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# THE APPLICATION OF MORINGA LEAF EXTRACT AS A NATURAL PRESERVATIVE TOWARDS THE QUALITY DETERIORATION OF PATIN FISH FILET BASED ON ORGANOLEPTIC CHARACTERISTICS AT ROOM TEMPERATURE

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## ABSTRACT

*Pangasius filets are highly perishable or easily damaged; one of the reasons is that they contain a lot of water and amino acids. High water content causes spoilage in fish meat due to enzyme activity, biochemical changes, and the growth of microorganisms. Research on the addition of moringa leaf extract to the deterioration of pangasius filet quality aims to determine the best concentration of moringa leaf extract to the deterioration of pangasius filet quality as a natural preservative at room temperature (25-28$^o$C) based on organoleptic characteristics. The method used in this study was experimental with moringa leaf extract soaking treatment consisting of the control treatment (0%), 5%, 10%, and 15% (v/v) and 20 semi-trained panelists. Moringa leaf extract soaking for 30 minutes, then stored at room temperature (25-28$^o$C) for 14 hours. Observations of patin filets were made at the 0th, 2nd, 4th, 6th, 7th, 8th, 10th, 12th, and 14th hours. Parameters observed included scoring test measurement of organoleptic characteristics (appearance, aroma, and texture), acidity (pH), and weight loss. Analyzed Organoleptic data used by two-way non-parametric statistics, namely Friedman, and Chi-squared tests. Analyzed pH and weight loss data was used by descriptively based on observations during storage. Moringa leaf extract with a concentration of 10% is the best treatment based on observations of the quality of pangasius filets for 10 hours at room temperature with the average organoleptic data consists of; fish appearance is 7.9, odor 7.5, and texture 7, pH value is 6.5, weight loss is 4.3%.*

***Keywords*** *: Patin filet, Moringa leaf extract, organoleptic, quality of Pangasius filet.*



## INTRODUCTION

The global pangasius production in 2010 reached 1,749.4 tons, and by 2018, it had increased to 2,359.5 tons, marking a 4.3% growth in overall aquaculture production according to FAO (2020). Indonesia plays a significant role in this surge in global pangasius production. In 2015, Indonesia pangasius production reached 339,069 tons, increased to 437,110 tons in 2016, and continued to rise, with the national production target reaching 1,149,400 tons in 2019 (Ministry of Marine Affairs and Fisheries 2019 cited in Tahapari et al. 2020). According to FAO (2015), Indonesia's average annual growth in pangasius production is 44.46%. This indicates the promising potential of pangasius sales in the Indonesian market.

Pangasius is well-suited for fillet production due to its thick flesh and ease of skinning for fillet preparation (Zega et al. 2017). Fillets offer efficiency in processing, contributing to the improvement of the overall product quality. However, fillets are highly perishable and have a short shelf life (Zega et al. 2017). Fish fillets are classified as high perishable due to their high water and amino acid (Suryaningrum et al. 2010). The elevated water content leads to a decline in fish meat quality due to enzymatic activity, biochemical changes, and microbial growth (Ariyani et al. 2007). After the fish dies, enzymes within the fish become active, degrading the fish meat into simpler substances, and bacteria start producing sulfur-containing compounds, causing an unpleasant odor (Hultin 1991 cited in Ariyani et al. 2007). Efforts to inhibit the deterioration of fish meat quality can be achieved through preservation methods.

The preservation process for fish meat can be carried out through methods such as refrigeration, smoking, radiation, and the addition of food additives. Preservation using smoke and radiation faces constraints due to the relatively high costs, thus increasing operational expenses (Purwani and Muwakhidah 2008). Preservation using safe, natural ingredients represents an alternative method to inhibit the deterioration of fish quality by selecting substances containing antibacterial compounds (Tjahyaningsih et al. 2013). The use of natural ingredients as preservatives is still under ongoing research to discover suitable antibacterial compounds for fish (Jusnita 2018). The application of natural preservatives in pangasius fillets has been explored in various studies, including the use of chitosan (Suptijah et al. 2008), starfruit leaf extract (Insani et al. 2016), apu-apu extract (Zega et al. 2017), and purun tikus leaf extract (Baehaki et al. 2019). The use of natural ingredients as preservatives is still being investigated to identify antibacterial compounds suitable for fish (Jusnita 2018).

Moringa, also known as "kelor" in Indonesian, is one such natural ingredient containing antibacterial compounds such as saponins, triterpenoids, and tannins that work to damage bacterial cells. Moringa leaves also contain essential oils and flavonoids that can prevent lipid peroxidation (Utami and Puspaningtyas 2013). Moringa is readily available in tropical regions and is widely cultivated in the yards of local communities in Indonesia, making it a promising candidate for further research as a natural preservative (Silalahi 2020). Research on moringa leaf extract as a natural preservative has mostly been conducted on whole fresh fish, with limited studies on fish fillets. Testing moringa leaf extract aims to demonstrate the impact of its antibacterial compounds on the shelf life of fish fillets. Evaluation of fish fillets based on organoleptic characteristics can be conducted to understand the occurring changes and the extent of the influence of antibacterial compounds in moringa leaf extract (Nai et al. 2019). Therefore, research on the use of natural ingredients, especially moringa leaf extract, is needed to potentially inhibit the deterioration of pangasius fillet quality based on organoleptic characteristics at room temperature.

## MATERIALS AND METHODS

The research was conducted in November 2022, involving organoleptic tests, pH tests, and weight loss tests at the Laboratory of Fisheries Product Technology, Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran. Additionally, the preparation of moringa leaf extract was carried out at the Central Laboratory of Universitas Padjadjaran.



### Tools and Materials

The equipment utilized in this research includes a 1000-liter fiber tank, a 5-liter volume cool box, plastic bags, basin, aerator, knife, cutting board, sieve, sonde needle, Biobase RE-301 rotary evaporator, precision digital scale (accuracy: 0.01), , precision digital scale (accuracy: 0.1 grams), 500 ml measuring cup, Whatman 125 mm filter paper, 100-micron nylon filter cloth, plastic funnel, 12-liter plastic drum, 100 cm diameter wooden strainer, 30 ml glass bottles, styrofoam plates, plastic sieve, cling wrap, tissue, organoleptic assessment sheetsand and pH meter (accuracy: 0.1). The materials used in this research consist of 500 grams of dried moringa leaves, live pangasius (*Pangasius hypothalamus*), 5 liters of 96% ethanol, crushed ice, pH buffer, and distilled water (Aquades).

### Research Methods

The data collection method involves primary data obtained directly from the field, consisting of organoleptic parameters, weight loss, and pH. Secondary data is acquired from journal references, books, and relevant literature. The research methodology employed in this study is experimental, comprising 4 treatments with 20 semi-trained panelists serving as replicates for organoleptic parameters. Pangasius fillets used in each treatment weigh approximately ±350 g per fish, with a total of 30 fish. The soaking of pangasius fillets in moringa leaf extract is conducted for 30 minutes, followed by storage for 0, 2, 4, 6, 8, 10, 12, and 14 hours (Nai et al. 2019). Based on the study by Husni et al. (2015), the selected observation time for fillets is 14 hours. The treatments applied are as follows:

A: Pangasius fillets without moringa leaf extract soaking (control)
B: Pangasius fillets soaked in 5% moringa leaf extract
C: Pangasius fillets soaked in 10% moringa leaf extract
D: Pangasius fillets soaked in 15% moringa leaf extract

**Research Stages**

The research procedures for this study involve several stages. Firstly, the Moringa leaf extract is prepared in a two-step process. The initial step comprises creating the primary extract, followed by the second step of diluting the Moringa leaf extract based on predefined formulas of 5% (v/v), 10% (v/v), and 15% (v/v). The extraction process follows the methodology outlined by Pendit et al. (2015) with modifications. The subsequent phase involves diluting the initial Moringa leaf extract with distilled water until achieving concentrations of 5% (v/v), 10% (v/v), and 15% (v/v). The dilution formulas adhere to those provided by Insani et al. (2016). The third stage encompasses the transportation and acclimatization of the fish, followed by the fish euthanization process using a method derived from the research of Afrianto and Liviawaty (1999). Moving forward, the fish fillets are crafted using procedures developed according to Suparno et al. (2004). In the subsequent phase, the Moringa leaf extract is applied to the pangasius fillets, which are drained and then immersed in the extract for 30 minutes, following treatment conditions specified by Nai et al. (2019). The final stage involves observation, where the fillets, after being packaged, labeled, and stored at room temperature, undergo observation for 14 hours at intervals of 0, 2, 4, 6, 8, 10, 12, and 14 hours, at a room temperature range of 25-28°C (Nai et al. 2019).

**Observed Parameters**

The parameters observed in this study include organoleptic tests, pH testing, and weight loss tests. The organoleptic tests conducted involve scoring for appearance, aroma, and texture.

**Organoleptic Scoring Tests**

The method employed for organoleptic testing in this research is scoring, which involves evaluating the tested samples (Arbi 2009). A total of 20 panelists are engaged, with 4 treatments being assessed simultaneously at the same time for each treatment. The organoleptic assessment sheet follows the form based on SNI 8606:2018 (BSN 2018) with a numerical scale of 1, 3, 5, 7, and 9. Fresh fish is deemed of high quality in the scoring test when its organoleptic value falls within the range of 7-9. Conversely, it is considered of moderate quality if the organoleptic value is 5-6 and of lower quality if the value is 1-4 (Soekarto and Soewarno 1985). The quality acceptance threshold for fish is set at a value of 7 according to SNI 8606:2018. Parameters observed in the scoring test for fish fillets include appearance, aroma, and texture, in accordance with SNI 2346:2011 regarding organoleptic and/or sensory testing in fisheries products (BSN 2011).

**pH Tests**

The measurement of the pH value of pangasius fillets is determined based on homogenates using a pH meter in duplicate (Insani et al. 2016). According to the research by Astriani (2011), homogenates for testing are extracted from 10 grams of pangasius meat, which is crushed and then placed into a glass beaker containing 10 ml of distilled water. The mixture is stirred until homogenous. The homogenate is measured using a pH meter, and the pH acceptance limit is based on Junianto (2003), with the pH value for fresh fish ranging from 5.2 to 6.8.

**Weight Loss Tests**

Weight loss is measured by weighing the initial and final weights, accomplished by placing the fillet container (styrofoam plate) on the scale. Subsequently, the fillet is placed on the styrofoam plate to obtain the weight loss of the fillet. According to Liviawaty and Afrianto (2010), the calculation of weight loss is as follows:

$$\text{Weight Loss} = \frac{\text{Initial Weight} - \text{Final Weight}}{\text{Initial Weight}} \times 100\%$$

## Data Analysis

The observational data consists of scoring tests, physical weight loss tests, and pH observations. The data from the weight loss observations are analyzed descriptively based on the average percentage of weight loss in pangasius fillets during storage. The pH observation data is descriptively analyzed based on the observed pH values in the fillets during storage. The scoring test data is analyzed using two-way non-parametric statistics, namely the Friedman test and the Chi-square test. The Friedman test is conducted to determine the effect of soaking pangasius fillets in moringa leaf extract based on organoleptic characteristics. The statistical formula used in the Friedman test is as follows (Sudjana 2005):

$$x^2 = \frac{12}{bk(k+1)} \sum_{i-l}^{x} (Rj)^2 - 3b(k+1)$$

Explanation :

$x^2$ : Friedman test statistics
$k_i$ : Treatment
b : Deuteronomy
Rj : Total ranking of each treatment

If there are identical numbers, correction factors are calculated using the following formula:

$$FK = \frac{\sum T}{bk-(k^2-1)} \qquad H_c = \frac{x^2}{FK}$$

Explanation :

T : $N(t^2\text{-}t)$
T : The number of identical observations for one rank
N : Total number of identical observations for one rank with the same value t.

The significance value of the Hc observation can be determined using the critical Chi-square values table with db= k-1 ; α = 0.05. The decision rule for the hypothesis is:

H0 = The treatment does not make a significant difference at the α = 0.05 level

H1 = The treatment makes a significant difference at the α = 0.05 level

If the value of H0 < $\chi^2$ α (k-1), then accept H0 and reject H1, and if the value of H0 > $\chi^2$ α (k-1), then reject H0 and accept H1. If H1 is accepted, then the treatment makes a significant difference, and the testing continues to determine the different median values and to identify differences between treatments with multiple comparison tests, using the following formula (Sudjana 2005):

$$\left|\bar{R}_i - \bar{R}_j\right| \leq Z\{\alpha/k(K-1)\}\sqrt{bk(k+1)/6}$$

Explanation :

$\left|\bar{R}_i - \bar{R}_j\right|$ : Difference in the sum of rankings
α : Experiment error at 0.05
k : Number of treatments
$R_i$ : Sum of rankings for sample i
$R_j$ : Sum of rankings for sample j
b : Number of data
Z : Value on Z for multiple comparisons

# RESULT AND DISCUSSION

## Scoring Tests

### Appearance

Appearance is one of the important characteristics related to product quality. Consumers can assess the freshness of fillets based on the appearance they see (Nai et al. 2019). Appearance is evaluated by visually observing the appearance of fillet flesh, including color, shape, and luster (BSN 2011). The average appearance values from organoleptic observations of the appearance of pangasius fillets during storage are presented in Figure 1.

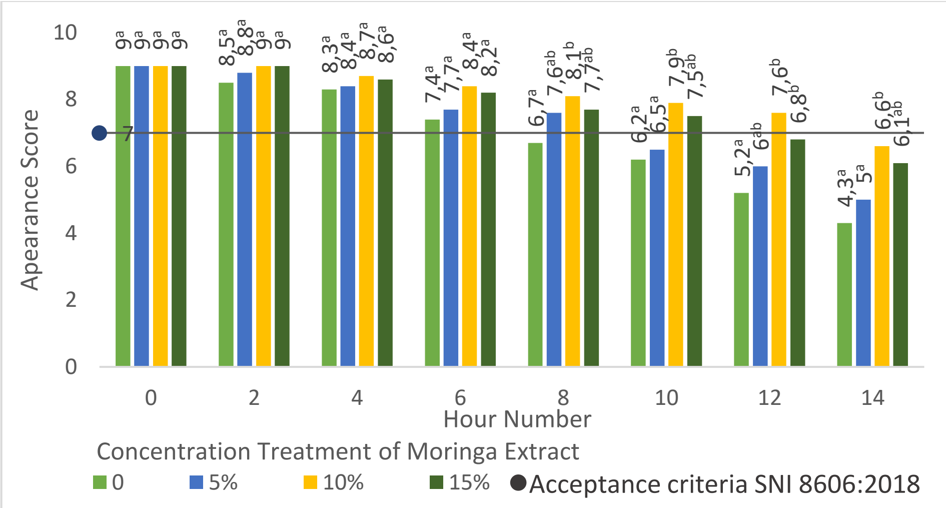


**Fig 1.** Graph of the Appearance of Pangasius Fillet with Moringa Leaf Extract Soaking Treatment

The organoleptic test results for the appearance characteristics, as depicted in Figure 1, indicate a decline in the average scores for the appearance of pangasius fillet across all treatments during storage. At time 0 hours, all treatments show an average score of 9, indicating that the fish fillet is still fresh in terms of appearance. According to SNI 8606:2018, a fillet with an appearance score of 9 has intact and neatly arranged flesh with a bright color and no slime. All treatments of pangasius fillet at time 0 have a fresh appearance because there is no bacterial growth, and the fish is still in the pre-rigor mortis phase. Referring to Figure 1, the scoring values fall below the threshold that can be maintained (SNI 8606:2018) for the control treatment at 8 hours, the 5% treatment at 10 hours, the 10% treatment at 14 hours, and the 15% treatment at 12 hours. According to Liviawaty and Afrianto (2014), fish is considered fresh as long as it is in the pre-rigor mortis to rigor mortis phase. Upon entering the post-rigor mortis phase, changes occur due to the activity of microbes and enzymes.



Fish fillet treated with the immersion of moringa leaf extract undergoes a color change from slightly yellowish to brownish since the initial immersion, attributed to the binding of the solution by the meat tissue. The color produced comes from moringa, which contains tannin compounds. According to Foo and Forter (1980), tannin crystals appear white-yellow to light brown when exposed to sunlight and turn dark brown when oxidized. The duration of storage affects the effectiveness of the antimicrobial properties contained in moringa leaves, resulting in the freshness of pangasius fillet at that time. In the scoring evaluation sheet, the assessment of the appearance of fillet treated with moringa leaves is distinguished from the control fillet assessment due to the color influence provided by moringa leaf extract. Referring to research conducted by Insani et al. (2016) on the extract of starfruit leaves, which contains active compounds and is applied to pangasius fillet, the fillet's color changes to yellow during application. Thus, the assessment of pangasius fillet treated with moringa leaf extract is valued between 9-7, indicating fresh yellow color with no or little slime, and between 6-1, indicating a change to brownish or dark brown color with thin slime. The average appearance score for the control treatment at 8 hours is 6.7, showing that the score is no longer within the acceptance limit according to SNI 8606:2018, which is 7, and continues to decline with the duration of storage. A score of 6 in organoleptic testing has characteristics of dull appearance, slightly shiny, and thin slime, indicating a decrease in quality for the control treatment at 8 hours according to Liviawaty and Afrianto (2014).

The appearance score for the treatment of soaking moringa leaf extract at 5% concentration at 10 hours is 6.5, indicating that the fish fillet has exceeded the acceptance limit according to SNI 8606:2018. The appearance of the fillet shows a color change to brownish, lacks brilliance, and has a small clumped brownish slime. The addition of moringa leaf extract containing tannins imparts a yellow-brown color to the fish fillet, becoming more intense with prolonged storage. Referring to Suptijah's research (2008), pangasius fillet stored at room temperature has a decrease in organoleptic values for meat, texture, odor, and slime at 10 hours due to environmental contamination and autolysis processes, followed by the activity of spoilage microbes with a quantity of 1.44 x 107 colonies/gram.

The average appearance score for pangasius fillets treated with 10% concentration of moringa leaf extract is higher up to 14 hours compared to other treatments, specifically 6.6. Based on the Friedman test, the calculated $X_2$ value ≥ the tabled $X_2$ value, indicates that pangasius fillets treated with a 10% concentration of moringa leaf extract at 8 hours show an influence of adding moringa leaf extract to the appearance of stored pangasius fillets at room temperature. The research results indicate that a 10% concentration of moringa leaf extract can maintain the brightness and color of pangasius fillets. The pangasius fillets with a 10% extract concentration at 14 hours show a dull color and a change to yellow-brown.

The average appearance score for pangasius fillets with a 15% concentration of moringa leaf extract shows a result of 6.8 at 12 hours, which is not acceptable according to SNI 8606:2018. It indicates that the pangasius fillets appear brownish, dull, and slightly slimy. Fillets with a 15% concentration experience a decrease in quality earlier than the 10% concentration. This suggests that the compounds present do not function well in the fillet due to the inhibition zone. The inhibition zone diameter usually increases proportionally with the increase in extract concentration. However, there is a decrease in the area of the inhibition zone at some higher concentrations, such as in gram-negative bacteria at 15%. In line with Elifah (2010), the diameter of the inhibition zone is not always directly proportional to the increase in antibacterial concentration due to variations in the diffusion rate of antibacterial compounds in the medium and different types and concentrations of antibacterial compounds. According to Ruchmana et al. (2017), the decrease in the effectiveness of the antimicrobial compound's inhibitory power is due to chemical changes in the active substances during storage, especially in polyphenolic compounds such as tannins and flavonoids that are damaged during the oxidation process.

## Aroma

The aroma parameters measured in the fillet include the characteristic fresh fish aroma, sour smell, and pungent rotten odor (BSN 2011). Organoleptic observations on the aroma of pangasius fillet during storage are presented in Figure 2.

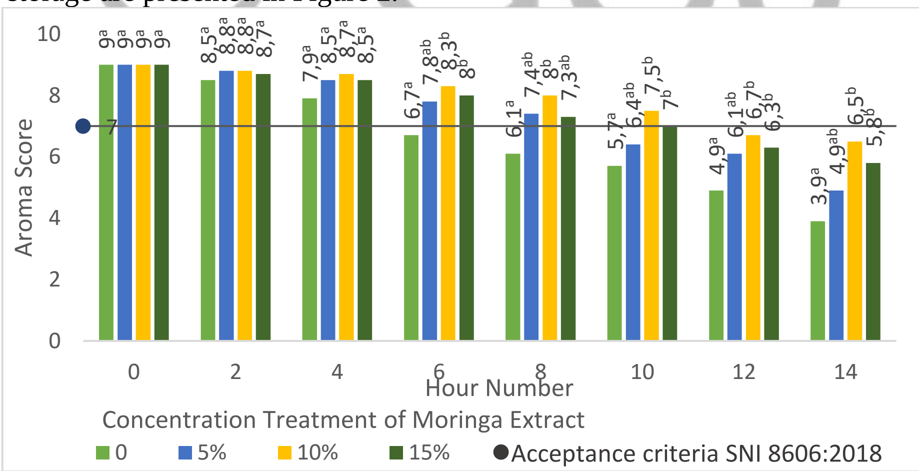


**Fig 2.** Graph of the Aroma of Pangasius Fillet with Moringa Leaf Extract Soaking Treatment

The results of organoleptic tests on aroma characteristics show that the average values of the aroma of pangasius fillet during storage continue to decrease for all treatments. At the beginning of the storage period, the aroma of pangasius fillet did not exhibit rancid, ammonia, or putrid smells because the compounds within the fish had not changed. Changes in aroma are caused by enzymatic, microbial, and chemical activities. Some compounds produced during bacterial decomposition include indole, $H_2S$, hypoxanthine, histamine, volatile reducing substances (VRS), total volatile base (TVB), and trimethylamine (TMA) or ammonia, which cause unpleasant odors (Hidayati et al. 2017). The average aroma value for the control treatment at 6 hours is 6.7, indicating that it is already beyond the acceptable limit according to SNI 8606:2018, which is set at a scale of 7. According to SNI

8606:2018, an aroma perceived at a scale of 6 indicates less freshness, slightly fishy, and has a slightly sour aroma in pangasius fillet.

The lowest aroma score is found in the control treatment at 14 hours, amounting to 3.9. This score indicates that the pangasius fillet has developed a sour, putrid, and unpleasant smell. The odor emanating from the fish is caused by the breakdown of enzymatic components and chemical activities in the fish. This degradation is a result of bacterial activities and decomposition (Nai et al. 2019). Pangasius fillet without moringa leaf extract treatment more quickly produces a putrid smell due to the absence of antimicrobial compounds that can inhibit the growth of spoilage bacteria. The addition of moringa leaf extract to the fish fillet affects the aroma of pangasius because moringa has its own distinctive smell. The essential oil content in moringa, which belongs to the group of volatile compounds, imparts a unique aroma to moringa leaves. According to Dewi et al. (2013), the essential oil content in moringa leaves is antimicrobial and volatile. Treatments with concentrations of 5%, 10%, and 15% produce fish fillets with a distinct moringa aroma during storage. According to Nai et al. (2019), the aroma of moringa leaves will become more intense with prolonged storage. The assessment of aroma characteristics focuses on the sour or putrid smell produced by the fish fillet and the intensifying moringa scent. The addition of moringa leaves to the fillet imparts the characteristic aroma of moringa, thus affecting the acceptance by the panelists.

The acceptance limit for aroma characteristics according to SNI 8606:2018 is on a scale of 7. The concentration of 5% at 10 hours is already below the acceptance scale with an average score of 6.4, while concentrations of 10% and 15% at 12 hours with average aroma scores of 6.7 and 6.3, respectively, also indicate that concentrations of 10% and 15% are unable to maintain the quality of the aroma or the scores fall below the acceptance limit according to SNI. Based on the results, the addition of moringa leaf extract affects the quality of pangasius fillet during storage. Based on the F-test results at a 5% significance level, an $X_2$ value of 14.51, an $H_c$ value of 14.5157, and an $X_2$ table value of 7.81473, where Fvalue > Ftable, the null hypothesis (H0) is rejected, and the alternative hypothesis (H1) is accepted. This indicates a significant difference in treatments, showing that the addition of moringa leaf extract has a significant effect starting from 6 hours. The addition of moringa leaf extract with a concentration of 10% is considered the best treatment for aroma parameters, as it has the highest aroma score up to 10 hours of storage, which is 7.5."



**Texture**

The texture parameters measured for the fillet include the level of tenderness and compactness of the fillet meat (BSN 2018). The assessment of organoleptic tests is matched with the pangasius fillet score sheet in Annex 2. The results of organoleptic observations on the texture of pangasius fillets are presented in Figure 3.

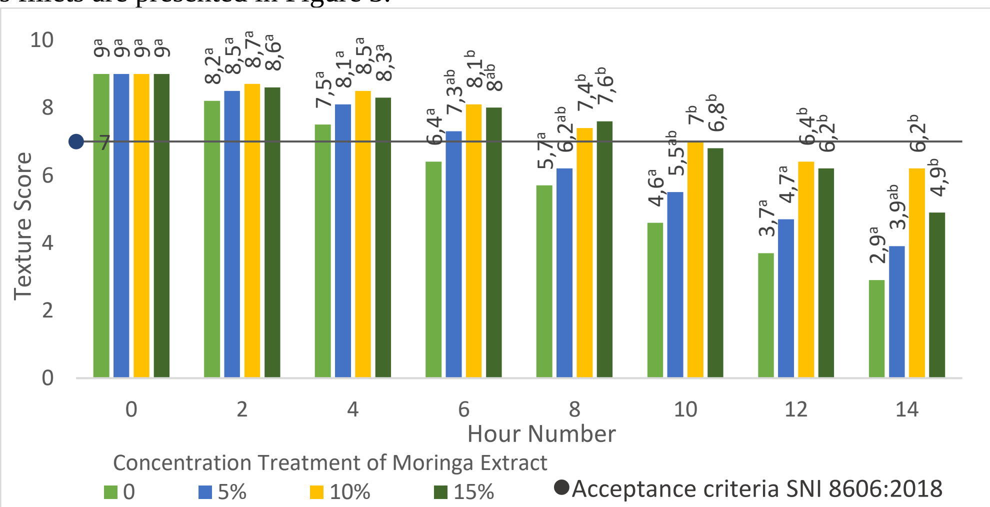


**Fig 3.** Graph of the Texture of Pangasius Fillet with Moringa Leaf Extract Soaking Treatment

The organoleptic test results for texture characteristics based on Figure 3 show that the average values at the beginning of the storage period for all treatments indicate the highest value at 9.

A value of 9, indicates that the fillet texture is still firm and compact (BSN 2018). According to Liviawaty and Afrianto (2014), fish that have just died enter the pre-rigor mortis phase, where the texture of the meat is still similar to live fish, resilient, elastic, and flexible. The lowest texture value at hour 14 is found in the control treatment, which is 2.9. The control treatment experiences the fastest decline compared to other treatments, consistent with the research by Nai et al (2019), which shows a decrease from 7.9 to 6.9 after 12 hours of storage and further decrease to 4.4 at hour 15. Based on this research, protein denaturation by enzymes and microbes causes a change in the meat structure, weakening the ability to bind water, and making the meat tender. According to Liviawaty and Afrianto (2014), the decrease in texture quality of pangasius fillet over the storage period is due to the breakdown of carbohydrate and protein compounds by enzymes and the continuous growth of bacteria, leading to degradation of the binding tissue.

The 10% concentration treatment can maintain the texture quality of pangasius fillets until hour 10, according to the acceptance limit set by SNI 8606:2018 at scale 7. The 5% treatment can only maintain the quality of the fillet until hour 6, the 15% treatment until hour 8, and the control treatment until hour 4. This indicates that the 10% treatment is the best concentration, and the antibacterial compounds in the moringa leaf extract play a role in inhibiting microbial activity in pangasius fillets, leading to changes in the fillet texture (Nai et al. 2019). Soeparno (2004) stated that there is a change in water-binding capacity in muscle after the fish dies. This change in water-binding capacity is related to the ability of muscle protein to bind water, and the ability of muscle protein is influenced by the pH value and the amount of ATP in muscle tissue. Meat with a high pH well above the isoelectric pH of actomyosin, the protein will bind more water, and as a result, the meat appears dry. Based on the results of the Friedman test at a 5% significance level, the $X_2$ value is 14.12, and $H_c$ is 14.1251, larger than the $X_2$ Table value of 7.81473, or Fvalue > Ftable. Therefore, H0 is rejected, and H1 is accepted, indicating that the treatment has a significant difference, showing that the addition of moringa leaf extract has an effect starting from hour 6 on the texture of pangasius fillets.

**Acidity Level pH**

Observation of acidity level (pH) values was conducted to determine the pH changes in fillets treated with moringa extract during room temperature storage (25-28°C). Table 1 presents the observed average pH values for pangasius fillets.

**Table 1.** Average pH Values of Pangasius Fillet with Moringa Leaf Extract Treatment

| Concentration % | pH (Hour-) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 |
| 0 | 6.4 | 6.3 | 6.2 | 6.4 | 6.5 | 6.7 | *6.9 | *7.1 |
| 5 | 6.5 | 6.3 | 6.2 | 6.4 | 6.6 | 6.6 | 6.8 | *6.9 |
| 10 | 6.6 | 6.5 | 6.4 | 6.4 | 6.5 | 6.5 | 6.6 | 6.7 |
| 15 | 6.6 | 6.4 | 6.3 | 6.4 | 6.5 | 6.6 | 6.7 | 6.8 |

Explanation: *The acceptance limit values are based on Junianto (2003) (ranging between 5.2 – 6.8)

Based on Table 1, the pH of the patin fillet decreases at the beginning of the storage period. This is a characteristic of chemical changes in the fish fillet, consistent with the statement by Chandra et al. (2020) that the initial decrease in pH is due to the transition from aerobic to anaerobic metabolism, resulting in the production of lactic acid from glycogen hydrolysis to produce ATP energy, leading to an accumulation of lactic acid and a decrease in pH.

The pH values for the control group show an increase from hour 4 to hour 10, from 6.2 to 6.7, indicating freshness. The pH value for the control group at hour 12 is 6.9, which means it is no longer considered fresh according to Junianto (2003). The control group exhibits the highest average pH value, reaching 7.1 at hour 14, compared to other treatments. According to Nurjanah et al. (2004), the increase in pH is caused by autolysis in fish meat, leading to the breakdown of enzymes into simpler compounds. Kasmadihardja (2008) states that pH is closely related to bacterial growth; the lower the pH, the lower the bacterial growth rate. The control group, not treated with moringa leaf extract containing antibacterial compounds, experiences a faster deterioration of fillet quality compared to the treatment with moringa leaf extract (Pandey et al. 2012).

According to Table 1, antibacterial compounds in moringa leaves, such as flavonoids, saponins, and tannins, effectively act as antimicrobials. This is evident from the pH test results, indicating that fillet treated with moringa leaf extract puts pressure on the pH increase in fillet as the concentration increases up to hour 14. The average pH values for all treatments increase, although they remain close to neutral pH. According to Santoso et al. (2017), bacterial and enzyme activity in fillet meat leads to an increase in pH due to the formation of ammonia. pH values in fish will increase starting from the late stage of the rigor mortis phase.

The average pH value for the fillet at 5% concentration at hour 14 is 6.9, which means it is no longer considered fresh according to Junianto (2003). Treatments at 10% and 15% show average pH values for the fillet until hour 14 that still fall within the fresh category, with values of 6.7 at 10% concentration and 6.8 at 15% concentration. The average pH value for the fillet at 15% concentration at hour 14 is at the acceptance threshold. The observation above for the treatment of moringa leaf extract concentration at 10% with the best pH value as it can maintain the pH value until hour 14 with an average pH value of 6.7. This is in line with Astriani's statement (2011) that fillet with the lowest decrease in pH and the longest time to return to normal has the best treatment.

**Weight Loss**

Weight loss is the decrease in weight that occurs after the storage process. Weight loss is generally caused by the loss of water content in fish meat during the storage process (Zega et al., 2017).

**Table 2.** Weight Loss Values of Fillet with Moringa Leaf Extract at Room Temperature

| Concentration % | Weight Loss (%) Hour- | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 |
| 0 | 0 | 1.4 | 1.4 | 2.7 | 4.1 | 6.9 | 11 | 15 |
| 5 | 0 | 4.5 | 4.5 | 4.5 | 5.7 | 6.3 | 8 | 9.1 |
| 10 | 0 | 1.4 | 1.4 | 1.4 | 2.8 | 4.3 | 5.7 | 7.2 |
| 15 | 0 | 4.4 | 6.6 | 6.6 | 6.6 | 7.7 | 8.8 | 10 |

The results of weight loss in Table 2 show that the percentage of weight loss in pangasius fillets during room temperature storage in the control treatment at hour 14 is the highest compared to other treatments, reaching 15%. The weight loss occurring in fish meat is due to denaturation and autolysis processes. Autolysis is a process that involves enzymes breaking down proteins in fish meat. The percentage of weight loss at hour 2 in all treatments shows a significant increase and decreases again at hour 4, with some treatments showing no weight loss at all. This is consistent with the statement by Naiu et al. (2018) that fish fillets in the pre-rigor mortis phase experience the highest weight loss compared to when the fillets are in the rigor mortis phase. This is because the fillets are in a wrinkled state during the pre-rigor phase. Weight loss at hour 6 begins to increase and continues until hour 14, indicating that the fillets undergo autolysis during the post-rigor mortis phase (Husni et al., 2015).

Based on Table 2, the observation of weight loss in pangasius fillets in all treatments with moringa leaf extract shows a pattern of lower increase compared to the control treatment. According to Antoniewski et al. (2007), this occurs because of the presence of active compounds in moringa leaves that function to increase surface tension in fillets, thereby inhibiting water release from fish meat. The tannin content in moringa leaves can form a stable complex, thus inhibiting the action of enzymes that can damage fish meat proteins (Trisnadewi et al., 2014).

**Tabulation of Research Results**

The organoleptic characteristics of fillets without immersion show the lowest values compared to fillets treated with moringa leaf extract (5%, 10%, 15%), demonstrating higher results (Table 3). The highest average value is at a concentration of 10% with parameter values for appearance, aroma, and texture being 7.9, 7.5, and 7, respectively. This aligns with the study by Toripah et al. (2014) on moringa leaf extract, which has been proven to contain phenolic compounds that play a role in preventing oxidation events, thereby maintaining the quality of pangasius fillets.

**Table 3.** Tabulation of Research Results

| No. | Pengamatan | Moringa Leaf Extract | | | |
|---|---|---|---|---|---|
| | | 0% | 5% | 10% | 15% |
| 1. | Characteristic organoleptic (Hour number-10) | | | | |
| | -Apearance | *6.2 | *6.5 | 7.9 | 7.5 |
| | -Aroma | *5.7 | *6.4 | 7.5 | 7 |
| | -Texture | *4.6 | *5.5 | 7 | *6.8 |
| 2. | pH (Hour number -10) | 6.7 | 6.6 | 6.5 | 6.6 |
| 3. | Weight Loss (Hour number -10) | 6.9% | 6.3% | 4.3% | 7.7% |

Explanation: * = Acceptance limit based on SNI 8606:2018

Observations of pH values in pangasius fillets show results that are not significantly different between treatments with moringa leaf extract soaking (5%, 10%, and 15%). The best pH value, 6.5 at the 10th hour, is found in fillets soaked in a 10% solution. The control group of pangasius fillets has the lowest pH value, 6.7 at the 10th hour. This is in line with Nai's (2019) research on moringa leaf extract's ability to maintain fish pH at room temperature. Observation results for the weight loss parameter at a concentration of 10% show the lowest percentage compared to other treatments, at 4.3%. According to Warkoyo et al. (2014), changes in weight loss are influenced by the concentration of active ingredients contained in moringa leaves. Active ingredients in moringa leaf extract, such as tannins, increase surface tension, thereby inhibiting water loss from fish meat. The 15% treatment has the highest percentage of weight loss, 7.7%, caused by protein denaturation in fish meat, leading to a loss of its ability to retain fluids. Fish undergoing weight loss are characterized by softened meat texture (Naiu et al. 2018). The determination of the best treatment in maintaining the quality of pangasius fillets in this study is based on considerations of all observed parameters, including organoleptic properties, pH, and weight loss. The research results indicate that the best quality pangasius fillets are those soaked in moringa leaf extract with a concentration of 10%.

## CONCLUSION

Formulation of the best concentration of moringa leaf extract as a natural preservative to maintain the quality of pangasius fillets based on organoleptic characteristics at room temperature involves soaking the fillets in a 10% concentration of moringa leaf extract. The addition of moringa leaf extract at a 10% concentration proves to be the optimal treatment for preserving the quality of pangasius fillets over a 14-hour storage period at room temperature. This treatment aligns with the organoleptic standards outlined in SNI 8606:2018, achieving average scores of 7.9 for appearance, 7.5 for aroma, and 7 for texture. The pH value remains at 6.5 by the 10th hour, and the average weight loss is 4.3%.

## REFERENCES

Antoniewski, M. N., 2007, *Effect of a Gelatin Coating on The Shelf Life of Fres Meat*, The Ohio State of Univ, Columbus, USA.

Arbi, A. S. 2009. *Introduction to Sensory Evaluation*. In Praktikum Evaluasi Sensori. Universitas Terbuka, Jakarta.

Ariyani, F., Trimurtini, J., Indriati, N., Dwiyitno, and Yusma Y. 2007. Use of Glyroxyl to Inhibit the Decrease in Quality of Fresh Carp (*Cyprinus carpio*). *Jurnal Perikanan* (1): 125–133.

Astriani. 2011. Use of Cinnamon Solution on Red Tilapia Filets at Low Temperature Storage Based on Organoleptic Characteristics. *Thesis*. Universitas Padjadjaran.

Baehaki, A, Herpandi and Rosalina. 2019. Sensory Characteristics of Patin Fish Fillet (*Pangasius* sp.) with the Addition of Purun Tikus Extract (*Eleocharis dulcis*). *Jurnal FishtecH*. 8(1): 12-17

Chandra, A.B., Abdus S. J., Nur D. K., Masrifatul, A., Zainuria, M. 2020. Characteristics of Tilapia (*Oreochromis Niloticus*) and Catfish (*Clarias* Sp.) in the Rigor Mortis Phase. *Journal of Fisheries and Marine Research*. 4(3):375-378

Dewi, F., Suliasih, N., and Garnida, Y. 2013. Making Cookies by Adding Moringa Leaf Flour (*Moringa oleifera*) at Various Baking Temperatures.*Thesis*. Universitas Pasundan.

Elifah, E. (2010). Antibacterial Test of Active Fraction of Methanol Extract of Senggani Leaves (*Melastoma candidum*, D.Don) against *Escherichia coli* and *Bacillus subtillis* and Thin Layer Chromatography Profile. *Thesis*. Biology, Faculty of Mathematics and Natural Sciences, Universitas Sebelas Maret.

Foo, L. Y., and Porter, L. J., 1980. The Phytochemistry of Proanthocyanidin Polimer. J *Phytochemistry* 19:1747.

Hidayati, F., Darmanto, Y. S, and Romadhon. 2017. Effect of different proportions of Sargassum polycystum extract and storage time on fat oxidation in catfish fillets (*Pangasius polycystum*). *Jurnal Ilmu Lingkungan*. 15(1): 64-73.

Husni, A., Brata, A. K., and Budhiyanti, S. A. (2015). Increasing the shelf life of mackerel with ethanolic extract of *Padina* sp. During Room Temperature Storage. *Jurnal Pengolahan Hasil Perikanan Indonesia*, 18(1).

Insani, M., Liviawaty, E., and Rostini, I. 2016. Use of Starfruit Leaf Extract on the Shelf Life of Patin Filet Based on Organoleptic Characteristics. *Jurnal Perikanan Dan Kelautan Unpad 7* (2): 14–21.

Jaelani, A., S. Dharmawati and Wanda. 2014. Various Storage Times for Fresh Broiler Chicken Meat in Plastic Packaging in the Refrigerator (Temperature 4ºC) and Their Effect on Physical and Organoleptic Properties. *Ziraa'ah.* 39 (3) : 119-128.

Junianto, 2003. *Fish Handling Techniques*. PT. Penebar Swadaya, Jakarta. Jakarta.

Jusnita, N. 2018. Natural Fish Preservation. *Jurnal Berdikari* 1 (1): 6–13.

Kasmadiharja, H. 2008. Study on Storage of Sausages, Chicken Naget and Seasoned Chicken Meat in Rigid Polypropylene Packaging. *Thesis.* Faculty of Agricultural Technology. Institut Pertanian Bogor. Bogor.

Liviawaty, E., and Afrianto, E. 2010. *Handling Fresh Fish*.Widya Padjadjaran. Bandung.

Liviawaty, E., Afrianto, E., and Hamdani, H. 1999. Studying the Effect of Post Mortem Conditions of Red Tilapia (*Oreochromis niloticus*) on Changes in Fillet Characteristics During Storage at Low Temperatures. *Jurnal Lembaga Penelitian Universitas Padjadjaran*. Universitas Padjadjaran, Bandung.

Liviawaty, E., and Afrianto, E. 2014. Determining the Time of Rigor Mortis of Red Tilapia (*Oreochromis Niloticus*) Based on the Pattern of Changes in Acidity Degree. *Jurnal Akuatika Indonesia* 5 (1): 244.

Nai, Y., Naiu, A., and Yusuf, N. 2019. Analysis of the Quality of Fresh Flying Fish (*Decapterus* sp.) During Storage Using Moringa Leaf Extract Solution (*Moringa Oleifera*) as a Natural Preservative. *Jambura Fish Processing Journal* 1 (2): 21–34.

Naiu, A., Koniyo, Y., Nursinar, S., and Kasim, F. 2018. *Handling and Processing of Fishery Products*. Athra Samudra, Jakarta.

National Standardization Agency (BSN). 2011. *Organoleptic and/or Sensory Testing Methods for Fishery Products.* SNI 2346:2011. Jakarta.

National Standardization Agency (BSN). 2018. *Frozen Pangasius Fillets* (*Pangasius* sp.). SNI 8606:201, Jakarta.

Pandey, A., Pandey, R., Tripathi, P., Gupta, P., Halder, J., Bhatt, S., and Singh, A. 2012. *Moringa oleifera* - a Plant With a Plethora of Diverse Therapeutic Benefits: an Updated Retrospection. *Medicinal & Aromatic Plants*. 1 (01): 1–8.

Pendit, P., Zubaidah, E., and Sriherfyna, F. 2015. Physical-Chemical Characteristics and Antibacterial Activity of Starfruit Leaf Extract (*Averhoa bilimbi*). *Jurnal Pangan Dan Agroindustri* 4 (1): 400–409.

Purwani, E., and Muwakhidah. 2008. The Effect of Various Natural Preservatives as a Substitute for Formalin on the Organoleptic Properties of the Shelf Life of Meat and Fish. *Jurnal Penelitian Sains & Teknologi*. 9 (1): 1–14.

Santoso, M., Liviawaty, E., and Afrianto, E. 2017. Effectiveness of Mango Leaf Extract as a Natural Preservative on the Shelf Life of Tilapia Filets at Low Temperatures. *Jurnal Perikanan dan Kelautan* 8 (2): 57–67.

Ruchmana, A. S. I. 2017. Effect of Storage Time for Oral Nutraceutical Solution of Red Pomegranate Flower Extract (*Punica granatum* L.) 72 on Changes in Growth Inhibition of Bacillus subtilis (In Vitro). *Thesis.* Universitas Muhammadiyah Surakarta. Surakarta

Setyaningsih, D., Apriyantono, A., and Puspita Sari, M. 2010. *Sensory Analysis for the Food and Agro Industry*. IPB Press, Bogor.

Silalahi, M. 2020. Utilization of Moringa Leaves (*Moringa oleifera*) as a Traditional Medicine and Food Ingredient. *Majalah Sainstekers* 7 (2): 107–116.

Soekarto, and Soewarno. 1985. *Organoleptic Assessment: For the Food and Agricultural Products Industry*. Bhratara Karya Aksara, Jakarta.

Soeparno . 2004. *Meat Science and Technology*. Gadjah Mada University Press Yogyakarta.

Sudjana. 2005. *Statistic methods*. Tarsito, Bandung.

Suptijah, P., Gushagia, Y., and Sukarsa, D. 2008. Study of the Inhibitory Effect of Chitosan on the Deterioration of the Quality of Catfish (*Pangasius hypopthalmus*) Fillets at Room Temperature Storage. *Buletin Teknologi Hasil Perikanan* 11: 89–101.

Suryaningrum, T., Muljanah, I., and Tahapari, E. 2010. Sensory Profile and Nutritional Value of Several Types of Fish. *Jurnal Pascapanen Bioteknologi Kelautan dan Perikanan* 5: 153–164.

Tahapari, E., Darmawan, J., and Suharyanto, S. 2020. Performance of Perkasa Pangasiid (*Pangasianodon hypophthalmus*) from Family Selection Results. *IJOTA* (*Indonesian Journal of Tropical Aquatic*). 3 (1).

Tjahyaningsih, W., Alamsjah, M., and Abdillah, A. 2013. Potential for Utilizing Ethanol Extract of Red Algae (*Kappaphycus alvarezii*) as a Natural Preservative Substitute for Formalin in Fish Meat. *Jurnal Ilmiah Perikanan dan Kelautan* 5 (2): 123–127.

Toripah, S., Abidjulu, J., and Wehantouw, F. 2014. Antioxidant Activity and Total Phenolic Content of Moringa Leaf Extract (*Moringa oleifera*). *Jurnal Ilmiah Farmasi 3* (4): 37–43.

Trisnadewi, A., Cakra, I., and Wirawan, I. 2014. Substitution of Gamal (*Gliricidiasepium*) with Calliandra (*Calliandra calothyrsus*) in rations on in-vitro digestibility. *Pastura*. 3 (2): 106-109.

Utami, P., and Puspaningtyas, D. 2013. *The Miracle of Herbs*. Jakarta Agromedia Pustaka. 8 (1).

Warkoyo, and Zuhriansyah, N. 2014. Increased Shelf Life of Fish Fillets With Edible Coating Incorporated with Ovocleidin-17 Crude Extract. *Jurnal Perikanan Universitas Gadjah Mada*. 16 (2): 59–65.

Zega, O., Baehaki, A., and Herpandi. 2017. Effect of Apu-apu Extract on the Shelf Life of Patin Fish Fillets Stored at Cold Temperatures. *Jurnal Teknologi Hasil Perikanan* 6 (1): 69–79.