

1 **Original Research Article**

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3 **Effectiveness of Aloe vera**

4 **In Reducing Formaldehyde Levels**

5 **On Indian Mackerel Fish (*Rastrelliger***

6 ***kanagurta*) During Cold Temperature Storage**

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12 **ABSTRACT**

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Aims: This research aims to know the reduction of formaldehyde on Indian mackerel fish using Aloe vera solution during cold temperature storage. Aloe vera has saponin compounds that potential to bind formaldehyde particles and dissolving it with water.

Place and Duration of Study: All of this research procedure was done in Fisheries Product Processing Laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University, between March until April 2019. The fomaldehyde levels was analyzed in Central Laboratory, Padjadjaran University at April 2019.

Methodology: 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.

Results: The results of the research show that the higher concentration of Aloe vera being 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 percentage of 63.47% - 74.48% and the lowest percentage decrease in formalin levels is found in the solution concentration Aloe vera 10%, with a percentage of 50.14% - 68.22%. pH parameters indicate the pH value of all treatment concentrations is still in the range of the pH value of fresh fish, which is 6.3 - 7.0. While the organoleptic observation parameters shows there is a difference between the characteristics of fresh fish, fish in formalin and after the fish soaked on Aloe vera solution. **Conclusion:** Based on the results of research that has been done, it can be concluded that with the increasing concentration of Aloe vera solution to a concentration of 40%, it will increase the reduction of formaldehyde levels in Indian mackerel fish during cold storage until the 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 can effectively reduce formalin levels in male mackerel during cold temperature storage.

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

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1. INTRODUCTION

(Language needs very much improvement – in spelling, grammar and sentence construction. Use the grammar-check part of the Word Program – or, add the Grammarly Program to the Word Program to help you write better. Preferably find someone fluent in the English language, maybe one whose first language is English to help with your article)

Fish is a food that has high protein and water content and can **being become** easily damaged or **quickly experiencing having a deterioration of quality quickly**, 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 types of activities, namely the autolysis reaction, chemical reactions and microorganism activity [12]. **Procedures in** handling fresh fish **aim to** maintain the quality of fish from the time **of the fish is 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 **organoleptic**, by controlling microbial growth, **reducing changes in** chemical, physical physiology and pollution [4].

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,with mostly 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 is a colorless and carcinogenic solution to humans, and in a long period of time can trigger the growth of cancer cells [22].

(Oncology Times 2004; Based on the new information, the expert working group determined that there is now sufficient evidence that formaldehyde causes nasopharyngeal cancer in humans.

“Their conclusion that there is adequate data available from humans for an increased risk of a relatively rare form of cancer—nasopharyngeal cancer—and a supporting mechanism, demonstrates the value and strengths of the Monographs Programme [which convened the working group],” he said.

The working group also found limited evidence for cancers of the nasal cavity and paranasal sinuses and “strong but not sufficient evidence” for leukemia.

The finding for leukemia reflects the epidemiologists' finding of strong evidence in human studies coupled with an inability to identify a mechanism for induction of leukemia, based on the available data.

“By signaling the degree of evidence for leukemia and cancer of the nasal cavity and paranasal sinuses, the working group identified areas where further clarification through research is needed,”)

(Official standing: ACGIH – suspected carcinogen; IARC – probable carcinogen)

(Nasopharyngel cancer mainly from breathing formaldehyde fumes as in cadaver-preservation, mortuary-work and mummification-work, and not contact on skin or by ingestion of small amounts).

63 Formalin is not a food preservative but is widely used by industry small to preserve food
64 products because the price is cheap so it can reduce production costs, can make springy,
65 whole, undamaged, practical and effective preserving food [18]. However, formaldehyde has
66 an impact which is harmful to human health, so it prohibits the use of formalin as Food
67 Additives (BTP) are listed in Republic of Indonesia Minister of Health Regulation No. 033 of
68 2012, about Food Additives.

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

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81 (Briefly describe 'cold temperature storage')

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84 (Discuss briefly fish-preservation in general. Beside formalin, what various substances are
85 being used? How effective and safe are these?)

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87 2. MATERIAL AND METHODS

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89 2.1 Time and Place of Research

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

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99 2.2 Material and Tools

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

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109 2.3 Research Methods

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111 This research used the experimental method with five Aloe vera concentration treatments
112 (0%, 10%, 20%, 30% and 40%) with parameters observation such as formaldehyde levels,

113 pH on observation days on 1st, 3rd, 5th, 7th, 8th, 9th, and 10th and comparison of
114 organoleptic characteristics of fresh fish, fish in formalin and after the fish soaked on Aloe
115 vera solution.

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117 **2.4 The Aloe vera Solution Concentration**

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119 The concentration that used in this study was:

- 120 1. Indian Mackerel (without soaking aloe vera)
- 121 2. Indian Mackerel with 10% concentration of Aloe vera soaking
- 122 3. Indian Mackerel with 20% concentration of Aloe vera soaking
- 123 4. Indian Mackerel with 30% concentration of Aloe vera soaking
- 124 5. Indian Mackerel with 40% concentration of Aloe vera soaking

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

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131 **2.5 Procedur**

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133 **2.5.1 Preparation of Aloe vera Solution**

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135 The operations of making Aloe vera solution were divided into six steps, such as sorting, first
136 washing, trimming, filleting, second washing, blending and diluting. Sorted the leaves of aloe
137 vera based on its physical appearance, and should be processed within 36 hours after
138 harvested to avoid degradation of the contained bioactive components. Washed the leaf to
139 remove dirt. Trimming is the process of aloe vera's entire skin was peeled using a knife. The
140 aims of trimming was to remove the *yellow sap* (*antraquinone* compound and its derivatives).
141 Filleting is the process of cutting aloe vera gel than has been skinned into small pieces.
142 Washed the pieces of aloe vera with clean water, then blended for about 10 minutes to
143 obtained aloe vera gel. Then diluting aloe vera gel using aquadest to produce aloe vera
144 solution with concentration 10%, 20%, 30% and 40% using a dilution formula.

145

$$146 \quad V_1 \cdot M_1 = V_2 \cdot M_2$$

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

149 M_1 = concentration of stock solution

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151 V_2 = final volume of new solution

152 M_2 = final concentration of new solution

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154 **2.5.2 Soaking Fish with Formalin**

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156 Formalin solution with concentration 2% was used to soaking Indian Mackerel (with a lid) for
157 60 minutes. Drained and stored Indian Mackerel on a tray for 10 minutes to let formaldehyde
158 absorb.

159

160 **2.5.3 Application of Aloe vera Solution on Indian Mackerel Fish**

161

162 After all the mackerel is washed, soaked with formaldehyde and drained, the mackerel was
163 soaked in a solution of aloe vera that has been prepared according to the concentration of
164 the treatment. After being soaked, mackerel is placed on a *Styrofoam's* plate that has been

165 given tissue paper and perforated plastic, which serves as an absorbent of water so as not
166 to pool in a Styrofoam's plate. Packaged using wrap ~~warp~~ plastic, and stored in a
167 refrigerator with 5-10 °C of temperature range of then observed the formaldehyde levels and
168 pH during storage on days 1st, 3rd, 5th, 7th, 8th, 9th, and 10th and the organoleptic test is
169 done to compare organoleptic characteristics of fresh fish, fish in formalin and after the fish
170 soaked on Aloe vera solution.

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172 **2.5.4 Analysis of Formaldehyde Levels**

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

176

177 *2.5.4.1 Sample preparation*

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

182

183 *2.5.4.2 Making Nash Reagent*

184

185 30 g of ammonium acetate; 0.4 mL acetyl acetone and 0.6 acetic acid are dissolved with
186 distilled water in a beaker glass and the sufficiently the solution to 200 mL.

187

188 *2.5.4.3 Making Standart Solution 1000 mg/L*

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190 0.0625 mL of 37% formaldehyde solution was taken and diluted in 25 mL flask. The diluted
191 formalin solution is dissolved by multilevel dilution to obtain concentrations of 5, 10, 15, 20
192 and 25 ppm.

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194 *2.5.4.4 Determination of Lambda Max*

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

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206 *2.5.4.5 Makin Calibration Curve of Formaldehyde Concentration*

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208 2 mL of each standard solution (5, 10, 15, 20 and 25 ppm) was taken into a test tube, then
209 added 2 mL of distilled water and 2 mL Nash reagent. The test tub heated in a waterbath at
210 60 °C for 30 minutes while closed and awaited until the solution cool. Adjusted the volume
211 using aquades to 10 mL, and shaken until homogeneous. Observed the absorption at a
212 wavelength of 411 nm with a UV-Vis spectrophotometer, which obtained a calibration curve
213 with a linear equation $y = a + bx$ and a correlation coefficient (r). Formaldehyde calibration
214 curve obtained with a regression equation $y = 0.0245x - 0.0087$ and determinant coefficient
215 value (R²) of 0.993 can be seen in Figure 1.

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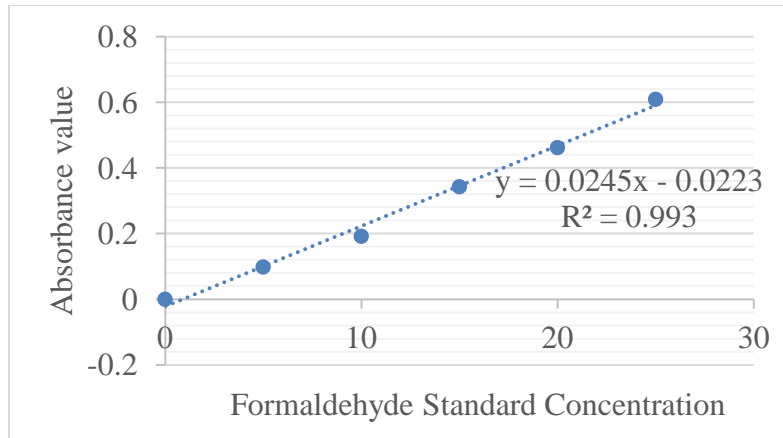


Figure 1. Formaldehyde Calibration Curve

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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 °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.

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$$\text{Formaldehyde Levels (ppm)} = \frac{\left(\frac{y + 0.0223}{0.0245}\right) \times 10}{\text{mg sample}}$$

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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

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

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

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

2.5.5 Determination of pH

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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.

251 Homogenate was measured by a pH meter that previously been calibrated with a buffer
252 solution pH 4 and pH 7.

253

254 **2.5.6 Organoleptic Tests**

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256 Organoleptic testing is a method of testing food using human sensory abilities as the main
257 tool for the acceptance of food products. The method used in this research organoleptic
258 testing is test scoring (*scoring test*) on fish fresh (before were given formalin) and for the
259 treatment of formalin and aloe conducted observations with description. Scoring test is a test
260 using a scale of numbers 1, 3, 5, 7, 9, supported by the specifications of each product that
261 can give understanding to the panelists. According to [19], scoring tests
262 for products or food ingredients can be said to be of good quality if the organoleptic value is
263 7-9, the quality is moderate if the organoleptic value is 5-6, and the quality is less if the
264 organoleptic value is 1-4. The observation of fish formalin with description was
265 compared with the characteristics of fish formalin according to [18]

266

267 (Describe in greater detail what Scores 1,3...9 mean. Produce here literature/reference on
268 any validation previously done on this method of Scoring).

269

270 **2.6 Data Analysis**

271

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

276

277 **3. RESULTS AND DISCUSSION**

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279 **3.1 Formaldehyde Levels**

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281 The formaldehyde content in this research is a determining factor in the success of aloe vera
282 in reducing formalin in Indian Mackerel. The results of the average analysis of reduced levels
283 of formaldehyde and the percentage of reduction in male bloated fish by soaking aloe vera
284 solution in cold temperature storage can be seen in Table 1.

285

286 **Table 1. Average Reduced Formalin Levels in Male Bloated Fish After Soaking Aloe**
287 **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

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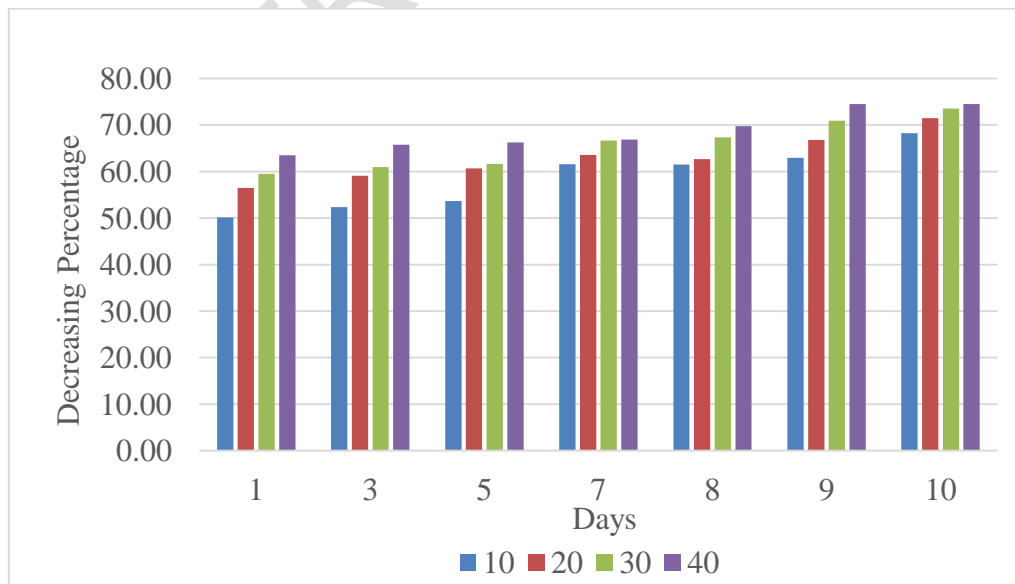
289 (The Descriptive Statistics does indeed seem that formalin levels are found decreased after
290 being soaked in aloe vera solution. But, you need to show that the difference i.e. the
291 decrease is indeed statistically significant by doing a appropriate analytic statistical test. You
292 could use appropriate statistical software to do such analytical statistics. If you are not
293 certain how to do it, find the help of a statistician at your University).

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

302 The levels of formaldehyde in the treatment of 10% - 40% aloe vera solution concentration
 303 decreased significantly (to use this word, you must do analytic statistics with an appropriate
 304 statistical test) along with the increase in aloe vera concentration. According to Jannah
 305 (2014) (write in the conventional way) [13], in the treatment of galangal addition with white
 306 shrimp samples, in addition to the evaporation of formalin, the
 307 decrease in formaldehyde levels was also caused by the presence of saponins in galangal
 308 so that the value of the decline was greater than the control. Saponin compounds that
 309 accelerate the decline in formaldehyde levels.

310
 311 According to [15], the saponin content in aloe vera is quite high, which is around 5.651% per
 312 100 grams. The saponin content is effective in binding formaldehyde particles so that
 313 formaldehyde can dissolve with water. Saponins are like natural soap or surfactants because
 314 they have a carbon atom hydrocarbon chain structure with both polar and non-polar groups,
 315 which are very polar or ionic at one end [7]. The existence of these two groups forms an
 316 emulsion, so that saponin acts as an emulgator which results in the stability of the emulsion
 317 from the pattern group by binding to formaldehyde particles. After formalin is bound,
 318 saponins will dissolve and form normal microemulsions or micelles in water so that
 319 formaldehyde can dissolve [6].

320 Decreasing percentage of formaldehyde levels was calculated to see how much each aloe
 321 vera soaking treatment reduced formaldehyde levels in Indian Mackerel. The results of the
 322 analysis of the percentage decrease in formaldehyde levels in male bloated fish after being
 323 soaked with aloe vera solution are in Figure 2.
 324



326 **Figure 2. Decreasing Percentage Graph of Formaldehyde Levels in Indian**
 327 **Mackerel After Being Soaked with Aloe Vera Solution During Cold**
 328 **Temperature Storage**
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330 The decreasing percentage of formaldehyde levels increases with the increasing
 331 concentration of aloe vera solution and the length of storage days. Based on concentration,
 332 the highest percentage decrease in formaldehyde concentration was found in the
 333 concentration of aloe vera solution 40%, with a range of percentage 63.47 % - 74.48% and
 334 the lowest percentage decrease in formaldehyde was found in the concentration of aloe vera
 335 10%, with a range of percentage of 50.14% - 68.22%.
 336

337 Formaldehyde levels have a safe threshold in the human body, which is 0.4 ppm
 338 by ACGIH (*American Conference of Governmental and Industrial Hygienists*) and 0.1 ppm
 339 according to IPCS (*International Program on Chemical Safety*). (Need not repeat. Already
 340 said above) Aloe vera effectively reduces formaldehyde levels in Indian Mackerel during cold
 341 storage until the day of 10th, but Indian Mackerel still cannot be consumed by humans
 342 because it has formaldehyde levels above the safe threshold in the human body, which is
 343 equal to 20.85 ppm.
 344

345 (0.4 ppm is the permissible exposure level (PEL) of formaldehyde in the air. The PEL for
 346 ingestion may be different. Use the document here to come to conclusion on such,
 347 especially food and drinking water.
 348 <https://www.who.int/ipcs/publications/cicad/en/cicad40.pdf>
 349

350 **3.2 Degree of Acidity (pH)**
 351

352 The degree of acidity (pH) was tested to determine the level of acidity or basicity of a product
 353 and determine the effect of the dynamics of changes in the degree of acidity to formalin
 354 mackerel. The pH value is an indicator of fish quality. The average value of the acidity (pH)
 355 of mackerel in formalin during the storage period can be seen in Table 2.
 356

357 **Table 2. Average Degree of Acidity (pH) of Indian Mackerel after Being Soaked with**
 358 **Aloe Vera Solution in Cold Temperature Storage**
 359

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

360
 361 (My comments on Table 1 above also apply here)

362 The pH value of fish meat when still alive generally has a neutral pH and after death
 363 becomes down [5]. The beginning pH value observed at each immersion treatment of aloe
 364 vera solution has a pH value that is close to acidic, which ranges from 6.30 - 6.47. This is
 365 caused by formalin and aloe vera gel which are both acidic. Formalin has an acidic pH value
 366 in the range of 2.8 - 4.0 [17] and the natural pH of aloe vera gel are between 4 – 5. There are
 367 three types of activities that cause deterioration in fish quality, namely the autolysis reaction,
 368 chemical reaction, and microorganism activity [12]. Acidic pH in formalin and aloe

369 vera causes the process of decay in bloated fish to be slower because it inhibits the
 370 contamination of spoilage microorganisms and is antibacterial, although chemical processes
 371 in the form of protein overhaul and formation still occur.

372 The pH value of formalin in mackerel at each treatment concentration increased during
 373 storage, which was in the range of 6.77 - 7.03 on the last day of storage. According to [14],
 374 fish that have not undergone decay have a pH ranging between 6.6 - 6.8. Increasing the pH
 375 value during the storage period can be caused by mackerel undergoing a chemical process
 376 in the form of protein overhaul and the formation of alkaline compounds. The amount of pH
 377 associated with the formation of compounds that are alkaline during storage [10]. Increasing
 378 the pH of protein products is usually following the formation of simple components during the
 379 quality degradation process. The basic component of protein breakdown is commonly used
 380 as an indicator of rot, for example, ammonia, histamine, and others [20].

381
 382 **3.3 Organoleptic Characteristics**

383
 384 Organoleptic characteristics of Indian Mackerel were observed when the fish were still in a
 385 fresh state, when the fish had been immersed in formaldehyde solution and during the
 386 observation period after being soaked in aloe vera solution. Observation of organoleptic
 387 characteristics was done to determine the freshness of Indian Mackerel, to know the
 388 difference in the ratio of fresh Indian Mackerel, Indian Mackerel that already soaked with
 389 formalin and the changes in organoleptic characteristics after being soaked on aloe
 390 vera. Organoleptic observation in the description of fresh mackerel, formalin and which has
 391 been soaked with aloe vera solution can be seen in Table 3.

392
 393 **Table 3. Organoleptic Descriptions of Fresh Fish, Fish Formalin Fish and After Being**
 394 **Soaked with Aloe Vera**

Parameter	Fresh fish	Formalin fish	Fish After Soaking with Concentration (%) Aloe Vera Solution			
			10	20	30	40
Appearance	Specifically brilliantly bloated fish, 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 formaldehyde 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 and grayish	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
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(Also tabulate in a different Table according to organoleptic test-score that you had described in your Method above – and, do analytical statistics)

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3.3.1 Organoleptic Characteristics of Fresh Indian Mackerel

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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 based on the score sheet. This is in accordance with research by (write the name and year) [16], where male bloated fish 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, 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 male mackerel can be seen in Figure 3.



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Figure 3. Fresh Indian Mackerel and Formalin Indian Mackerel

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3.3.2 Organoleptic Characteristics of Formalin Indian Mackerel

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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

426 characteristics of formalin fish according to [18]. Based on the results of all parameters, it
427 can be seen that formalin immersion affects the organoleptic characteristics of fish because
428 there are differences between fresh male bloated fish and those that have been soaked in
429 formalin.

430 **3.3.3 Organoleptic Characteristics of Indian Mackerel after Soaked with Aloe vera**

431

432 Based on observations of mackerel in the description after being soaked with aloe vera, the
433 parameters of the appearance of formalin male bloated fish that have been treated with aloe
434 vera have differences with the treatment which is only given formalin. This can be seen by
435 the difference in the remaining gel soaking aloe vera which causes bloated fish to be a little
436 bright and shiny. The difference in appearance can also be seen from the different
437 concentrations of aloe vera, where the higher the concentration of aloe vera, the aloe vera
438 gel, and brilliance in fish are increasingly visible. The aroma parameter also showed that the
439 smell of formalin was only slightly smelled at a concentration of 10% aloe vera and lost at a
440 concentration of 20%, 30%, and 40% aloe vera solution, although the aroma of aloe vera
441 leaves increasingly smelled with increasing concentration. The texture parameters also
442 change when compared to the control treatment or without the addition of aloe vera, where
443 the texture of the fish becomes dense, compact and the meat is not so hard when pressed,
444 but the addition of concentration is not so visible in terms of texture. Differences in
445 organoleptic characteristics of the eye are seen with loss of cloudy corneas, but there is no
446 difference as an increase in aloe vera concentration.
447



Day-1



Day-3



Day-5



Day-7



Day-8



Day-9



Day-10

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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.

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

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

478 4. CONCLUSION

479
480 Based on the results of research that has been done, it can be concluded that by increasing
481 the concentration of aloe vera solution to a concentration of 40% will increase the reduction
482 in formaldehyde levels in male bloated fish during cold storage until the 10th day. At a
483 concentration of 40% aloe vera solution, it can reduce the highest levels of formalin with a
484 range of percentage decrease in formaldehyde levels of 63.47% - 74.48%, so that aloe vera
485 can effectively reduce formaldehyde levels in male bloated fish during cold storage.

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490 (List References only in the style recommended by the 'Author Guidelines' found at the
491 website/Editorial Manager of this Journal. Languages beside English can only be
492 used in case the Guidelines allow.)

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551

UNDER PEER REVIEW