
| k1l2 | 1 |
| k1l3 | 4 |
| k2l1 | 3 |
| k2l2 | 4 |
| k2l3 | 4 |
| k3l1 | 4 |
| k3l2 | 4 |
| k3l3 | 4 |

Based on the analysis of physics in each treatment showed no significantly different results except the soaking time 15 min. The principle is that the higher the concentration of lime water then the resulting violence will be higher. The highest concentration was 2.5%, but 2.5% concentration of lime water and 1.5% showed results that were not significantly different for the concentration of lime water use efficiency of 1.5%. So the result is superior physical analysis is k2l1.

Based on the superior results of the chemical analysis, physical and organoleptic analysis, it was concluded that the best treatment is k3l1. K3l1 sample is treated with a concentration of 2.5% soaking for 15 minutes longer. This treatment was chosen because it has the highest score on the test results of organoleptic and chemical analysis. Concentration the higher the reinforcement material will give rigidity of plant cell tissue is harder, so that the product will be crisp. That the longer the soaking time will prevent enzymatic browning and gives a nice color and appearance, but not as well as the taste of the products produced, the higher the concentration is likely to feel bitter because Ca (OH) 2 is alkaline, so in order to effectively and efficiently in the treatment process, selected the highest concentration to be effective in providing rigidity to the cells to be more crisp, and the soaking time most small to be efficient in its processing.

Treatment with 2.5% concentration of lime water and soaking time 15 minutes had a moisture content of 24.8, the starch content of 31.92, and fiber content of 4.97. French Fries the resulting products can be seen in the image below:



Figure 4. Sweet Potatoes French fries Products

Figure 5. French fries potato products

Potatoes in terms of market competition is better known as the bulbs are practical and can easily be encountered in a variety of menus, such as French Fries. Though sweet potatoes are much healthier than potato.

Research American Institute for Cancer Research, the same weight, potatoes provide 51 grams of simple carbohydrates, while the sweet potato provides 35 grams of complex carbohydrates that are healthier (SBRC IPB, 2013).

Fiber found in many sweet potatoes will make a person feel full longer, and make the amount of blood sugar remains stable. Contained soluble fiber in sweet potatoes also help lower levels of LDL (bad cholesterol) in the blood (IPB SBRC, 2013).

Potato production in Indonesia is dominated by varieties of Granola that reaches 90% of the total planted area, while potatoes from other varieties occupy just 10% only. Granola potato varieties when used for industrial potato chips and french fries will produce a product with a less attractive color (brownish yellow to brown) and has a texture that is less crisp. This is due to the high water content and reducing sugar in potato varieties. Limitations that causes underdevelopment of the processed potato industry in Indonesia (Leni, 2013).

**CONCLUSION**

1.Hasil organoleptic preliminary study, type of effect on the color of sweet potatoes, and sweet potato French Fries flavor, but does not affect the texture of the sweet potato French Fries.

2. Introduction In the study can be determined based on the best type of sweet potato organoleptic test, the yellow sweet potato with a water content of 65.101%, 19.556% starch and fiber content of 1.250%.

3. Varying the concentration of lime water affect the water content, organoleptic test for texture, hardness, and flavor and has no effect on levels of starch, fiber content, organoleptic tests for color, appearance and aroma.

4. Varying soaking time does not affect the water content, starch content, fiber content, organoleptic tests for color, aroma, texture, appearance and hardness except the sweet potato French fries.

5. The interaction between the concentration of lime water and soaking time effect on physical analysis hardness tests Potato French Fries potato.

6. Organoleptic test results, chemical analysis and physical analysis of the samples obtained best sempel k3l1 where lime water concentration of 2.5% with a 15-minute immersion time produce moisture content of 24.8%, amounting to 31.92% starch and fiber content of 4, 97%. Treatment concentration of 1.5% lime and 15 minutes soaking time can also be done because of the hardness test results showed no significant difference between the 2.5% concentration of lime water and lime water concentration of 1.5% making it more efficient. K2l1 treatment produces water content of 26.12%, starch content of 3.82% and fiber content of 3.09%.

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