

## Effect Combination Treatment Different Concentration of Liquid Smoke, Immersion Duration, Packaging and Storage Duration to Organoleptic quality Fillet Tilapia Fish (*Oreochromis niloticus*)

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### ABSTRACT

This study aims to know the organoleptic quality (color, aroma, texture and appearance) fillet of tilapia (*Oreochromis niloticus*). Smoke is obtained from the combined treatment of smoke liquid smoke concentration, soaking time, types of packaging and different storage time. This research is done experimentally uses completely randomized design (CRD) factorial 5 x 3 x 3 x 5 with 3 replicates in order to obtain 675 experimental units. A factor consists of the concentration of liquid smoke consisting of Control (smokeless liquid / 0%), 5% and 10%, 15% and 20%; B factor consists of soaking time with liquid smoke is composed of three (3) levels ie soaking time 5 minutes, 10 minutes and 15 minutes; C factor consists of the type of packaging consists of three (3) levels ie without packaging (control), polyethylene packaging (PE) and polypropylene packaging (PP) and D factor consists of the storage time (days) consists of 5 (five) levels ie 0 , 3,6,9 and 12 days. The observed parameters are organoleptic test (color, aroma, texture and appearance). The results show the quality of the best smoked fillet of tilapia on the organoleptic test (a) the color is got in treatment combination of soaking 5 minutes at a concentration of liquid smoke to 20% with an average score of 6.81 (like), a combination of liquid smoke concentration of 20% with packaging polyethylene (PE) with an average score of 6.67 (like), a combination of liquid smoke concentration of 20% on storage time of 9 days with an average score of 7:12 (love), a combination of soaking 10 minutes on the packaging of polyethylene (PE) with a score of an average of 6.5 (like), a combination of soaking 10 minutes at a storage time of 9 days with an average score of 6.94 (like). (B) quality of the best tilapia fish fillet smoked from the organoleptic test is got in the combination treatment of soaking time 5 min at a concentration of liquid smoke to 20% with an average score of 6.6 (like). (C) Quality of the best smoked tilapia fillet from organoleptic test textures is found in concentrations of 20% liquid smoke with a long soaking 5 minutes with an average score of 6.99 (like), liquid smoke concentration of 20% on the type of packaging Polyethylene with the mean score average 6.75 (like), liquid smoke concentration of 20% with storage time 6 days with an average of 7:25 (like), soaking time 5 minutes to the type of packaging Polyethylene (PE) with an average score of 6.45 (like). (D) Quality of the best Tilapia Fillet smoked from organoleptic test is found in the combination treatment of liquid smoke concentration of 20% with 10 minutes soaking time on the packaging polyethylene (PP) with an average score of 7:18 (like).

**Key Words:** Fish Fillet, Immersion, Concentration, Packaging, Storage, Organoleptic

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## 1. INTRODUCTION

West Sumatra land potential for fish farming in pond estimated area of 12,300 hectares [1]. Among the species of freshwater fish are now being developed and grown in West Sumatra province are Tilapia (*Oreochromis niloticus*). This is because these fish are easy to live, fast breeding, the meat is white and the taste is quite tasty. Processing methods can be developed to those fish is a fish fillet processing. The results of fishery processing such as fillets of fish are included high perishable food. As perishable foodstuffs, then the quality of the fish must be able to be maintained as much as possible to get into the hands of consumers. For that we need good handling and preservation as well as processing into product care ready to be eaten but durable power is longer. One way of processing that has long been known to the public is the curing of fish.

Fumigation is a technique of embedding and incorporating various chemical compounds of smoke into foodstuffs [2]. In time, fogging was intended to extend the shelf life of a material, but in line with the increase of public acceptance to the product of smoke then that goal began to turn to the flavor, such as give aroma and distinctive taste and prevents rancidity of the meat due to the oxidation of fat. Fumigation can be done both traditional and modern. Traditional fumigation can be done in the cold and heat by burning wood or sawdust, where the smoked fish are directly contact with the smoke. Meanwhile modern fumigation uses liquid smoke (steam dispersion in the fluid as a result of smoke condensation from wood pyrolysis) as smoke transmission. In general, wider community, especially the coastal communities do fumigation with traditional fumigation techniques and the technique of curing has a lot of shortcomings. For the example desired take a long time, is not efficient in the using of firewood, the uniformity of the product to produce color and flavor are difficult to control, environmental pollution, and the most dangerous is the residual tar and hydrocarbon compounds polycyclic aromatic (Benzo (a)pyrene) were deposited in food that can be harmful to health. In areas producing smoked fish, in order to fulfill the source of the smoke (firewood) many people cut down trees, even mangroves which become sea protector from logging target. These circumstances make alternative use of firewood has to be considered as well as fogging technique. It is the time to be replaced with modern fumigation. The use of liquid smoke is wider for its application to replace the traditional way of curing. With liquid smoke, the granting of smoke aroma to those fish will be more practical because only by spraying or dipping the fish in a solution of liquid smoke, followed by heating. The development of liquid smoke are more rapidly in the preservation of foodstuffs, because the required cost for timber and the equipment for making smoke are more safe, components that are harmful can be separated or reduced before being used in food as well as the composition of the liquid smoke is more consistent to use repeatedly [3] ,

Modern fogging is fumigation with the gas phase (gas phase smoke) or fumigation with liquid smoke (liquid smoke). Fumigation with the liquid smoke is done by soaking the product in liquid smoke that has been disbursed through the process of pyrolysis and distillation [3]. This way of fumigation can improve the quality of products in terms of health because of carcinogenic compounds such as benzo(a)pyrene which contain in the liquid smoke can be absorbed and reduced in number, while the tar can be separated by using sedimentation and filtration method [4].

Some researches about the production and use of liquid smoke have been carried out include the determination of the temperature and time of pyrolysis of rubber wood to produce quality liquid smoke [5], the determination of antibacterial properties of liquid smoke produced from several types of softwood [6], pickling smoked tongue with liquid smoke produced from teak [7]. Those researches utilize hardwood and softwood separately. Whereas softwood with low lignin content will be very effective to extend the lasting power of fish and produce flavor which is not typical [8] if it is combined with other wood (hardwood).

With the right process of soaking on liquid smoke cinnamon which during this has been no information about it and it is continued by drying the fish fillet resulting in decreased water levels expected product microbial activity is inhibited, resulting in a longer lasting power products. Because that is still traditional, fish fillet products are usually not packaged properly so it is easy to be contaminated by microorganisms which will result in reduce durable power. Besides that the water content of the product is still relatively high. To obtain lower water content, then fillet products are not made in the form of a thick but in the form of thin slices. This thing is intended that the cinnamon liquid smoke can be more quickly penetrated into slices of fillet of tilapia, as well as the drying process is faster. With the form of the product likethe form of thin slices of fillet, it is expected no thorns entrained, all parts can be eaten and thin form is more attractive for consumers. Contamination with microbes and other damage can be prevented by packing them with a plastic bag. Until this time, the information about the type of packaging and storage time for tilapia fillet smoked haven't been existed or found. The results of the research [9] showed the absence of good packaging, during storage will increase the water content of the product. The purpose of this research is to know about the organoleptic quality (color, smell, texture and appearance) smoked fillet of tilapia which is given combined treatment of liquid smoke concentration, soaking time, types of packaging and different storage time.

## **2.MATERIALS AND METHODS**

### **2.1. Materials**

The materials used for the manufacture of fish are black tilapia which is bought at LubukBuaya market in Padang citywith an average weight of 250 grams / fish, alcohol 70%, salt, water and the result of smoke cinnamon purified with distillation temperature of 140°C. The tools used in this research are: a. Equipment for the manufacture of preservative solutions flask, glass beaker, beakers, pipettes, propipet and stirrer. b. Equipment for the manufacture of fish filet are basins, pans, mixers, stainless steel knives, water heating, cutting boards, working desks, spraying equipment, pan drainer, freezer, and analytical scales. c. Equipment for drying of tilapia fillets: briquette stove heat resistant (Patent [10]), a drying oven tool length 240 x width 100 x height 80 cm equipped with a temperature gauge to 70°C. d. Equipment for packaging and storage: storage shelves, polyethylene, polypropylene plastic, label paper, paper plates for a fillet. Another tool used in this study such as, refrigerator coolers, freezers, flask, cup petridist, electric stove, filter paper, oven, autoclaf, incubators, distillation apparatus, oven, porcelain dish, desiccator, filter, thermometer, pH meter, erlenmeyer 125 ml and 500 ml, beaker, filter paper, soxhlet, test tubes, centrifuge tubes, micro burette, pipette, pipette volumetric flask of 250 ml, centrifuge, spectrophotometer, pycnometer

### **2.2.Research methods**

The experimental design used in this research used a completely randomized design (CRD) factorial is a combination of liquid smoke concentration with soaking time, types of packaging and storage in order to obtain 5 x 3 x 3 x 5 x 3 trial replications = 675 experimental units. The first factor consists of 5 (five) level such as the concentration of liquid smoke control, 5% and 10%, 15% and 20%; The second factor of soaking with liquid smoke consists of three (3) levels such as soaking time 5 minutes, 10 minutes and 15 minutes; The third factor type of packaging consists of three (3) levels. They are without packaging, packaging polyethylene (PE) and polypropylene packaging (PP) and the factor of the place of storage time (days) consists of 5 (five) levels such as 0, 3,6,9 and 12 days. Data's are analyzed by analysis of variance on the real level of 5%, when it is different then It will be continued significantly different by Tukey's test at 5 percent significance level [11].

### 2.3. Implementation Research.

(A) Preparation of liquid smoke. Before being done the pickling process with the result of cinnamon liquid smoke purification by distillation using a temperature of 140°C after that, it is diluted with distilled water. The concentration of preservative liquid smoke used is smokeless liquid (control), 5%, 10%, 15% and 20 %.( B). Making fillets of tilapia and preservation with liquid smokeThe process of making fillets of tilapia and preservation with liquid smoke as well as packaging and storage which is done in this research are as follows: In the conduct of research activities is began with the preparation of materials and tools such as a desk, knives, cutting board that has been sterilized with alcohol 70% and cinnamon liquid smoke that has been purified. We have to prepare a qudest (control), liquid smoke concentration of 5%, 10%, 15% and 20%, Tilapia are chosen in fresh condition refers to the SNI [12] about specification of fresh fish and SNI specifications [13] about requirement of raw material with the characteristics of the raw materials are clean, free of any odor indicating decay, free from decomposition sign and forgery, free from other natural properties that can reduce the quality and it is not harmful for health. Organoleptically, raw materials have some characteristic of freshness: a) Appearance: Whole, convex eyes, bright white cutlet; b) Smell: Fresh fish specific; c) Texture: Dense, compact and elastic, with a weight of  $250 \pm 10$  grams. As the way of making tilapia fillet as follows: it is cultivated using fresh fish that has passed through freezing phase (rigor mortis) and cleanliness is always maintained by weeding the scales of a fish, discarding the entrails, feces, and lining the black wall of the stomach, then do the washing up until clean to remove any remaining dirt, blood, separated scales and also lenders. Already clean next do an incision behind the gill fins to the back of the head; cut in front of head toward tail along the dorsal fin using a stainless steel knife and a knife is made parallel so separate it from the ribs when taking fillet

Turn the fish, cut from the back fin gills until the head backward; cut it from tail toward the head. Open the fillet by cutting toward the head and holding knife close to the ribs, cutting through the bone of thorns. Furthermore fillet which is obtained immediately put into place in the cooling conditions in the container immediately faxed. To prevent a decline in quality, fillet cleanliness is always maintained and in working to make fillets have to really pay attention to sanitary aspects such as using gloves, head, working table knife would have been made sterile by rinsing with alcohol before starting the job

In this research using fillets in the form of fish block is boneless filet. Avoid it from contamination which can easily infiltrate into the meat tissue and muscle meat that has been opened to the whole fish. In the process of handling for each stage of work to keep the fish stay fresh is to protect from the sunlight, wind, other heat source which can increase the temperature of the fish and after being made, fillet is put in the freezer. To reduce drip (water from the lost muscle tissue in the frozen product melted) fillet do immersion in pure saline solution 15% for 20 seconds

This fillet construction is done quickly but carefully to avoid spoilage, contamination and defects due to carelessness which can adversely affect the product and to anticipate these things put in freezer. Waste which is obtained from fillet is soon removed from the processing to avoid contamination of the product. In blocks, fillet is easily stored, transported and handled [14]. Furthermore, fish blocks are cut in the form of stick (size of  $\pm 5 \times 10$  cm with a thickness of  $\pm 2$  cm) and given treatment of liquid smoke that is given liquid smoke 5%, 10%, 15%, 20% and control (without liquid smoke) as well as combined with different long immersion are immersion 5 minutes, 10 minutes and 15 minutes. After completion of the



immersion, the fillet is removed and drained and winds up until fillet surface dry. Fillet of tilapia further are arranged on the shelves of the oven so evenly, and dried at 70 °C for 6 (six) hours

Having smoked tilapia fillets dried due to heating, fillet cooled at room temperature for 20 minutes to cool  $\pm$  placed in container that are clean and hygienic styreform [15], and then inserted into the packaging polyethylene (PE), polypropylene (PP) and without packaging. Next they are stored at room temperature and held observation start the day 0, 3 days, 6 days, 9 days and 12 days on the organoleptic [16],[17] by the method for hedonic scale of the color, smell, texture and appearance.

### 3.RESULTS AND DISCUSSION

#### 3.1.Effect different concentrations of liquid smoke with a soaking time of the color, aroma, texture and appearance of fillets of tilapia.

There are several factors that determine the quality of foodstuffs. These factors are the taste, texture, nutritional value, microbiological and color. Before other factors are considered visually, the color factor will appear firstly. The color factor will be the first consideration when food materials are chosen [2]. Organoleptic test by scoring a test is done to know about the level of acceptance of the panelists which included the reason or response to the resulting product ratings [17]. This test is done by untrained panelists as many as 30 people for each treatment. Tested parameters include color, texture, aroma and appearance with grading scale from 1 to 9. To see the score average observed organoleptic test a combined treatment with different concentrations of liquid smoke soaking time to organoleptic color, aroma, texture, and appearance of fish fillets indigo smoke as table 1 below.

Table 1. Average observations combined treatment with different concentrations of liquid smoke soaking time to organoleptic color, aroma, texture, and appearance of smoked filet of tilapia.

| Combination Treatment              | Organoleptic Color | organoleptic aroma | Organoleptic texture | Organoleptic Appearance |
|------------------------------------|--------------------|--------------------|----------------------|-------------------------|
| L0K1 (liquid smoke 0%, 5 minutes)  | 5.7564 gh          | 6.304 abc          | 5.4264 k             | 5.9893 efghi            |
| L0K2 (liquid smoke 0%,10 minutes)  | 5.8080 fgh         | 6.042 cd           | 5.9118 ij            | 6.0953 defg             |
| L0K3 (liquid smoke 0%,15 minutes)  | 5.8969 efg         | 6.024 cd           | 5.9987 ghi           | 5.9951 efgh             |
| L1K1 (liquid smoke 5%,5 minutes)   | 5.5449 h           | 5.904 d            | 5.6169 jk            | 5.8153 hi               |
| L1K2 (liquid smoke 5%,10minutes)   | 5.9816 defg        | 6.221 abcd         | 5.9558 hi            | 5.9569 fghi             |
| L1K3 (liquid smoke 5%,15 minutes ) | 5.8027 fgh         | 5.893 d            | 6.0464 fghi          | 5.7260 i                |
| L2K1 (liquid smoke 10%,5 minutes ) | 6.0847 defg        | 6.513 a            | 5.9360 hi            | 5.8327 ghi              |
| L2K2 (liquid smoke 10%,10 minutes) | 6.6073 abc         | 6.484 ab           | 6.7438 abc           | 6.7338 bc               |
| L2K3 (liquid smoke 10%,15 minutes) | 6.1807 de          | 6.217 abcd         | 6.2409 efgh          | 6.234 de                |
| L3K1 (liquid smoke 15%,5 minutes)  | 6.2689 cd          | 6.117 bcd          | 6.5787 bcd           | 6.148 def               |
| L3K2 (liquid smoke 15%,10minutes)  | 6.2229 de          | 6.557 a            | 6.3233 def           | 6.3382 d                |
| L3K3 (liquid smoke 15%,15 minutes) | 6.3222 bcd         | 5.915 cd           | 6.4976 cde           | 6.6782 c                |
| L4K1 (liquid smoke 20%,5 minutes)  | 6.8107 a           | 6.560 a            | 6.9893 a             | 6.9873 ab               |
| L4K2 (liquid smoke 20%,10minutes)  | 6.6589 ab          | 6.102 d            | 6.8158 ab            | 7.0820 a                |
| L4K3 (liquid smoke 20%,15 minutes) | 6.1444 def         | 6.261 abcd         | 6.2809 defg          | 6.6409 c                |

\*Different superscript alphabets in the average column shows real difference ( $P < 0,05$ )

Organoleptic testing is subjective testing, using the senses aimed to the appearance, smell, and texture. The obtained data were tested using ANOVA statistical test. According [18] fish is said fresh when the sensory test value ranged between 9-7 and said unfresh when the value of a sensory test ranged from 4-1. Results of variance in test organoleptic color showed no

interaction of the two combination treatments such as soaking time with the type of packaging to the color of fillet of tilapia ( $P > 0.05$ ) while the interaction occurs very real in a combination of two other treatments, for the third and fourth other treatments did not show any interaction.

According to the table 1 above that average combination of the best treatment at different concentrations of liquid smoke with a soaking time of the organoleptic color, aroma, texture and appearance of filet of tilapia smoke contained in the combination of the concentration of liquid smoke 20% on a long immersion 5 minutes in color with a score of 6,81 (like), aroma with a score of 6.56 (like) and texture with a score of 6.99 (like). If the organoleptic appearance best treatment combination contained in the liquid smoke concentration of 20% at 10 minutes soaking time with a score of 7.08 (like). According to [2] determination of the product quality of foodstuffs in general depends on several factors such as flavor, color, texture, and nutritional value, in addition to the existing microbiological properties. But before other factors are considered, visually appear first color factor and sometimes very decisive. A material is considered nutritious, tasty, and the texture is very well not be purchased if it has a color which is not unsightly or gives the impression has deviated from the color it should be. According (29) The result indicates that concentration and optimum immersing duration are 5% and 10 minutes, respectively and pH Fillet of *Lates Calcarifer* until the 10th keeping day does not bring about significant impact on the time.

### 3.2. Effect different concentrations of liquid smoke to the type of packaging for color, aroma, texture and appearance of fillets of tilapia.

To see the average scores observed organoleptic test treatment combined different concentrations of liquid smoke to the type of packaging to organoleptic color, aroma, texture, and appearance of smoked tilapia fish fillets such as in Table 2 below.

Table 2. Average observations combined treatment of different concentrations of liquid smoke to the type of packaging to organoleptic color, aroma, texture and appearance of smoked filet of tilapia..

| Combination Treatment                  | Organoleptic Color | organoleptic aroma | Organoleptic texture | Organoleptic Appearance |
|--|--------------------|--------------------|----------------------|-------------------------|
| L0KK liquid smoke ( 0%, non packaging) | 5.578 e            | 5.906 g            | 5.4736 e             | 5.8578 e                |
| L0PP (liquid smoke 0%, packaging PP)   | 5.5993 e           | 6.287 defg         | 5.5776 e             | 5.9887 de               |
| L0PE (liquid smoke 0%, packaging PE)   | 6.284 bcd          | 6.904 ab           | 6.2858 cd            | 6.2333 bcd              |
| L1KK (liquid smoke 5%, non packaging)  | 5.5493 e           | 6.807 abcd         | 5.6258 e             | 5.5604 f                |
| L1PP (liquid smoke 5%, packaging PP)   | 5.5987 e           | 4.712 h            | 5.7440 e             | 5.74e f                 |
| L1PE (liquid smoke 5%, packaging PE)   | 6.1811 cd          | 5.959 fg           | 6.2493 cd            | 6.1978 cd               |
| L2KK (liquid smoke 10%, non packaging) | 6.1362 d           | 6.270 defg         | 6.2000 d             | 6.1549 cd               |
| L2PP (liquid smoke 10%, packaging PP)  | 6.1822 cd          | 6.679 abcd         | 6.2962 cd            | 6.2331 bcd              |
| L2PE (liquid smoke 10%, packaging PE)  | 6.5542 ab          | 6.647 abcde        | 6.4244 bcd           | 6.4124 bc               |
| L3KK (liquid smoke 15%, non packaging) | 6.1662 cd          | 4.474 h            | 6.3944 bcd           | 6.2807 bc               |
| L3PP (liquid smoke 15%, packaging PP)  | 6.1153 d           | 6.337 cdefg        | 6.4593 abcd          | 6.4033 bc               |
| L3PE (liquid smoke 15%, packaging PE)  | 6.5324 ab          | 6.650 abcde        | 6.5458 abc           | 6.4804 b                |
| L4KK(liquid smoke 20%, non packaging)  | 6.4464 abcd        | 7.065 a            | 6.6553 ab            | 6.9773 a                |
| L4PP (liquid smoke 20%, packaging PP)  | 6.4989 abc         | 7.067 a            | 6.6831 ab            | 6.9404 a                |
| L4PE (liquid smoke 20%, packaging PE)  | 6.6687 a           | 4.906 h            | 6.7476 a             | 6.7924 a                |

\*Different superscript alphabets in the average column shows real difference ( $P < 0,05$ )

Texture is an important parameter. Texture is defined by [19] as the way the constituent components and structural elements arranged and combined into micro and macrostructure and reality of this structure out in terms of flow and deformation. Texture is everything related to the mechanical, geometric and surface of a product that can be observed in the mechanical, taste, touch, sight, and hearing. At variance showed no interaction on the combination of the two treatments, the difference of soaking with different concentrations of liquid smoke ( $P > 0.05$ ) on the aroma of tilapia fillet smoked. Interactions also occur in two different types of packaging treatment combination with storage time on the aroma smoked fillet of tilapia, while the two other treatment combinations that there is no interaction. For the three and four-factor interactions showed no interaction ( $P > 0.05$ ).

According to the table 2 above that average combination of the best treatment at different concentrations of liquid smoke to the type of packaging to organoleptic color, aroma, texture, appearance fillet of tilapia smoke contained in the combination of the concentration of liquid smoke 20% on packaging type PE (polyethylene) for color with a score of 6.67 (like). On the scent with the score 7:07 (love) on a combination of liquid smoke concentration of 20% on the type of packaging PP (polypropylene) and texture with a score of 6.99 (like) in a combination of liquid smoke concentration of 20% without packaging (control), the same thing happened also on the organoleptic appearance with a score of 6.98 (like). [20] states that the Maillard reaction may give rise to brown the food product due to heating or long term storage. [21], states that the Maillard reaction of UHT milk heating process at  $140^{\circ}\text{C}$  for 4 seconds will generate the same level of brown color with one week of storage at  $25^{\circ}\text{C}$  or about one day at  $40^{\circ}\text{C}$ .

### 3.3. Effect different concentrations of liquid smoke to the storage duration of the color, aroma, texture and appearance of fillets of tilapia.

To see an average score of observation test organoleptic combined treatment with different concentrations of liquid smoke storage time to organoleptic color, aroma, texture, and appearance of smoked tilapia fish fillets such as table 3 below.

Table 3. Average observations combined treatment with different concentrations of liquid smoke storage time to organoleptic color, aroma, organoleptic texture, organoleptic appearance smoked fillet of tilapia.

| Combination Treatment           | Organoleptic Color | organoleptic aroma | Organoleptic texture | Organoleptic Appearance |
|---------------------------------|--------------------|--------------------|----------------------|-------------------------|
| L0S0 (liquid smoke 0%, 0day)    | 5.6626 g           | 5.906 g            | 5.6800 k             | 5.8767 h                |
| L0S1 (liquid smoke 0%, 3 day)   | 6.3144 ef          | 6.287 defg         | 6.0993 ijk           | 6.1115 gh               |
| L0S2 (liquid smoke 0%, 6 day)   | 6.5633 cde         | 6.904 ab           | 6.3552 fghi          | 6.8056 cde              |
| L0S3 (liquid smoke 0%, 9 day)   | 6.4130 de          | 6.807 abcd         | 6.6200 defg          | 6.6085 def              |
| L0S4 (liquid smoke 0%, 12day)   | 4.1489 j           | 4.712 h            | 4.1404 m             | 4.7307 j                |
| L1S0 (liquid smoke 5%, 0 day)   | 5.8004 g           | 5.959 fg           | 5.7300 jk            | 5.8293 h                |
| L1S1 (liquid smoke 5%, 3 day)   | 5.900 ef           | 6.270 defg         | 6.1119 hij           | 6.1030 gh               |
| L1S2 (liquid smoke 5%, 6day )   | 6.5678 cde         | 6.679 abcd         | 6.2130 ghi           | 6.7407 cde              |
| L1S3 (liquid smoke 5%, 9 day)   | 6.5744 cde         | 6.647 abcde        | 6.8456 abcde         | 6.1385 gh               |
| L1S4 (liquid smoke 5%, 12day)   | 4.0393 j           | 4.474 h            | 4.4648 lm            | 4.3522 k                |
| L2S0 (liquid smoke 10%, 0 day)  | 6.3074 ef          | 6.337 cdefg        | 6.3489 fghi          | 6.3300 fg               |
| L2S1 (liquid smoke 10%, 3day )  | 6.5089 cde         | 6.650 abcde        | 6.5415 efgh          | 6.5515 def              |
| L2S2 (liquid smoke 10%, 6 day)  | 6.9344 abc         | 7.065 a            | 6.7763 bcdef         | 6.8833 bcd              |
| L2S3 (liquid smoke 10%, 9day )  | 7.0541 ab          | 7.067 a            | 7.1496 ab            | 6.6767 def              |
| L2S4 (liquid smoke 10%, 12 day) | 4.6496 i           | 4.906 h            | 4.7181 l             | 4.8926 ij               |
| L3S0 (liquid smoke 15%, 0 day)  | 6.4037 de          | 6.030 fg           | 6.7137 cdef          | 6.4385 efg              |
| L3S1 (liquid smoke 15%, 3 day)  | 6.5367 cde         | 6.289 defg         | 6.7481 bcdef         | 6.7089 de               |
| L3S2 (liquid smoke 15%, 6 day)  | 6.8370 abcd        | 7.050 a            | 6.9926 abcd          | 7.0967 abc              |
| L3S3 (liquid smoke 15%, 9 day)  | 6.8937 abc         | 6.861 abc          | 7.1533 ab            | 6.7400 cde              |

|                                 |              |             |            |           |
|---------------------------------|--------------|-------------|------------|-----------|
| L3S4 (liquid smoke 15%, 12 day) | 4.6856 hi    | 4.752 h     | 4.7248 l   | 4.9567 ij |
| L4S0 (liquid smoke 20%, 0 day)  | 6.6867 abcde | 6.196 efg   | 7.1067 abc | 7.2300 ab |
| L4S1 (liquid smoke 20%, 3 day)  | 6.6315 bcde  | 6.453 bcdef | 7.0659 abc | 7.4248 a  |
| L4S2 (liquid smoke 20%, 6 day)  | 7.0963 ab    | 7.122a      | 7.2511 a   | 7.4241 a  |
| L4S3 (liquid smoke 20%, 9day)   | 7.1215 a     | 7.000 a     | 7.2393 a   | 7.2089 ab |
| L4S4 (liquid smoke 20%, 12 day) | 5.1541 h     | 4.767 h     | 4.8137 l   | 5.2293 i  |

\*Different superscript alphabets in the average column shows real difference ( $P < 0, 05$ )

The smell is one of the parameters that determine a person's level of satisfaction on the quality of the product. The smell of fresh fish fillet has a specific smell fresh and while the smell of rotten fish fillets have a harsh odor of ammonia and malodorous [22]. At variance showed no interaction of the two combination treatments, soaking time difference with storage time ( $P > 0.05$ ), while the combination of the other two treatments showed an interaction. For the treatment of treatment combination of three factors and four factors, showed no interaction. The average value of the color of fillet of tilapia in Table 3 were given treatment liquid smoke concentration of 20% with a storage time of 9 days provides the highest color score of 7.12 (like). In the organoleptic score tertinngi on aroma, texture and appearance contained in the combination treatment concentration liquid smoke to 20% with storage time 6 days respectively of 7.12 (like), 7.25 (love) and 7.42 (love). This means that the panelists liked the color fillet of tilapia given liquid smoke with a concentration ranging from 20% to 9 days of storage. The colors are preferred by the panelists is yellowish brown color without color is black (charred). According [23] stated that the process autolysis causes changes in fish meat, such as fish meat texture becomes soft and easily separated from the bone. According (28) giving liquid smoke and chitosan on tofu is done by immersion, while the meatballs made by mixing liquid smoke and chitosan into the boiling water of meatballs. Then samples tofu and meatballs were analyzed TPC and organoleptic tests. Results showed addition of liquid smoke with a concentration of 1.5% and chitosan 2.5% is able to extend the life of tofu and meatballs for three days.

### 3.4. Effect difference prolonged submersion in liquid smoke to the type of packaging for color, aroma, texture and appearance of fillets of tilapia.

To see the average scores observed organoleptic test long combined treatment of immersion in liquid smoke to the type of packaging to organoleptic color, aroma, texture, and appearance of smoked tilapia fish fillets such as table 4 below.

Table 4. Average observation time damping in combination treatment with liquid smoke different types of packaging to organoleptic color, aroma, texture, appearance tilapia fillet smoked.

| Combination Treatment            | Organoleptic Color | organoleptic aroma | Organoleptic texture | Organoleptic Appearance |
|----------------------------------|--------------------|--------------------|----------------------|-------------------------|
| K1KK (5 minutes, non packaging)  | 5.9319 b           | 6.226 ab           | 5.8873 e             | 6.0195 e                |
| K1PP (5 minutes, packaging PP)   | 5.9460 b           | 6.169 abc          | 5.9879 de            | 6.1155 de               |
| K1PE (5 minutes, packaging PE)   | 6.4015 a           | 6.444 a            | 6.4532 a             | 6.3287 bc               |
| K2KK (10 minutes, non packaging) | 6.1156 b           | 6.266 ab           | 6.2167 bc            | 6.3521 abc              |
| K2PP (10 minutes, packaging PP)  | 6.1128 b           | 6.140 bc           | 6.3181 abc           | 6.4479 ab               |
| K2PE (10 minutes, packaging PE)  | 6.5388 a           | 5.941 c            | 6.5155 a             | 6.5237 a                |
| K3KK (15 minutes, non packaging) | 5.8783 b           | 6.454 a            | 6.1055 cde           | 6.1271 de               |
| K3PP (15 minutes, packaging PP)  | 5.9319 b           | 6.436 a            | 6.1501 cd            | 6.1155 de               |
| K3PE (15 minutes, packaging PE)  | 6.3920 a           | 6.298 ab           | 6.3831ab             | 6.4175 ab               |

\*Different superscript alphabets in the average column shows real difference ( $P < 0,05$ )

Appearances are the main characteristics that assessed consumers to consume a product. The apparition is a parameter that determines the acceptance of the panelists for many commodities assessed quality properties with visions such as shape, size, color and surface properties (smooth, rough, bleak, shiny, homogeneous, heterogeneous and flat wavy). When the apparition good impression or, preferably, then the consumer will see the other



characteristics (aroma, flavor and so on). Sightings notonly specify the level of consumer preferences in absolute, but also affect the appearance of consumer acceptance. Products with immaculate shape, nice and intact certainly preferred by consumers compared to products that are less tidy and intact [17]. Results of analysis of variance appearance organoleptic test showed no interaction of the two combination treatments, soaking time with this type of packaging, whereas the other two treatment combinations showed an interaction. For the three treatments, namely a combination of soaking, different concentrations and types of packaging showed interactions ( $P < 0.05$ ). While the combination of the other three treatments and combinations of four combination treatment did not show any interaction.

The average value of the color of fillet of tilapia in Table 4 are given the treatment prolonged submersion for 10 minutes on the type of packaging Polyethylene (PE) provides the highest color score of 6.54 (like). Aroma organoleptic score highest on the combined treatment of 15 minutes soaking time at the controls of 6.45 (a bit like). Score the highest organoleptic texture and appearance of the treatment combination of soaking 10 minutes on the packaging Polyethylene (PE) each of 6.42 (a bit like) and 6.52 (love). This means that the panelists liked the color fillet of tilapia given immersion liquid smoke with 10 minutes of the packing material polyethylene (PE). The colors are preferred by the panelists is yellowish brown color without color is black (charred).

### 3.5. Effect difference prolonged submersion in liquid smoke to the storage duration of the color, aroma, texture and appearance of fillets of tilapia.

To see the average scores observed organoleptic test long combined treatment of immersion in liquid smoke with storage time of the organoleptic color, aroma, texture, and appearance of smoked tilapia fish fillets such as table 5 below.

Table 5. The average observation time reduction in the combined treatment of liquid smoke with different storage time to organoleptic color, aroma, organoleptic texture, organoleptic appearance smoked filet of tilapia.

| Combination Treatment    | Organoleptic Color | organoleptic aroma | Organoleptic texture | Organoleptic Appearance |
|--------------------------|--------------------|--------------------|----------------------|-------------------------|
| K1S0 (5 minutes, 0 day)  | 6.1358 d           | 6.194 cd           | 6.197 f              | 6.1104 g                |
| K1S1 (5minutes,3 day)    | 6.4867 bc          | 6.509 bc           | 6.502 cdef           | 6.3758 efg              |
| K1S2 (5 minutes,6 day)   | 6.7307 ab          | 6.944 a            | 6.627 cde            | 6.9956 ab               |
| K1S3 (5 minutes,9 day)   | 6.7498 ab          | 6.975 a            | 6.812 bc             | 6.5729 def              |
| K1S4 (5 minutes,12 day)  | 4.3627 e           | 4.777 e            | 4.410 g              | 4.7180 h                |
| K2S0 (10 minutes, 0 day) | 6.3122 cd          | 6.148 cd           | 6.466 def            | 6.5553 def              |
| K2S1 (10 minutes,3 day)  | 6.4909 bc          | 6.443 bc           | 6.663cde             | 6.7942 bcd              |
| K2S2 (10 minutes,6 day)  | 6.8573 a           | 6.986 a            | 6.788 bc             | 7.0789 a                |
| K2S3 (10 minutes,9 day)  | 6.9387 a           | 6.995 a            | 7.148 a              | 6.8171 abcd             |
| K2S4 (10 minutes,12 day) | 4.6796 e           | 4.845 e            | 4.686 g              | 4.9607 h                |
| K3S0 (15 minutes, 0 day) | 6.0684 d           | 5.915 d            | 6.285 f              | 6.3569 fg               |
| K3S1 (15 minutes,3 day)  | 6.1573 cd          | 6.218 cd           | 6.375 ef             | 6.5698 def              |
| K3S2 (15 minutes,6 day)  | 6.8113 ab          | 6.962 a            | 6.738 bcd            | 6.8958 abc              |
| K3S3 (15 minutes,9 day)  | 6.7456 ab          | 6.669 ab           | 7.045 ab             | 6.6336 cde              |
| K3S4 (15 minutes,12 day) | 4.5642 e           | 4.546 e            | 4.621 g              | 4.8182 h                |

\*Different superscript alphabets in the average column shows real difference ( $P < 0.05$ )

The average value of the color of fillet of tilapia in Figure 5 are given the treatment prolonged submersion for 10 minutes at soaking period of 9 days provides the highest color score of 6.94 (like). Organoleptic flavor and highest texture scores in treatment combination of soaking 10 minutes soaking time of 9 days each at 6.99 (love) and 7:15 (love). Organoleptic appearance score highest in treatment combination of soaking 10 minutes to 6 days storage time of 7:08. This means that the panelists liked the fillet of tilapia

given liquid smoke by soaking 10 minutes with storage up to 9 days. The colors are preferred by the panelists is yellowish brown color without color is black (charred). According (30)

Organoleptic and chemical tests showed, dried fish preserved with NaCl-liquid smoke is the best preserved. It can be seen from smell that is not too smelled of smoke, less brown color, shelf life of 63 days, water content of 32.9 %, ash content of 24.4 % and protein content of 13.6%.

### 3.6. Effect different concentrations of liquid smoke, prolonged submersion with the type of packaging for color, aroma, texture and appearance of fillets of tilapia.

To see the average scores observed organoleptic test a combined treatment of liquid smoke concentration, soaking time and different storage time to organoleptic color, aroma, texture, and appearance of smoked tilapia fish fillets such as table 6 below.

Table 6. Average observations combined treatment of different concentrations of liquid smoke, prolonged submersion and type of packaging to the organoleptic appearance smoked file of tilapia.

| Combination Treatment               | Organoleptic Appearance          |                           |                             |
|-------------------------------------|----------------------------------|---------------------------|-----------------------------|
|                                     | KK (control / without packaging) | packaging PP (polietilen) | Packaging PE (polipropilen) |
| L0K1 (liquid smoke 0%, 5 minutes)   | 5.8113 klmnopq                   | 5.9533 jklmnopq           | 6.2033 fghijklm             |
| L0K2 (liquid smoke 0%, 10 minutes)  | 5.9187 jklmnopq                  | 6.1233 ijklmno            | 6.2440 fghijkl              |
| L0K3 (liquid smoke 0%, 15 minutes ) | 5.8433 klmnopq                   | 5.8893 klmnopq            | 6.2527 efghijkl             |
| L1K1 (liquid smoke 5%, 5 minutes )  | 5.5993 opq                       | 5.7073 mnopq              | 6.1393 hijklmn              |
| L1K2 (liquid smoke 5%, 10 minutes)  | 5.6620 nopq                      | 5.9127 jklmnopq           | 6.2960 defghijk             |
| L1K3 (liquid smoke 5%, 15 minutes)  | 5.4200 q                         | 5.600 opq                 | 6.1580 ghijklmn             |
| L2K1 (liquid smoke 10%, 5 minutes ) | 5.5527 pq                        | 5.7340 lmnopq             | 6.2113 fghijklm             |
| L2K2 (liquid smoke 10%, 10 minutes) | 6.7853 abcde                     | 6.6873 abcdefg            | 6.7287 abcdef               |
| L2K3 (liquid smoke 10%, 15 minutes) | 6.1267 ijklmno                   | 6.2780 defghijk           | 6.2973 defghijk             |
| L3K1 (liquid smoke 15%, 5 minutes)  | 6.0193 jklmnop                   | 6.1493 hijklmn            | 6.2753 efghijk              |
| L3K2 (liquid smoke 15%, 10 minutes) | 6.2420 fghijklm                  | 6.3367 defghijk           | 6.4360 cdefghij             |
| L3K3 (liquid smoke 15%, 15 minutes) | 6.5807 bcdefghi                  | 6.7240 abcdef             | 6.7300 abcdef               |
| L4K1 (liquid smoke 20%, 5 minutes)  | 7.1147 ab                        | 7.0333 ab                 | 6.8140 abcd                 |
| L4K2 (liquid smoke 20%, 10 minutes) | 7.1527 a                         | 7.1793 a                  | 6.9140 abc                  |
| L4K3 (liquid smoke 20%, 15 minutes) | 6.6647 abcdefgh                  | 6.6087 bcdefghi           | 6.6493 abcdefghi            |

\*Different superscript alphabets in the average column shows real difference ( $P < 0,05$ )

The results of the study on tilapia fillets showed the interaction of three treatments, namely the concentration difference, kind of packaging and soaking time ( $P > 0.05$ ). The interaction of the three factors above means that the third factor in treatment is jointly affect scores appearance. The average score of the highest appearance in the organoleptic tilapia fillets on a combined treatment of liquid smoke concentration of 20% on a long soaking time 10 minutes on the type of control packaging, polyethylene (PE) and polypropylene (PP). At a concentration of 20% liquid smoke on a long soaking 10 minutes, starting without packaging, polyethylene and polypropylene packaging the best, allegedly because of the concentration of liquid smoke used high that the carbonyl component, phenols there is also higher so it will affect the appearance by the panelists. There are several factors that determine the quality of foodstuffs. These factors, among others, the taste, texture, nutritional value, microbiological and color. Before other factors are considered visually, the color factor will appear first. The color factor will be the first consideration when foods have [2].

The aroma of food in many ways determine whether or not the food is tasty. With one's sense of smell can recognize whether or not tasty food from a distance without tasting it directly. Even the food industry thought it very important to test the smell, because it can quickly provide the results of an assessment of whether a product can be favored or not by the consumer [17]. This means that the panelists liked the appearance of fillets of tilapia at the beginning of the manufacturing process. The appearance is preferred by the panelists is the typical appearance of fillets of tilapia. This shows that the panelists have the same relative level of votes for all the appearance of fillets of tilapia produced. Nevertheless there is a tendency to give an assessment panel that the lower along with increasing storage time. Fresh fish meat incision was brilliant while fish rotten flesh color dull [24]. The results research (25) obtained in the present study were highly positive and encouraging, since the smoked product at 22°C was placed as first in the preference order followed by the smoked at 28°C with the commercial product with equal preference results. Liquid smoke is considered as a substitute to traditional method, even though it was difficult to duplicate the color. But, in general there was no different proximate composition between liquid smoked and traditional smoked fish in this study (26). The sensory evaluation score showed no significant difference ( $P > 0.05$ ) between organoleptic properties and it can be concluded that smoked skipjack tuna from Kendari were accepted by the panelists (27).

#### 4. Conclusion

1. Average combined the best treatment on a combination of liquid smoke concentration with prolonged submersion in organoleptic test color smoked fillet of tilapia found in liquid smoke concentration of 20% at 5 minutes soaking time with a score of 6.81 (like), aroma with a score of 6.56 (like) and texture with a score of 6.99 (like), when the organoleptic test appearance best treatment combination contained in the liquid smoke concentration of 20% at 10 minutes soaking time with a score of 7.08 (like).
2. Average the best combination of treatments at different concentrations of liquid smoke to the type of packaging to organoleptic color tilapia fillets are smoked on a combination of liquid smoke concentration of 20% in packaging type PE (polyethylene) with a score of 6.67 (like), the aroma with score 7.07 (like) in a combination of liquid smoke concentration of 20% on the type of packaging PP (polypropylene) and texture with a score of 6.99 (like) in a combination of liquid smoke concentration of 20% without packaging (control), the same thing happens also in organoleptic appearance with a score of 6.98 (like).
3. Average the best organoleptic test on the combined treatment of liquid smoke concentration with storage time on the color of smoked tilapia fillets on the treatment of liquid smoke concentration of 20% with a storage time of 9 days give the highest score of 7.12 (like), the aroma, texture and appearance there on a combination of liquid smoke treatment concentration of 20% with storage time 6 days respectively of 7.12 (like), 7.25 (like) and 7.42 (like).
4. Average best organoleptic test on the combination of soaking treatment with this type of packaging on the color of smoked fillet of tilapia found in the treatment of soaking for 10 minutes on the type of packaging Polyethylene (PE) gave the highest score of 6.54 (like), aroma in combination treatment of soaking 15 minutes in the control of 6.45 (a bit like), texture and appearance are the treatment combination of soaking 10 minutes on the packaging Polyethylene (PE) each of 6.42 (a bit like) and 6.52 (Like).
5. Average the best organoleptic test on the combination of soaking with different storage time on the color of smoked tilapia fillets are long immersion treatment for 10 minutes at a storage time of 9 days provides the highest color score of 6.94 (like), aroma and texture is highest the treatment combination of soaking 10 minutes soaking time of 9 days each at

- 6.99 (like) and 7:15 (like) and the appearance organoleptic score highest in treatment combination of soaking 10 minutes with 6 days of storage time 7,08
6. The average score of the highest appearance in the organoleptic tilapia fillets on a combined treatment of liquid smoke concentration of 20% on a long soaking time 10 minutes on the type of control packaging, polyethylene (PE) and polypropylene (PP).

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