



# Preservative Role of Boiling Water of Binahong Leaves (*Anredera cordifolia*) on the Shelf Life of Mackerel Fish Based on Organoleptic Characteristics

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

This study aims to obtain the concentration of binahong leaf boiled water with the longest shelf life of mackerel based on organoleptic characteristics. The research method using experimental method with complete random design (CRD) consists of 4 treatments, namely the concentration of binahong leaf boiled water (0%, 55%, 60%, and 65%). Parameters observed in this study are organoleptic characteristics (appearance, meat, scent and texture) and pH in mackerel. Soaking fish using binahong leaf boiled water is done for 30 minutes. The use of boiled water from binahong leaves with a concentration of 60% was able to maintain mackerel during storage until the 11th day with a pH value of 7.3 and organoleptic assessment with the longest acceptance limit.

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## 1. INTRODUCTION

Based on statistical data on total catch fishery production in 2018 in West Java province, mackerel occupies the third highest position, reaching 10 million tons/year. Mackerel is one of the small pelagic fishery products that have important economic value. The content of omega-3 and protein in mackerel is higher than salmon [1].

Mackerel has the same characteristics as other fishery commodities, which are very fast in the decay process (*Highly perishable food*). This is due to the high protein content in fish and environmental conditions that are very suitable for the growth of decomposing microbes. Efforts to prevent the decay process, it is needed to develop alternative ways of preservation or processing that are appropriate and do not endanger the health of consumers. People usually often use harmful synthetic preservatives such as formaldehyde to preserve fish. The use of formalin for food preservatives is not recommended because it can interfere with health [2]. For this reason, natural preservation is needed, which is easy to obtain, cheap and does not harm. Natural preservatives have the potential as a substitute for harmful synthetic chemical compounds and among them are organic acids produced from components contained in plants. Binahong leaves is one of the traditional medicinal plants, because it contains flavonoid compounds that can be used as antibacterial, antioxidant, and anti-inflammatory [3].

Binahong leaves can be used as a natural ingredient that is used as an alternative material for preservation, as well as extend the shelf life of fish.

Based on research by [4] stated that the use of binahong leaf dekok with different concentrations with the concentrations used were 20%, 40%, 60% had an effect on the Total Plate Number (ALT), air content, protein content, and organoleptic of white tofu. The use of boiled water from binahong leaves by soaking during the shelf life of fish as a natural preservative has not been widely used. The purpose of this study was to obtain the concentration of boiled water from binahong leaves with the longest shelf life of mackerel based on organoleptic characteristics.

## 2. MATERIALS AND METHODS

### 2.1 Time and Place of Research

This research was conducted from November to December 2021 at the Laboratory of fishery processing and Marine Sciences, Padjadjaran University.

### 2.2 Tools and Materials

The tools used include *box styrofoam*, knife, cutting board, Basin, plastic container, measuring cup (500ml, 1000ml), scale, *hotplate*, 5 liter jerry cans, 1mm plastic filters, aluminum foil, thermometers, spoons, tissues, styrofoam plates, plastic perforated, *cling wrap*, pH meter, and score sheet . The ingredients used include mackerel, binahong leaves, distilled water, and curai ice.

### 2.3 Methods

The method used in this study was an experimental method with 4 treatments and 15 semi-trained panelists as the number of repetitions. Soaking was carried out for 30 minutes, while the treatment used was:

- A : Mackerel without water immersion decoction (control)
- B : Mackerel with soaking binahong leaf extract (55%)
- C : Mackerel with soaking binahong leaf extract (60%)
- D : Mackerel with soaking binahong leaf extract (65%)

The preparation of binahong leaf extract concentration was done in 2 stages. The first step is to make boiled water from binahong leaves according to [5] namely as follows: the binahong leaves to be used are prepared then the binahong leaves are washed clean, the clean binahong leaves are cut into 100 grams. The chopped binahong leaves are put into a sterile *beaker glass* , then add 100 ml of distilled water and cover with aluminum foil and boil. Binahong leaves are boiled at 80°C for 15 minutes. After boiling, the boiled water of the binahong leaves is cooled, then filtered through a sterile filter and collected.

The second stage is dilution of the boiled water of binahong leaves based on the percentage of the formula to be applied, namely 55% (v/v), 60% (v/v), 65% (v/v). by using the following formula:

$$V1 \cdot M1 = V2 \cdot M2$$

Description :

V1 = Volume before dilution  
 V2 = Volume after dilution  
 M1 = Concentration before dilution  
 M2 = Concentration after dilution

After obtaining the concentration of the binahong leaf extract, mackerel soaked in the boiled water of the binahong leaves for 30 minutes according to the concentration of the treatment. After the mackerel is soaked, the fish is placed on a *styrofoam plate* and then packaged using *clingwrap plastic*. Mackerel that has been packaged and labeled is then stored in a refrigerator with a temperature range below 4°C for scoring and pH tests.

## 2.4 Organoleptic Testing

The method used in organoleptic testing in this study was a scoring test, namely the assessment of the samples tested by giving scores on a scale of numbers ranging from 1-9 on the score sheet and supported by the specifications of each product which can provide an understanding to the panelists. Parameters observed were appearance, meat, scent, and texture.

## 2.5 pH Measurement

The pH measurement was carried out by taking 10 grams of crushed fish meat and then homogenizing it with 20 ml of distilled water for 1 minute. Before the pH meter is used, it is first calibrated with a pH 7 *buffer solution* [6].

## 2.6 Data Analysis

Data from pH observations were analyzed descriptively based on the average pH of the fish meat to see changes in the decrease and increase in the pH of the fish during storage.

Data on the results of organoleptic testing which included appearance, meat, aroma, and texture were analyzed using Friedman test analysis to determine the effect of binahong leaf cooking water on the organoleptic characteristics of

mackerel, if the test shows significant results, a follow-up test of multiple comparisons was carried out to determine the difference in each treatment [7]. Friedman test statistical formula:

$$X_r^2 = \left[ \frac{12}{bK(K+1)} \times \sum_{j=1}^k (R_j)^2 \right] - [(3b)(K+1)]$$

Description :

X =Friedman Test Statistics  
 R<sub>j</sub> =Total ranking for each treatment  
 b =Deuteronomy  
 K =Treatment

## 3. RESULTS AND DISCUSSION

### 3.1 Appearance

Testing the organoleptic characteristics of appearance is one of the important things related to the quality of a food product. Appearance of fish is one of the assessments for consumers to determine the level of freshness of fish. The results of organoleptic observations on the appearance of mackerel during low temperature storage are presented in Table 1.

The organoleptic test results in Table 1 show that the appearance of fresh mackerel soaked without treatment and with treatment using boiled water from binahong leaves deteriorated with the length of storage time. On the 1st and 2nd day of storage, the appearance of mackerel from all treatments was the same, namely having a quality value of > 7, namely with the condition that the eyeballs were convex, the gills were dark red and not slimy.

According To [4] binahong leaves contain flavonoid, saponin and tripenoid compounds that act as antibacterial. The decline in the value of organoleptic quality is caused because after the fish dies, the immune system that protects the fish from bacterial attack does not work anymore and bacteria begin to enter the fish's body. Spoilage bacteria in fish come from outside the body of the fish that enter through the skin or from the body of the fish itself [8].

The results of multiple comparison tests Table 2 on the 8th day showed the average appearance value of fresh mackerel ranged from 27 to 59. The highest average value was found in the 0% concentration treatment whose results were significantly different from other treatments. while

the lowest average value was found in the 55% and 60% concentration treatment which had a median value of 6.

### 3.2 Meat

Organoleptic testing of fish meat is an indicator to determine the freshness of fish quality. According to [9] fresh fish have a bright and not dull appearance, but the appearance of this meat will decrease over time. The results of organoleptic observations of mackerel meat during low temperature storage are presented in Table 3.

The organoleptic test results in Table 3 show that the quality value of fresh mackerel meat soaked in binahong leaf boiled water in all treatments decreased with the length of storage time.

The quality value of mackerel meat without treatment decreased on the 5th day, while the treatment concentrations of 55%, 60% and 65% decreased on the 8th day. The effect of using binahong leaf boiled water as an antibacterial was only able to maintain the quality of the meat until the 11th day. This is thought to be because the antibacterial compounds in the boiled water of binahong leaves are still effective in inhibiting the growth of bacteria, so damage to the meat can be prevented. Flavonoids can act directly as antibacterial by interfering with the function of bacteria. The mechanism of action of flavonoids includes causing damage to the permeability of the bacterial cell wall and being able to inhibit bacterial motility [10].

Multiple comparison test results on Table 4 showed that on the 8th day the average value of fresh mackerel meat ranged from 22.5 to 58.5. The highest average value is found in 0% concentration treatment, while the lowest average value is found in 60% and 65% concentration treatment. Based on statistical tests of immersion treatment with concentrations of 55%, 60% and 65% did not show a significant difference with a concentration of 0%. The median value of fish meat with 60% and 65% treatment showed the same acceptability limit of 6.

### 3.3 Scent

Testing the scent or smell in fish is one of the indicators to determine the quality of fish freshness. The results of organoleptic observations of the scent quality of mackerel during low-temperature storage are presented in Table 5.

Organoleptic test results based on Table 5 showed the median value of mackerel scent decreased along with the duration of the fish storage process at low temperatures. Mackerel that is soaked in boiled water of binahong leaves has a different scent compared to that without treatment, because the aroma present in the boiled water of binahong leaves can disguise the specific smell of the fish. The increase in smell or scent in fish can be influenced from the content of fat and oil contained in the fish so that the fish will easily experience the process of Decay [11].

**Table 1. Median value of mackerel appearance by soaking in binahong leaf extract**

Concentration of binahong leaf extract (%)	Day of storage											
	1	2	3	4	5	6	7	8	9	10	11	12
0	9	8	7	6	5	3	3	1	-	-	-	-
55	9	8	8	7	7	7	6	6	5	5	3	3
60	8	8	8	8	7	7	6	6	5	5	5	3
65	8	8	7	7	7	6	6	5	5	3	3	1

Note: (-) : No change in appearance

**Table 2. Median value and average appearance of mackerel fish by soaking in binahong leaf extract (day 8)**

Concentration of binahong leaf extract (%)	Median	Average
0	1	59b
55	6	27a
60	6	27a
65	5	37a

Note: Numbers followed by different letters on the average treatment indicate a significant difference according to the multiple comparison test at a significance level of 5%

**Table 3. Median value of mackerel meat by soaking in binahong leaf extract**

Concentration of binahong leaf extract (%)	Day of storage											
	1	2	3	4	5	6	7	8	9	10	11	12
0	8	7	6	6	5	3	3	1	-	-	-	-
55	8	8	8	7	7	6	6	5	5	5	3	3
60	9	8	8	8	7	6	6	6	6	5	5	3
65	9	8	8	7	7	7	6	6	5	5	3	3

Note: (-) : No change in appearance

**Table 4. Median and average values of mackerel meat by soaking in binahong leaf extract (day 8)**

Concentration of binahong leaf extract (%)	Median	Average
0	1	58.5b
55	5	38.5a
60	6	22.5a
65	6	30,5a

Note: Numbers followed by different letters on the average treatment indicate a significant difference according to the multiple comparison test at a significance level of 5%

**Table 5. Median value of mackerel scent by soaking in binahong leaf extract**

Concentration of binahong leaf extract (%)	Day of storage											
	1	2	3	4	5	6	7	8	9	10	11	12
0	8	7	6	5	3	3	3	1	-	-	-	-
55	8	8	8	7	6	6	6	3	3	3	1	1
60	9	8	8	7	7	6	5	5	3	3	3	1
65	8	8	7	7	6	5	5	3	3	3	1	1

Note: (-) : No change in appearance

According to [8] stated that the aroma that arises in fish is caused by damage to enzyme components and chemical activity in fish. The damage is caused by the activity and overhaul carried out by microbes.

The results of multiple comparison tests Table 6 on the 8th day showed the average value of the smell of fresh mackerel ranged from 22.5 to 56. The highest average value is found in the 0% concentration treatment, the results are significantly different from other treatments and has the lowest median value of 1, while the lowest average value is found in the 60% concentration treatment but has the highest median value of 5. The median value of 55% and 65% concentration treatment had the same value of 3.

### 3.4 Texture

Assessment of fish texture in organoleptic testing is one of the quality indicators to determine the level of fish freshness. The results of organoleptic observations of the texture of mackerel during low-temperature storage are presented in Table 7.

The organoleptic test results based on Table 7 showed that on the 1st day storage of fish texture with a concentration of 0% and 60% have the same median value that has a dense texture, compact and very elastic compared to 2 other samples. The change in the texture of the fish which becomes soft is thought to be due to the texture of the damaged muscles experiencing autolysis or the activity of enzymes that break down the structure of the fish meat.

This is in line with research [11] which states that changes in the texture of fish meat are influenced by increasing enzyme activity in the autolysis process, causing the texture of fish meat to become mushy.

The results of multiple comparison test Table 8. shows that on the 8th day the average value of the texture quality of fresh mackerel ranged from 23.5 to 59.5. The highest average value is found in 0% concentration treatment, while the lowest average value is found in 55% and 60% concentration treatment.

Based on the statistical test immersion treatment with a concentration of 0% significantly different from the other 3 treatments, namely 55%, 60% and 65%. The median value of fish texture treatment concentration of 55% and 65% showed the same acceptance limit is 5, while the median value at a concentration of 60% is 6. This shows that the concentration of binahong leaf boiled water 60% is the best concentration to maintain the texture of mackerel.

### 3.5 pH Value

The results of observations during the study showed that the use of boiled water from binahong leaves had an effect on the pH value of fresh mackerel. The pH value of mackerel with the use of boiled water from binahong leaves during low temperature storage is presented in Fig. 1.

**Table 6. Median value and average scent of mackerel by soaking in binahong leaf extract (day 8)**

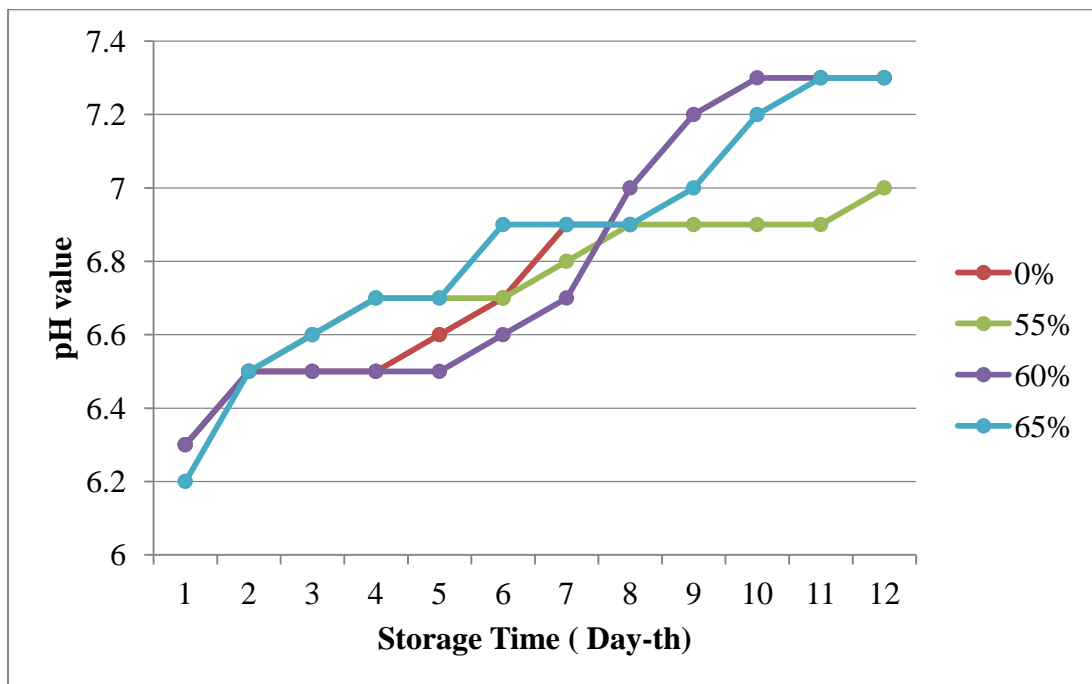
Concentration of binahong leaf extract (%)	Median	Average
0	1	56b
55	3	32.5a
60	5	22.5a
65	3	39ab

Note: Numbers followed by different letters on the average treatment indicate a significant difference according to the multiple comparison test at a significance level of 5%

**Table 7. Median value of mackerel texture by soaking in binahong leaf extract**

Concentration of binahong leaf extract (%)	Day of storage											
	1	2	3	4	5	6	7	8	9	10	11	12
0	9	8	7	6	5	3	1	1	-	-	-	-
55	8	8	7	7	6	6	6	5	5	3	3	3
60	9	8	8	7	7	7	6	6	5	5	3	3
65	8	8	7	7	6	6	5	5	5	3	3	1

Note: (-) = No change in appearance



**Fig. 1. Graph of pH value of mackerel with Binahong Leaf boiled water consumption during storage at low temperature**

**Table 8. Median value and average texture of mackerel fish by soaking in binahong leaf extract (day 8)**

Concentration of binahong leaf extract (%)	Median	Average
0	1	59,5b
55	5	32a
60	6	23,5a
65	5	35a

Note: Numbers followed by different letters on the average treatment indicate a significant difference according to the multiple comparison test at a significance level of 5%

Based on the results of testing the average pH value of fresh mackerel during storage at low temperatures obtained the average pH value on the 1st day to the 7th day ranged from 6.2 to 6.9. On the 9th day the pH value in mackerel at a concentration of 60% and 65% increased. The increase in the pH value lasted until the 12th day in mackerel with a concentration of 60% and 65%. This is due to the process of decomposing protein in fish meat by enzymes and bacteria which causes the formation of alkaline compounds such as ammonia.

According to [12] in [13] stated that the increase in pH value in fish meat indicates the activity of proteolytic enzymes found in fish meat tissue to form ammonia compounds that are alkaline. The higher the pH, the more ammonia is formed.

Based on the pH value of the fish obtained can be seen that the use of binahong leaf boiled water can extend the shelf life of fresh mackerel 4 days longer than mackerel without treatment. The longer the storage, the more alkaline pH produced due to the increasing activity of microorganism which ultimately leads to decay [14].

#### 4. CONCLUSION

Based on the results of the research carried out, it can be concluded that the treatment of soaking mackerel in boiled water of binahong leaves gives different results (55%, 60% and 65%) with immersing fish without treatment. The concentration of 60% gave the best concentration that is able to extend the shelf life of mackerel until the 11th day with a value of degree of acidity (pH) 7.3 and organoleptic assessment with the longest acceptance limit.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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