Effectiveness of Aloe vera In Reducing Formaldehyde Levels On Indian Mackerel Fish (*Rastrelliger kanagurta*) During Cold Temperature Storage

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ABSTRACT

Aims: This research aims to know how many Aloe vera solution could reduce the formaldehyde levels on Indian mackerel fish during cold temperature storage.
Place and Duration of Study: Fisheries Product Processing Laboratory, Faculty of Fisheries and Marine Sciences, and Central Laboratory, Padjadjaran University between March until April 2019.
Methodology: This research used the experimental method with five different Aloe vera treatment concentrations (0%, 10%, 20%, 30% and 40%). Data obtained from observations of formaldehyde, pH and organoleptic characteristics analyzed descriptively by comparing parameters with the literature.
Results: The results of the research show that the higher concentreation of Aloe vera used and the longer of storage period, the more reduced formaldehyde levels on Indian mackerel fish. The highest percentage of fomaldehyde reduction was on the concentration of 40% Aloe vera solution, with a decrease percentage was 63.47% - 74.48% and the lowest percentage decrease in formalin levels found in the solution concentration Aloe vera 10%, with a decrease percentage was 50.14% - 68.22%. pH value of all treatment concentrations was still in the range of the pH value of fresh fish, which is 6.3 - 7.0. The organoleptic parameters showed there is a difference between the characteristics of fresh fish, fish in formalin and after the fish soaked on Aloe vera solution.
Conclusion: The increasing concentration of Aloe vera solution until 40% increased the reduction of formaldehyde levels on Indian mackerel fish during cold storage until 10th day. At a concentration of 40% Aloe vera solution, it can reduce the highest formaldehyde levels with a range of percentage decreases in formalin levels by 63.47% - 74.48%, so that aloe vera could effectively reduce formalin levels in Indian mackerel during cold temperature storage.

Keywords: formalin, Indian mackerel, Aloe vera, reduction, saponins

1. INTRODUCTION

Fish is a food that has high protein and water content and can become easily damaged or experiencing a deterioration of quality, both in the form of decrease in the quality of texture, appearance, taste and odor [2]. The decrease of fish freshness can be caused by three

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types of activities, namely the autolysis reaction, chemical reactions and microorganism activity [12]. Procedure in handling fresh fish aim to maintain the quality of fish from the time fish caught until the fish is consumed. In maintaining the quality and in extending the shelf life of fish, carried out in various ways, one of them through storing cold temperatures and using preservatives, which can inhibit the process occurrence of unwanted changes in nutritional value and quality, by controlling microbial growth, reducing changes in chemical, physical physiology and pollution [4].

Fish-preservation is a human effort to enhance the durability and storability of fish with the aim that the quality of fish can be maintained in good condition, such as chilling, freezing, canning, salting, drying, pickling, and smoking. Various natural substances also can be used to longer the shelf life of fish (ex., bay leaf, basil leaf, aloe vera, galangal, ginger, etc). Natural subtances usually have anti microorganism compounds, and safer than synthesis ones. Cold temperature storage is a way of preserving fish by using a low temperature to inhibit the activity of enzymes and microbes. Cooling will extend the shelf life of fish. At a temperature of 15-20 °C, fish can be stored for up to about two days, at a temperature of 5 °C hold for 5-6 days, while at a temperature of 0 °C can reach 9-14 days. The use of low temperatures that is most often and easily done is the provision of ice. Ice is a cooling medium that has several advantages, namely having a large cooling capacity, does not enandger consumers, cools fish faster, is relatively cheap, and is easy to use [11].

The Indian mackerel (*Rastregiller kanagurta*) is a small pelagic fish, one of marine species that economically important or have high production capacity and a lot consumed by people in Indonesia [8]. According to the Departement of Maritime and Fisheries Affairs West Java, the production of mackerel in 2017 reaches a number 13,110.25 tons, number five of most caught fish species,and mostly catched are Indian Mackerel. As one of the fish that has many consumers in the community, various attempts were made to extend the period life. This causes several fishermen and traders make shortcuts using prohibited preservatives, mostly uses formalin. Formalin could have an impact on human health, which can be both an acute and a chronic impact. ACGIH (*American Conference of Governmental Industrial Hygienists*) suspected fomalin are carcinogen, meanwhile IARC (*International Agency for Research on Cance*r) said formalin could probable carcinogen.

Formalin is not a food preservative but is widely used by industry small to preserve food products because the price is cheap so it can reduce production costs, can make springy, whole, undamaged, practical and effective preserving food [18]. However, formaldehyde has an impact which is harmful to human health, so it prohibits the use of formalin as Food Additives (BTP) are listed in Republic of Indonesia Minister of Health Regulation No. 033 of 2012, about Food Additives.

Aloe vera has the potential to reduce formaldehyde molecules by saponin compounds, natural anti-bacterial and harmless if consumed by humans. Saponin compounds potentially as a formalin reducing agent, because it is classified as a surfactant that can bind formaldehyde particles and dissolve with water [9]. Formalin itself has the safe threshold in the body is 0.4 ppm according to ACGIH (*American Conference of Governmental Industrial Hygienists*), 1.5 - 14 mg/day in food and 0.1 ppm in the form of drinking water according to IPCS (*International Program on Chemical Safety*) . Based on this, the authors are interested in doing this research to find out how far the effectiveness of aloe vera in reducing formalin content in Indian mackerel (*Rastregiller kanagurta*) during cold temperature storage.

2. MATERIAL AND METHODS

2.1 Time and Place of Research

This research has been carried out from March 2019 until April 2019 in the Fisheries Product Processing Laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University, and the fomaldehyde levels was analyzed in Central Laboratory, Analysis Section 2, Padjadjaran University.

2.2 Material and Tools

The material used in this research includes Aloe vera leaf to make Aloe vera solution, fresh Indian mackerel fish as samples, ice to maintain fish freshness, 2% Formaldehyde solution, Aquadest, Ammonium acetate (Merck), Glacial acetic acid pa and acetyl acetone for making Nash reagents. The tools used in this research are cool boxes, knives, blenders, basins, measuring cylinder, trays, Styrofoam plates, tissue towels, plastic warp, labeling stickers and equipment for analyzed formaldehyde levels are test tubes, *micropipette*, volumetric pipette, laboratory waterbath, rubber bulb, analytical balance, spatula, filter papers, glass funnel, centrifuges, UV-Visible spectrophotometer and pH meter.

2.3 Research Methods

This research used the experimental method with five Aloe vera concentration treatments (0%, 10%, 20%, 30% and 40%) with parameters observation such as formaldehyde levels, pH on observation days on 1st, 3rd, 5th, 7th, 8th, 9th, and 10th and comparison of organoleptic characteristics of fresh fish, fish in formalin and after the fish soaked on Aloe vera solution.

2.4 The Aloe vera Solution Concentration

The concentration that used in this study was:
1. Indian Mackerel (without soaking aloe vera)
2. Indian Mackerel with 10% concentration of Aloe vera soaking
3. Indian Mackerel with 20% concentration of Aloe vera soaking
4. Indian Mackerel with 30% concentration of Aloe vera soaking
5. Indian Mackerel with 40% concentration of Aloe vera soaking

All aloe vera soaking treatments carried out for 60 minutes. Observations were made on formaldehyde and pH levels during storage on days 1st, 3rd, 5th, 7th, 8th, 9th and 10 while organoleptic observations were carried out on mackerel before being soaked in formalin, after being soaked in formalin, and after being soaked with aloe vera during the observation period.

2.5 Procedure

2.5.1 Preparation of Aloe vera Solution

The operations of making Aloe vera solution were divided into six steps, such as sorting, first washing, trimming, filleting, second washing, blending and diluting. Sorted the leaves of Aloe vera based on its physical appearance, and should be processed within 36 hours after harvested to avoid degradation of the contained bioactive components. Washed the leaf to remove dirt. Trimming is the process of aloe vera's entire skin was peeled using a knife. The aims of trimming was to remove the *yellow sap* (*antraquinone* compound and its derivatives). Filleting is the process of cutting aloe vera gel than has been skinned into small pieces.

Washed the pieces of aloe vera with clean water, then blended for about 10 minutes to obtained aloe vera gel. Then diluting aloe vera gel using aquadest to produce aloe vera solution with concentration 10%, 20%, 30% and 40% using a dilution formula.

$$V_1 . M_1 =. V_{2.} M_2$$

Description : V_1 = volume of stock solution needed to make the new solution
M_1 = concentration of stock solution

V_2 = final volume of new solution
M_2 = final concentration of new solution

2.5.2 Soaking Fish with Formalin

Formalin solution with concentration 2% was used to soaking Indian Mackerel (with a lid) for 60 minutes. Drained and stored Indian Mackerel on a tray for 10 minutes to let formaldehyde absorb.

2.5.3 Application of Aloe vera Solution on Indian Mackerel Fish

After all the mackerel is washed, soaked with formaldehyde and drained, the mackerel was soaked in a solution of aloe vera that has been prepared according to the concentration of the treatment. After being soaked, mackerel is placed on a *Styrofoam's* plate that has been given tissue paper and perforated plastic, which serves as an absorbent of water so as not to pool in a *Styrofoam's* plate. Packaged using wrap plastic, and stored in a refrigerator with 5-10 ^{o}C of temperature range of then observed the formaldehyde levels and pH during storage on days 1st, 3rd, 5th, 7th, 8th, 9th, and 10th and the organoleptic test is done to compare organoleptic characteristics of fresh fish, fish in formalin and after the fish soaked on Aloe vera solution.

2.5.4 Analysis of Formaldehyde Levels

Formaldehyde levels was analyzed by using a simple and sensitive spectrophotometric method, utilizing Nash reagents according to [23] that already been modified.

2.5.4.1 Sample preparation

The sample filtrates was made from four grams of mashed meat and skin samples dissolved on 20 mL of distilled water and filtered with filter papers. Centrifuged the sample filtrates at a speed of 6000 RPM for twenty minutes to obtain a supernatant solution.

2.5.4.2 Making Nash Reagent

30 g of ammonium acetate; 0.4 mL acetyl acetone and 0.6 acetic acid are dissolved with distilled water in a beaker glass and the sufficiently the solution to 200 mL.

2.5.4.3 Making Standard Solution 1000 mg/L

0.0625 mL of 37% formaldehyde solution was taken and diluted in 25 mL flask. The diluted formalin solution is dissolved by multilevel dilution to obtain concentrations of 5, 10, 15, 20 and 25 ppm.

2.5.4.4 Determination of Lambda Max

The lambda max was carried out in 15 ppm formalin solution, piped as much as 2 mL into a test tube, then added 2 mL of distilled water and 2 mL Nash reagent which give the solution a yellow color. The test tub heated into waterbath at 60 ^{o}C for 30 minutes while closed and awaited until it cool. Adjusted the volume using aquades to 10 mL, and shaken until homogeneous. Then observed the solution for absorption at wavelengths of 380 - 490 nm with a UV-Vis spectrophotometer and obtained a lambda max of 411 nm for the test.

2.5.4.5 Making Calibration Curve of Formaldehyde Concentration

2 mL of each standard solution (5, 10, 15, 20 and 25 ppm) was taken into a test tube, then added 2 mL of distilled water and 2 mL Nash reagent. The test tub heated in a waterbath at 60 ^{o}C for 30 minutes while closed and awaited until the solution cool. Adjusted the volume using aquades to 10 mL, and shaken until homogeneous. Observed the absorption at a wavelength of 411 nm with a UV-Vis spectrophotometer, which obtained a calibration curve with a linear equation y = a + bx and a correlation coefficient (r). Formaldehyde calibration curve obtained with a regression equation y = 0.0245x - 0.0087 and determinant coefficient value (R2) of 0.993 can be seen in Figure 1.

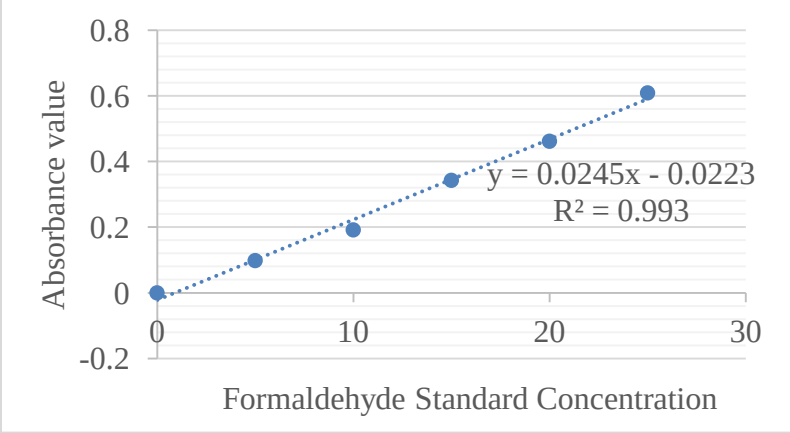

Figure 1. Formaldehyde Calibration Curve

2.5.4.6 Determination of Formaldehyde Levels

2 mL of the supernatant solution of the filtrate was piped and put into a test tube, then added 2 mL of distilled water and 2 mL of Nash reagent. Heated the test tube in a waterbath at 60 ^{o}C for 30 minutes while being closed. The solution is waited until it cools, the volume is adjusted using aquades to 10 mL, and shaken until homogeneous. Observed absorbance at a wavelength of 411 nm with a UV-Vis spectrophotometer. After the absorbance value obtained, calculated the actual concentration to determine the formalin levels using calibration curve.

$$\text{Formaldehyde Levels } (ppm) = \frac{\left(\frac{y + 0{,}0223}{0{,}0245}\right) \text{x } 10}{mg\ sample}$$

Description : Regression Equation : y = 0.0245x – 0.0223
y = absorbance of standard formaldehyde (OD)
x = formaldehyde level (mg/L)

2.5.4.7 Decreasing Percentage of Formaldehyde Levels

After the formaldehyde levels in the sample was known, calculated decreasing percentage of formaldehyde levels using the formula,

$$\text{Percentage Decrease (\%)} = (a-b) / a \times 100\%$$

Description : a = initial concentration (without immersion aloe vera)
b = final concentration (with aloe vera immersion treatment)

2.5.5 Determination of pH

Measuring the pH of Indian mackerel was done by using a pH meter. pH measurement was carried out to determine chemical changes during storage. One gram of mashed meat and skin's fish put into a tub test, added 9 mL of distilled water and shaken until homogenous. Homogenate was measured by a pH meter that previously been calibrated with a buffer solution pH 4 and pH 7.

2.5.6 Organoleptic Tests

Organoleptic testing is a method of testing food using human sensory abilities as the main tool for the acceptance of food products. The method used in this research organoleptic testing is test scoring (*scoring test*) on fish fresh (before were given formalin) and for the treatment of formalin and aloe conducted observations with description. Scoring test is a test using a scale of numbers 1, 3, 5, 7, 9, supported by the specifications of each product that can give understanding to the panelists. According to Soekarto (1985) [19], scoring tests for products or food ingredients can be said to be of good quality if the organoleptic value is 7-9, the quality is moderate if the organoleptic value is 5-6, and the quality is less if the organoleptic value is 1-4. Score sheet that used in the scoring test could be seen in Table 1.

Table 1. Fish Fresh Score Sheet

Description	Value
A. Appearance	
• Brilliantly specific types, clear and thin, thin mucus	**9**
• Kind of brilliantly specific, thin mucus	**7**
• Somewhat dull, thin mucus	**5**
• Dull, somewhat slimy	**3**
• Dull, thick, yellowish thick slimy	**1**
B. Aroma	
• Fresh, typical of fresh fish	**9**
• Fresh, typical of soft fresh fish	**7**
• Somewhat fresh, the characteristic smell of fresh fish is gone (neutral)	**5**
• Not fresh and smells different (slightly rotten smelling)	**3**

• Not fresh, smells rotten very strong	**1**
C. Texture (Overall Elasticity)	
• Solid and elastic (easy to return when pressed on the body part of the fish)	**9**
• A bit dense and somewhat elastic (if the body is pressed, it will take a long time to return to normal)	**7**
• A bit soft and less elastic (if the body is pressed, it will take a long time to return to normal)	**5**
• A little soft and not elastic (if pressed will cause a little mark on the body of the fish)	**3**
• Soft and inelastic (if pressed, do not return to normal and leave obvious marks on the fish's body)	**1**
D. Eyes	
• Convex, transparent cornea, bright black pupils	**9**
• Slightly convex, slightly cloudy cornea, grayish black pupils are less bright	**7**
• Data, the cornea is rather turbid, grayish black pupils are less bright	**5**
• Somewhat concave, cloudy cornea, whitish gray pupils rather dull, somewhat shriveled and slightly submerged	**3**
• Concave, milky white cornea, white pupils, dull, wrinkled and submerged	**1**

Source: Liviawaty (2001)

The observation of fish formalin with description was compared with the characteristics of fish formalin according to Sanger (2008) [18]

2.6 Data Analysis

Data obtained from observations of formaldehyde, pH and organoleptic characteristics were analyzed descriptively by comparing parameters with the literature so that it can be said that the mackerel studied has formaldehyde, pH and organoleptic levels that are fit for sale or human consumption.

3. RESULTS AND DISCUSSION

3.1 Formaldehyde Levels

The formaldehyde content in this research is a determining factor in the success of aloe vera in reducing formalin in Indian Mackerel. The results of the average analysis of reduced levels of formaldehyde and the percentage of reduction in Indian Mackerel by soaking aloe vera solution in cold temperature storage can be seen in Table 2.

Table 2. Average Reduced Formalin Levels in Indian Mackerel After Soaking Aloe Vera Solution During Cold Temperature Storage

Soaking Aloe Vera Solution (%)	Formalin Levels (ppm) on Observation Day-						
	1	**3**	**5**	**7**	**8**	**9**	**10**
0	93.29	89.97	87.66	87.14	85.21	85.88	81.73
10	46.52	42.86	40.65	33.47	32.79	31.82	25.97
20	40.61	36.81	34.48	31.77	31.82	28.51	23.33

30	37.77	35.12	33.64	29.09	27.83	24.97	21.64
40	34.08	30.83	29.62	28.90	25.80	21.93	20.85

Formaldehyde levels in fish that were soaked with formalin solution only or without soaking aloe vera also decreased during the observation period of day 1st to day 10th with a range of 93.29 - 81.73 ppm. This is caused by the chemical characteristics of formalin substances which are volatile, resulting in evaporation during the cold temperature storage period even though it runs slowly [18]. Meat that being soaked in formalin solution, formalin will bind with protein and the rest in free formalin which will be absorbed in the tissue so that it is protected from outside air, causing the evaporation process to occur slowly [3].

The levels of formaldehyde in the treatment of 10% - 40% aloe vera solution concentration decreased along with the increase in aloe vera concentration. According to Jannah (2014) [13], in the treatment of galangal addition with white shrimp samples, in addition to the evaporation of formalin, the decrease in formaldehyde levels was also caused by the presence of saponins in galangal so that the value of the decline was greater than the control. Saponin compounds that accelerate the decline in formaldehyde levels.

According to Makkar (2007) [15], the saponin content in aloe vera is quite high, which is around 5.651% per 100 grams. The saponin content is effective in binding formaldehyde particles so that formaldehyde can dissolve with water. Saponins are like natural soap or surfactants because they have a carbon atom hydrocarbon chain structure with both polar and non-polar groups, which are very polar or ionic at one end [7]. The existence of these two groups forms an emulsion, so that saponin acts as an emulgator which results in the stability of the emulsion from the pattern group by binding to formaldehyde particles. After formalin is bound, saponins will dissolve and form normal micro emulsions or micelles in water so that formaldehyde can dissolve [6].

Decreasing percentage of formaldehyde levels was calculated to see how much each aloe vera soaking treatment reduced formaldehyde levels in Indian Mackerel. The results of the analysis of the percentage decrease in formaldehyde levels in Indian Mackerel after being soaked with aloe vera solution are in Figure 2.

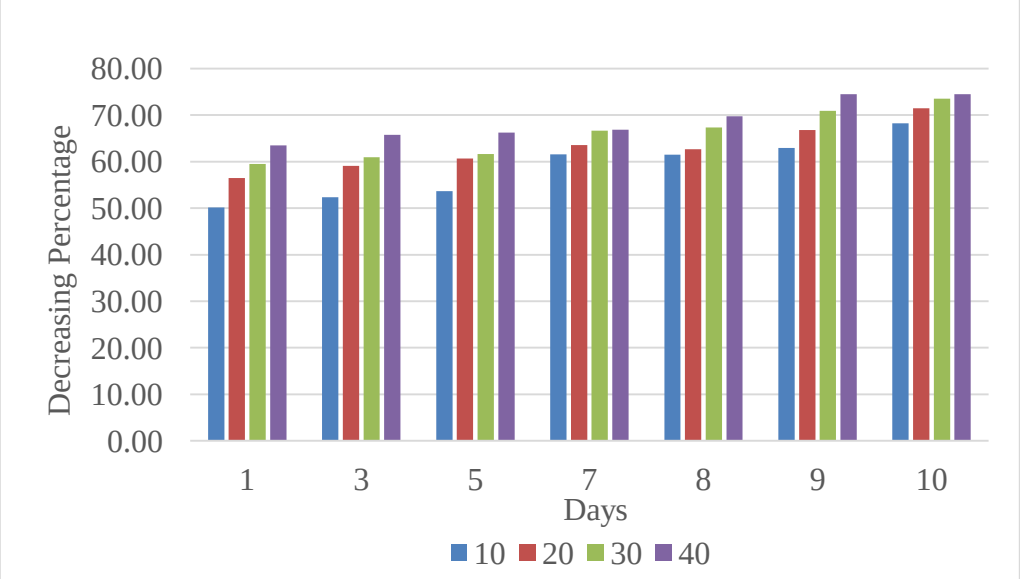

Figure 2. Decreasing Percentage Graph of Formaldehyde Levels in Indian Mackerel After Being Soaked with Aloe Vera Solution During Cold Temperature Storage

The decreasing percentage of formaldehyde levels increases with the increasing concentration of aloe vera solution and the length of storage days. Based on concentration, the highest percentage decrease in formaldehyde concentration was found in the concentration of aloe vera solution 40%, with a range of percentage 63.47 % - 74.48% and the lowest percentage decrease in formaldehyde was found in the concentration of aloe vera 10%, with a range of percentage of 50.14% - 68.22%.

Aloe vera effectively reduces formaldehyde levels in Indian Mackerel during cold storage until the day of10th, but Indian Mackerel still cannot be consumed by humans because it has formaldehyde levels above the safe threshold in the human body, which is equal to 20.85 ppm. In the few studies of the formaldehyde content of foods in Canada, the concentrations of formaldehyde were within the range <0.03–14 mg/kg (Health Canada, 2000). The proportion of formaldehyde in foods that is bioavailable is unknown, however the highest levels of formaldehyde of fish (e.g., 10–20 mg/kg) may not be considered palatable as a human food source.

3.2 Degree of Acidity (pH)

The degree of acidity (pH) was tested to determine the level of acidity or basicity of a product and determine the effect of the dynamics of changes in the degree of acidity to formalin mackerel. The pH value is an indicator of fish quality. The average value of the acidity (pH) of mackerel in formalin during the storage period can be seen in Table 3.

Table 3. Average Degree of Acidity (pH) of Indian Mackerel after Being Soaked with Aloe Vera Solution in Cold Temperature Storage

Soaking Aloe vera Solution (%)	Day Observation						
	1	3	5	7	8	9	10
0	6.47	6.60	6.73	6.83	6.87	6.93	7.03
10	6.40	6.47	6.63	6.73	6.83	6.97	7.00
20	6.37	6.43	6.47	6.57	6.60	6.63	6.80
30	6.33	6.43	6.47	6.57	6.63	6.70	6.77
40	6.30	6.37	6.47	6.57	6.63	6.70	6.77

The pH value of fish meat when still alive generally has a neutral pH and after death becomes down [5]. The beginning pH value observed at each immersion treatment of Aloe vera solution has a pH value that is close to acidic, which ranges from 6.30 - 6.47. This is caused by formalin and aloe vera gel which are both acidic. Formalin has an acidic pH value in the range of 2.8 - 4.0 [17] and the natural pH of aloe vera gel are between 4 – 5.There are three types of activities that cause deterioration in fish quality, namely the autolysis reaction, chemical reaction, and microorganism activity [12]. Acidic pH in formalin and aloe vera causes the process of decay in Mackerel to be slower because it inhibits the contamination of spoilage microorganisms and is antibacterial, although chemical processes in the form of protein overhaul and formation still occur.

The pH value of formalin in mackerel at each treatment concentration increased during storage, which was in the range of 6.77 - 7.03 on the last day of storage. According to [14],

fish that have not undergone decay have a pH ranging between 6.6 - 6.8. Increasing the pH value during the storage period can be caused by mackerel undergoing a chemical process in the form of protein overhaul and the formation of alkaline compounds. The amount of pH associated with the formation of compounds that are alkaline during storage [10]. Increasing the pH of protein products is usually following the formation of simple components during the quality degradation process. The basic component of protein breakdown is commonly used as an indicator of rot, for example, ammonia, histamine, and others [20].

3.3 Organoleptic Characteristics

Organoleptic characteristics of Indian Mackerel were observed when the fish were still in a fresh state, when the fish had been immersed in formaldehyde solution and during the observation period after being soaked in aloe vera solution. Observation of organoleptic characteristics was done to determine the freshness of Indian Mackerel, to know the difference in the ratio of fresh Indian Mackerel, Indian Mackerel that already soaked with formalin and the changes in organoleptic characteristics after being soaked on aloe vera. Organoleptic observation in the description of fresh mackerel, formalin and which has been soaked with aloe vera solution can be seen in Table 4.

Table 4. Organoleptic Descriptions of Fresh Fish, Fish Formalin Fish and After Being Soaked with Aloe Vera

Parameter	Fresh fish	Formalin fish	Fish After Soaking with Concentration (%) Aloe Vera Solution			
			10	20	30	40
Appearance	Specifically brilliantly Mackerel, thin mucous	Not brilliant, clean and shiny, mucous is gone	Not so bright, clean, a little shiny, a little gel from aloe vera	A little bright, clean, a little shiny, a little bit gel of aloe vera	A little brilliant, clean, a bit shiny, a little aloe vera gel	A little brilliant, clean, shiny, aloe vera gel a lot
Aroma	Fresh, typical of fresh soft fish	Formaldehyde can be smell but not so strong	The smell of formaldehyde is not so overpowering, there is the aroma of aloe vera solution	The smell of formaldehyde is gone, the aroma of aloe vera is slightly wafted	The smell of formaldehyd e is gone, the aroma of aloe vera is slightly wafted	The smell of formalin is gone, the aroma of aloe vera is very strong
Texture	Solid and elastic	The texture of the meat is a bit hard, dense and a little stiff	Solid, compact, slightly hardened meat	Compact, the flesh is not so hard when pressed	Solid, compact, not so hard when pressed	Solid, compact, not so hard when pressed
Eye	Slightly convex, the cornea is somewhat cloudy, the pupils are black	Somewhat convex, cloudy white cornea, gloomy	Slightly convex, the cornea is not so white	Slightly convex, the cornea is not white	Slightly convex, the cornea is not white	Slightly convex, the cornea is not white

and grayish

3.3.1 Organoleptic Characteristics of Fresh Indian Mackerel

Organoleptic characteristic of fresh Indian Mackerel was tested with a scoring method before any treatment was given. The results of observations of the parameters of the freshness of fish, organoleptic characteristics of Indian Mackerel can be said to be good and fresh because they still have an average value of 7.00 - 8.33 (Table 5) based on the score sheet.

Table 5. Organoleptic Test-score of Fresh Indian Mackerel

Parameters	Panelist			Median	Average
	1	2	3		
Appearance	7	9	7	7	7,67
Aroma	7	7	7	7	7,00
Texture	9	7	7	7	7,67
Eyes	7	9	9	9	8,33

This is in accorandce with research by Nurqaderianie (2016) [16], where Indian Mackerel sold in retail in Makassar City has organoleptic values ranging from 7.08 - 8.42 after 3 hours of sales. The decline in fish quality begins immediately after the fish die, so the handling must be done clean, careful, and fast and at low temperatures [11]. The decline in the freshness of these fish can be caused by three types of activities, namely the autolysis reaction, chemical reaction and microorganism activity [12].Fresh Indian mackerel can be seen in Figure 3.

Figure 3. Fresh Indian Mackerel and Formalin Indian Mackerel

3.3.2 Organoleptic Characteristics of Formalin Indian Mackerel

Observation by description was carried out on formalin Indian Mackerel (Figure 3). Based on organoleptic observations by a description of fish that have been soaked in formalin, the appearance has changed not to be not bright and the mucous disappears. The aroma parameter changes to formaldehyde can be smelled but were not so oppressive. The smell of formaldehyde that is not so strong is caused by the use of low formaldehyde

concentration, which is 2%. The content of formalin in food ingredients is very low, then the visual characteristics of these food ingredients will be difficult to detect [1]. The texture parameters have changed to slightly hard and stiff meat texture. This is because formalin begins to absorb into the meat tissue. The eye parameter has a description of the fish's eye becoming gloomy and murky white, which is caused by the fish's eyes getting in direct contact with formalin solution so that the difference is very visible. This is consistent with the characteristics of formalin fish according to [18]. Based on the results of all parameters, it can be seen that formalin immersion affects the organoleptic characteristics of fish because there are differences between fresh Indian Mackerel and those that have been soaked in formalin.

3.3.3 Organoleptic Characteristics of Indian Mackerel after Soaked with Aloe vera

Based on observations of mackerel in the description after being soaked with aloe vera, the parameters of the appearance of formalin Indian Mackerel that have been treated with aloe vera have differences with the treatment which is only given formalin. This can be seen by the difference in the remaining gel soaking aloe vera which causes Mackerel to be a little bright and shiny. The difference in appearance can also be seen from the different concentrations of aloe vera, where the higher the concentration of aloe vera, the aloe vera gel, and brilliance in fish are increasingly visible. The aroma parameter also showed that the smell of formalin was only slightly smelled at a concentration of 10% aloe vera and lost at a concentration of 20%, 30%, and 40% aloe vera solution, although the aroma of aloe vera leaves increasingly smelled with increasing concentration. The texture parameters also change when compared to the control treatment or without the addition of aloe vera, where the texture of the fish becomes dense, compact and the meat is not so hard when pressed, but the addition of concentration is not so visible in terms of texture. Differences in organoleptic characteristics of the eye are seen with loss of cloudy corneas, but there is no difference as an increase in aloe vera concentration.

Day-1

Day-3

Day-5

Day-7

Day-8

Day-9

Day-10

Figure 4. Indian Mackerel after Being Soaked Aloe vera on Observation Day 1st, 3rd, 5th, 7th, 8th, 9th and 10th

On the first day of observation, there were no significant changes in organoleptic characteristics in each treatment between the control treatment and aloe vera treatment. Observations on days 3rd, 5th and 7th (Figure 4) of formalin fish which had been treated with aloe vera, in general, were still the same as those observed on day 1st, but experienced slight changes in the appearance and aroma parameters. The gel found in the fish begins to disappear and the aroma of aloe vera is not so strong.

Observation of the 8th day (Figure 4), formalin fish which has been treated with aloe vera has undergone many changes, the appearance has a description of not bright and slightly dull, clean, and slightly shiny. The aroma of formaldehyde is also not very strong when compared to the control treatment, and the aroma of aloe vera has disappeared, while the texture and eye parameters are not so visible difference. Observation day 9th and 10th (Figure 4) formalin fish which has been treated with aloe vera had a change on appearance parameters. The appearance parameter has a description of the duller the lower the concentration of aloe vera.

Based on observations of organoleptic characteristics, changes occur from fresh fish, then soaked in formaldehyde, and soaked by aloe vera solution. The difference in concentration of aloe vera also shows the difference with the amount of gel and the aroma of aloe vera the higher the concentration. On the 1st, 3rd, 5th, 7th, 8th, 9th and 10th day of observation, it can be concluded that on the appearance parameters, the Indian Mackerel which is stored changes color to become dull and less brilliant the longer the storage day. The aroma parameters, the odor of formaldehyde is getting lost and the aroma of the aloe vera solution is lower in concentration, and also the longer the storage day. The texture parameters also change to less dense the longer the storage day. The eye of the fish experiences a change from turbid white due to formalin to transparent with less white color caused by soaking aloe vera, and gloomy upon entering the 10th day of observation.

4. CONCLUSION

Based on the results of research that has been done, it can be concluded that by increasing the concentration of aloe vera solution to a concentration of 40% will increase the reduction in formaldehyde levels in Indian Mackerel during cold storage until the 10th day. At a concentration of 40% aloe vera solution, it can reduce the highest levels of formalin with a range of percentage decrease in formaldehyde levels of 63.47% - 74.48%, so that aloe vera can effectively reduce formaldehyde levels in Indian Mackerel during cold storage.

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