THE USE OF GARLIC EXTRACT TO CARP FISH FOR PREVENTING DEGRADATION, INVESTIGATION OF ORGANOLEPTIC AND PH TESTS DURING COLD STORAGE OF THE PRODUCT

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ABSTRACT

This research aims to find out how long carp can be left at low temperatures at 5^{o} - 10^{o} C with the addition of the natural preservative garlic based on organoleptic tests and pH tests. Garlic contains allicin which functions to kill gram-positive and negative bacteria.Garlic is also a natural preservative that has antimicrobial properties. Fish were examined on days 0, 3, 7, 9, 10. The concentrations of garlic solution used were 15%, 20%, and 25%. The suitability level of carp is determined based on Indonesian National Standard 2729:2013. The limit for suitability for consumption of fresh fish is 5. Based on research results at a concentration of 15% carp can still be declared fit until the 3rd day because after the 3rd day there begins to be a decline in terms of the organoleptic value of the eyes, flesh, smell and texture. At a concentration of 20% carp can still be declared fit until the 7th day because the organoleptic value of the eyes, flesh, smell and texture begins to decline to unfit levels. And at a concentration of 25% carp can still be declared viable until day 9. The pH obtained on day 3 at concentrations of 15%, 20%, and 25% is 6.1, 5.8, and 5.8 respectively. On day 7, the pH values at concentrations of 15%, 20%, and 25% were 6.1, 6.3, and 6.0, respectively. So the concentration that is still safe when viewed from the pH value limit is a concentration of 25% with a pH value of 6.0.

Keywords: Carp; Organoleptic; pH;Fish preservation; Garlic extract

1. INTRODUCTION

Fish is an aquatic commodity that easily experiences quality degradation. The decline in quality in fish is caused by the activity of enzymes, bacteria and chemical processes [21].Enzyme and bacterial activity can break down the components that make up fish body tissue, resulting in physical changes such as soft fish flesh and chemical changes that produce volatile and foul-smelling compounds [14].The decline in quality experienced by fish can be clearly seen physically. Fish will have an unattractive odor, texture, color, slime and appearance. Fish is also a source of animal protein which is easily damaged by bacteria, yeast and fungi [31].Mold can grow at water levels greater than 22% [13]. Putrefactive bacteria can grow when the water content is at 80% or more and at a pH that is close to neutral [20]. In fish, high water content is a medium that can make spoilage bacteria grow well [8]. The water content in fish is generally high, reaching 56.79%, making it very possible for biochemical reactions to occur by enzymes that take place in the body of fresh fish [4]. In

carp, the water content in them is around 79.65% [27]. The highest water content in carp is 81.57%, while the lowest is 79.75% [13].
The market value for fishery products is determined by the degree of freshness and durability. Therefore, one way to overcome this is by preserving it. There are various ways to preserve fish, including: salting, drying, drying, smoking, fermenting and cooling the fish [11].The usual way of preserving is by storing fishery products at low temperatures. By storing at low temperatures, it can inhibit the growth of putrefactive bacteria because most bacteria cannot live at temperatures of 5^{o} - 10^{o} C [4]. Storage at low temperatures is also an effort to inhibit microbial or enzyme activity by storing it in a refrigerator (refrigerator) or freezer [31].Storage at low temperatures is intended to inhibit the growth of spoilage bacteria, therefore fish that will be stored at low temperatures must be cleaned first to reduce microorganisms that may be present in the fish. The cleaning process is known as weeding, namely removing the gills and internal parts of the fish because they are the main source of spoilage microbes in fish storage [6].
When preserving fish, natural preservatives can be added to make the fish store longer. Natural preservatives are used because they are considered not to cause toxins in the body and are considered safer [18]. Examples of natural preservatives are garlic [8], clove oil [17], carrots [31], and so on. According to research [15] which states that garlic extract dissolved in water is antibacterial against gram-positive and gram-negative bacteria. According to research [31], adding garlic and carrot extracts for 7 days resulted in water content < 60%, ash content < 2% and the amount of microbial contamination < 5.0 x 104 colonies/gram.This is in accordance with the Indonesian National Standard which is a reference for research in terms of assessing and testing a product [20].
Garlic contains allicin which functions to kill gram-positive and negative bacteria [31]. Garlic is also a natural preservative that has antimicrobial properties. According to [7], the benefit of garlic is that it reduces the number of aerobic bacteria and other microorganisms with the resulting benefit being that food lasts longer. Garlic can ensure food safety without having a negative impact on the nutritional quality of food products [19].
Based on research [8], the use of garlic extract in African catfish has a significant effect on organoleptic values, texture, smell and eyes. And the concentration that gives good results is a concentration of 20% with a storage time of 6 days. Meanwhile, storage of 0%, 10% and 15% did not provide any real difference because the concentration of garlic given was different, the higher the concentration of garlic given, the better the organoleptic value.
Based on the description above, the problem that can be formulated is what is the effect of the application of garlic as a preservative for carp at low temperature storage at 5^{o} - 10^{o} C based on organoleptic tests and fish pH tests. The degree of acidity or pH is an indicator to determine the degree or level of acidity or validity of fresh meat or meat products produced [32]. Glycogen in meat undergoes a glycolysis process which will produce lactic acid, causing a decrease in the pH of the meat, besides that the rate of glycolysis is influenced by the phosphorylase enzyme [26]. The phosphorylase enzyme is an enzyme that adds phosphate groups to organic molecules [30]. The freshness of fish can also be determined by measuring the pH of fish flesh because the production of lactic acid from the anaerobic glycolysis process after the fish dies will determine changes in pH in fish flesh [23].

2. MATERIAL AND METHODS

This research was conducted in October 2023 at the Fisheries Products Technology Laboratory, Faculty of Fisheries and Marine Affairs, Padjadjaran University. The aim of this research was to determine the effectiveness of garlic concentration on the organoleptic quality of carp (Cyprinuscarpio).

In this research, the materials used were carp (Cyprinuscarpio) weighing 210-250 grams per fish, 1.5 kilograms, and 1.2 kilograms of garlic obtained from the Cileunyi market, and 8 liters

of distilled water. The tools used are styrofoam, plastic wrap, plastic containers, knives, choppers, scales, labels, and refrigerators.

The method used for organoleptic testing of hedonic quality is by using the fresh fish scoring test, Indonesian National Standard 2729:2013. The results obtained from the organoleptic assessment of hedonic quality were then analyzed, then the freshness level of the carp was determined according to the criteria of the Indonesian National Standard 2729:2013 [20].

2.1 Fish Preservation Procedures

2.1.1 Making Garlic Extract

Garlic extract was made based on the method used by Putro at al. (2008). In this study, 4 treatments of garlic extract concentration were used based on modified research carried out by [8], namely 15, 20, and 25%. To obtain garlic extract with a concentration of 15%, 150 g of garlic has been crushed, blended and dissolved in 1 liter of distilled water. Leave the garlic solution for 25 minutes, then filter to separate the dregs.

2.1.2Fish Preparation, Soaking Treatment, and Storage

The carp used in the research were brought to the laboratory in an insulated box (cool box) and kept fresh with ice. The fish is then weeded and washed clean Soak the fish in garlic extract for 15 minutes. The concentration of garlic extract solution used is 15%; 20 % ; 25 %. Use 1 liter of distilled water so that the entire surface of the fish is submerged. After soaking, the fish is then drained, placed in a styrofoam container, then covered with cling wrap and stored in the refrigerator at a temperature of 5°C - 10°C. Observations were made on days 0, 3, 7, 9, and 10.
The parameters observed include pH and organoleptic. The pH value is measured simply using a digital pH meter. A sample of carp meat was weighed as much as 15 g and then crushed until smooth. The finely ground sample was put into a test tube containing 10 ml of distilled water, shaken until homogeneous. The homogenate was then measured with a digital pH meter which had previously been calibrated at pH 7 and 4 with standard buffer.
The method used for organoleptic testing of hedonic quality is a scoring test, which uses a number scale ranging from 1 to 9 and is supported by fresh fish specifications based on the Indonesian Nationalization Standard 2729:2013 [20]. which can provide understanding to the panelists. The number of panelists included in the testing was 10 semi-trained panelists who also served as repeat participants. The data obtained from the results of the organoleptic assessment of hedonic quality were then analyzed, then the freshness level of the carp was determined using criteria based on Indonesian National Standard 2729:2013.

3. RESULTS AND DISCUSSION

The process of soaking carp in a garlic extract solution can be seen in **Fig. 1**.

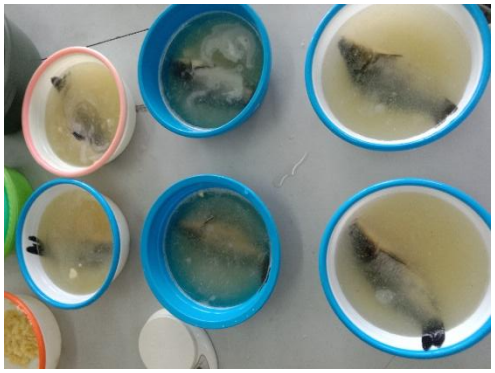

Fig.1 Process of Soaking CarpIn a Garlic Extract Solution

3.1 Organoleptic Test Value of Eyes in Carp

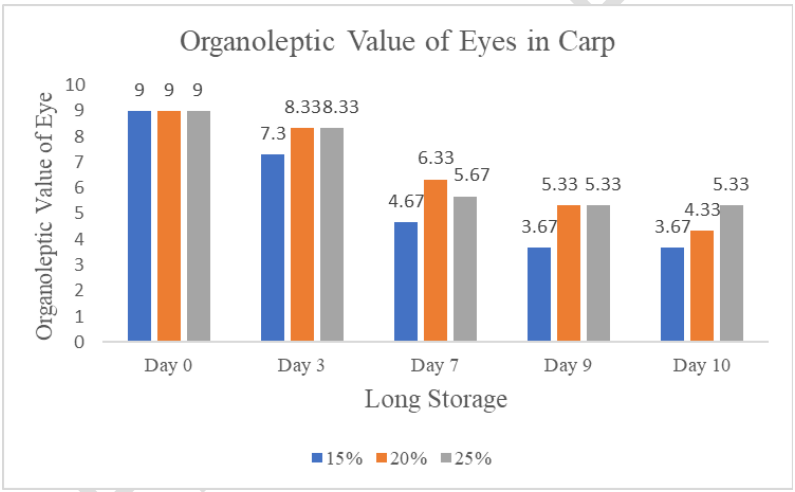

Fig. 2 Organoleptic Value of Eyes in Carp

The eyes are the easiest freshness indicator for consumers to see when buying fish. One of the important things on the body of the fish that is used as a parameter for the freshness of the fish is the appearance of the eyes [25]. The results of the organoleptic analysis of carp eyes can be seen in Table 1. From the results of the analysis of the organoleptic value of carp eyes in all treatments on day 0, it has a very high organoleptic value of 9 with convex eyeball criteria, clear cornea and pupils, and specific shiny. However, the organoleptic value of carp eyes appeared to decrease with the length of storage at low temperature. The organoleptic value of carp eyes appeared higher with the addition of higher concentrations of garlic. The decrease in the organoleptic value of carp eyes varied, on day 3 the highest eye organoleptic value in the addition of 20% and 25% garlic concentration was 8.33, on day 7 the highest eye organoleptic value in the addition of 20% garlic concentration was 6.33, on day 9 the highest eye organoleptic value in the addition of 20% and 25% garlic concentration was 5.33, and on day 10 the highest eye organoleptic value in the addition of 25% garlic concentration was 5.33. On the final day of observation of the organoleptic test (day 10) the highest carp eye value has the criteria of a slightly sunken eyeball, cloudy cornea, slightly grayish pupil and not shiny. The level of feasibility of carp consumption is determined based

on the Indonesian National Standard 2729:2013, where the limit of feasibility of fresh fish consumption is 5. The results of the organoleptic value of carp eyes show that the consumption feasibility standard is not below the value of 5, namely on day 10 with a garlic concentration level of 25% with a value of 5.33.
The decrease in the organoleptic value of the eyes of different carp is caused by differences in the concentration of garlic given, the higher the concentration of garlic given, the better the organoleptic value of the eyes and the longer the carp is stored. The organoleptic value of the eyes decreases, this is because the activity of the compounds in garlic decreases. Garlic contains only a small amount of active substances that can inhibit bacterial growth so that to become a strong antibacterial, a higher concentration of garlic is needed [35].

Table 1. Organoleptic Characteristics of Carp Eyes

Specifications Eyes	Score
Convex eyeballs, clear cornea and pupil, shiny specific type of fish	9
Flat eyeballs, clear cornea and pupils, rather shiny specific type of fish	8
The eyeball is flat, the cornea is slightly turbid, the pupils are slightly grayish, slightly shiny specific to the type of fish	7
The eyeball is slightly sunken, the cornea is slightly turbid, the pupils are slightly grayish, rather shiny specific to the type of fish	6
The eyeball is slightly sunken, the cornea is turbid. Pupils slightly grayish, not shiny	5
Sunken eyeballs, cloudy cornea, grayish pupils, not shiny	3
The eyeball is strongly sunken, the cornea is very turbid, the pupil is gray, not shiny	1

3.2 Organoleptic Test Value of Meat in Carp

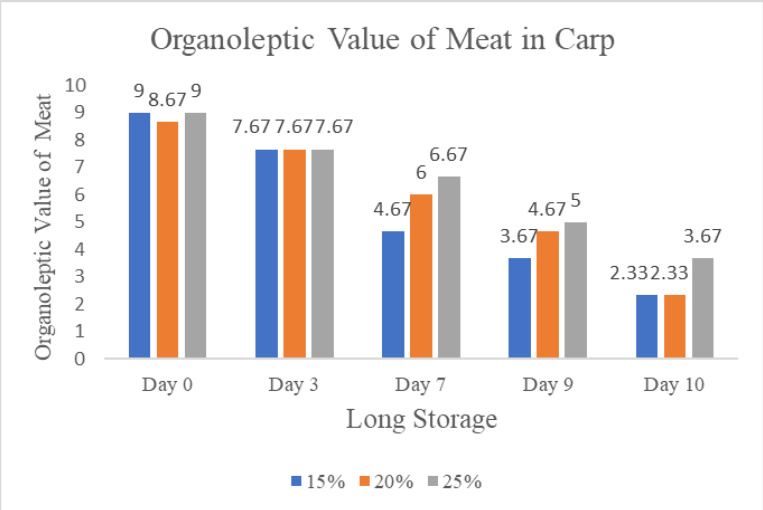

Fig. 3Organoleptic Value of Meat in Carp

Meat is one of the parameters that determine the freshness of fish. The results of the organoleptic analysis of carp meat can be seen in Table 2. From the results of the analysis of the organoleptic value of carp meat in all treatments on day 0, it has the highest organoleptic value with the addition of 15% and 25% garlic concentration of 9. On day 0, the organoleptic value of adding 20% garlic concentration is 8.67, this is because the fish meat at the time of the first observation has a slight wound that allows the meat to be contaminated by bacteria which can accelerate the decline in fish quality. The organoleptic value of carp meat on day 3 in all treatments of adding garlic concentration decreased by 7.67, on day 7 the highest organoleptic value of carp meat was the addition of 25% garlic concentration of 6.67, on day 9 the highest organoleptic value of carp meat was the addition of garlic concentration of 5, and on day 10 the highest organoleptic value of carp meat was the addition of 25% garlic concentration of 3.67. The results of the organoleptic value of carp meat show that the standard of suitability for consumption is not below the value of 5, namely on the 9th day with a garlic concentration level of 25% with a value of 5 which has the characteristics of the incision of the meat starting to fade and the tissue is less strong.
Referring to the quality standards of fresh fish Indonesian National Standard 2729-2006, the organoleptic value of fish meat can be said to be fresh if there has been no change in the fish meat. This is indicated by the criteria of fish meat which is still solid and chewy and difficult to tear the meat with the spine. The decrease in organoleptic value in carp meat is due to the activity of compounds in garlic decreasing along with the length of storage, the quality of fish meat decreases and begins to rot due to microbial activity.

Table 2. Organoleptic Characteristics of CarpMeat

Specifications Meat	Score
The incision of the flesh is very shiny, the specifics of the breed, the meat tissue is very strong	9
Breed specific shiny meat incision, strong meat tissue	8
The meat incision is slightly less shiny, the flesh tissue is strong	7
The incision of the flesh is less shiny, the flesh tissue is slightly less strong	6
The incision of the flesh begins to fade, the flesh tissue is less strong	5
The incision of the flesh is dull, the meat tissue is less strong	3
The incision of the flesh is very dull, the flesh tissue is damaged	1

3.3 Organoleptic Test Value of Odor in Carp

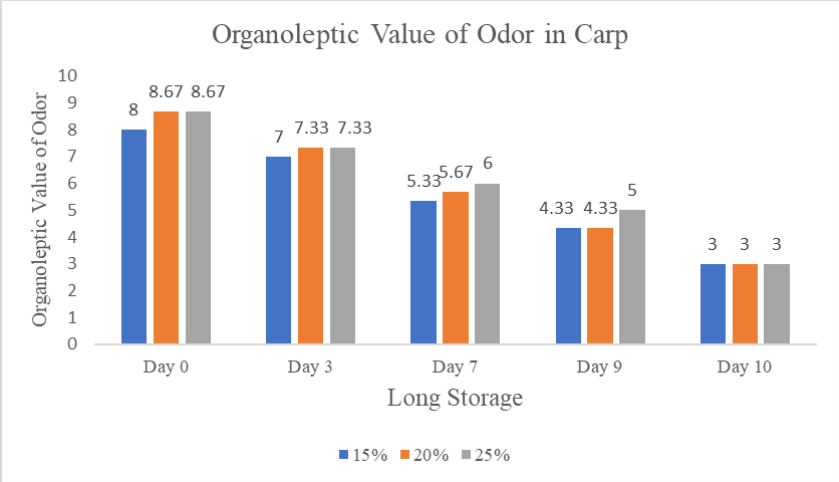

Fig. 4 Organoleptic Value of Odor in Carp

Odor is one of the easy-to-use parameters for determining fish freshness. Odor is more influenced by the sense of smell. In general, the odors that can be received by the nose and brain are mostly a mixture of four types of odors, namely fragrant, sour, rancid and burnt [37]. The organoleptic value of fish odor appears to be higher at higher garlic concentrations. However, the sensory value at all levels of garlic concentration will decrease with the length of storage. The results of the organoleptic analysis of carpodor can be seen in Table 3. The sensory value of carp odor at 0 days of storage with the addition of 15% garlic was 8, the addition of 20% garlic was 8.67, and the addition of 25% garlic was 8.67. The criteria are fresh smelling, specific type. After 10 days of storage, the organoleptic value of the odor of carp with the addition of 15%, 20% and 25% garlic decreased to 3. This shows that organoleptically the rotten smell and ammonia smell began to smell. The level of suitability for consuming carp is determined based on the Indonesian National Standard 2729:2013, where the limit for suitability for consuming fresh fish is 5. The odor of carp with the addition of 15% and 20% garlic began to be rejected by panelists on the 9th day of storage while the smell Carp treated with the addition of 25% garlic began to be rejected on the 10th day of storage. Fish spoilage is characterized by oxidative rancidity due to fat oxidation reactions, giving rise to an undesirable rancid odor [10]. Rejection of the odor of carp was caused by the odor of the fish which had a very strong rotten aroma. The change in odor is caused by the activity of fat-degrading bacteria. According to Buckle et al. (1987), microbial growth in food causes a very unpleasant odor due to the process of breaking down proteins, fats and the aroma of the microbes themselves. Enzymatic activity in proteins and fats produces unpleasant odors originating from ketone compounds, aldehydes and butyric acid [5].

Table 3. Organoleptic Characteristics of Carp Odor

Specifications	Score
Odor	
Very fresh, specific strong type	9
Fresh, specific type	8
Fresh, less specific types	7
Neutral	6
Slight sour odor	5
Strong sour odor	3

3.4 Organoleptic Test Value of Texture in Carp

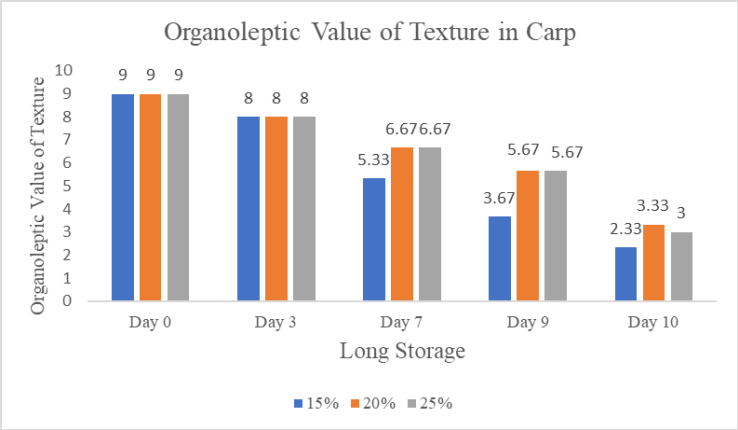

Fig. 5 Organoleptic value of Texture in Carp

Texture is everything related to mechanics, taste, touch, sight and sound, including evaluation of moisture, dryness, hardness, smoothness, roughness and fat [11]. Texture factors include touch by hand, tenderness, and ease of chewing [16]. Organoleptically, fish is categorized as fresh if it has a texture that is still dense and chewy, and it is difficult to tear the flesh from the spine [36]. This refers to the quality standards for fresh fish as stated in Indonesian National Standard 2729:2013 [20] that the texture of fresh fish is dense, compact and very elastic. The organoleptic value of carp texture appears to be higher at higher garlic concentrations. However, the organoleptic value at all levels of garlic concentration decreased with the length of storage. The results of the organoleptic analysis of carp texture can be seen in Table 4. The organoleptic value of the texture in each treatment decreased with different results, the organoleptic value of the carp texture after 0 days of storage was 9. The criteria included dense, compact and elastic flesh when pressed with a finger. After 10 days of storage, the organoleptic value of carp texture with the addition of 15% garlic decreased to 2.33, the addition of 20% garlic decreased to 3.33, and the addition of 25% garlic decreased to 3. Organoleptically the texture was very soft, finger marks wouldn't disappear, and the flesh was easily torn from the spine. The level of suitability for consumption of carp is determined based on the Indonesian National Standard 2729:2013, where the limit for suitability for consumption of fresh fish is 5. The texture of carp with the addition of 15% garlic began to be rejected by panelists on the 9th day of storage while the texture of carp with The treatment with the addition of 20% and 25% garlic began to be rejected on the 10th day of storage. The decrease in texture quality is caused by the work of microbial enzymes which modify the fish meat to become softer. Texture is also influenced by water retention which is related to denaturation of fish proteins. The decline in fish quality is characterized by a change in the texture of the meat to become softer which is caused by the breakdown of muscle tissue through an enzymatic process and the release of mucus from the surface of the skin by bacteria [2].

Table 4. Organoleptic Characteristics of Carp Texture

Specifications	Score
Texture	

Dense, compact, very elastic	9
Dense, compact, elastic	8
A bit soft, a bit elastic	7
A bit soft, a little less elastic	6
A bit soft, less elastic	5
Soft visible finger marks and very slow is lost	3
Very soft, finger marks do not disappear	1

3.5 pH Levels of Carp

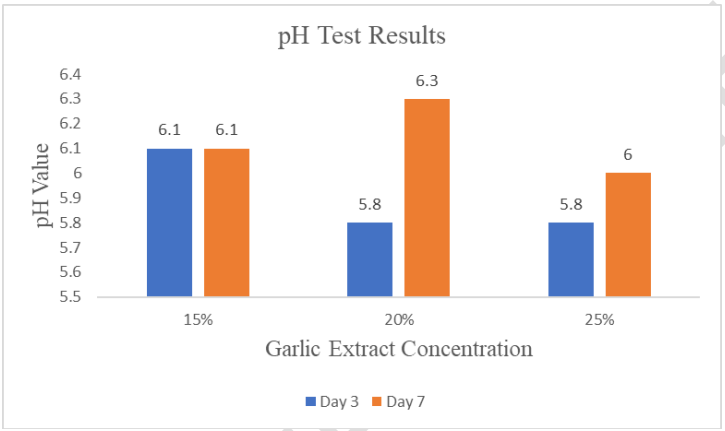

Fig. 6 pH Test Results

The pH value is an index used to determine the freshness of fish. In the spoilage process in fish, changes in the pH of the flesh play a very important role because it affects the autolysis process and bacterial attack. In the research conducted, the pH of each treatment can be seen in table 1. A good pH for preserved fish is between 2.0–5.5, while a pH of 6.0–8.0 is a good medium for the growth of microorganisms [1]. An increase in pH is an indication of a decrease in quality, the higher the pH value, the more microbes will damage the fish [28]. So the pH of carp which is below neutral or close to neutral, 6.0 - 8.0, is a good medium for the growth of microorganisms [33]. Based on the research results, the pH value when administering 15% garlic extract on days 3 and 7 has a constant value. However, giving 20% and 25% garlic extract has a pH value that increases on the 7th day. On the seventh day there is an increase in pH, this is due to the protein breakdown process in fish flesh by enzymes and bacteria resulting in the formation of alkaline compounds such as ammonia. [9]. Storing fish at low temperatures (5^{o} - 10^{o} C) slows down enzyme activity in the fish's body. The lower the temperature used, the more inhibited enzyme activity is [9].

4. CONCLUSION

From the results of research conducted on carp that were given a natural preservative in the form of garlic and stored at low temperatures (5^{o}C - 10^{o}C), organoleptic results showed how long carp could be preserved at low temperatures with the addition of the natural preservative garlic. From the organoleptic perspective of carp eyes, the addition of garlic extract concentrations of 25% and 20% can make carp eyes remain within the freshness acceptance limit until the 9th day, whereas at a concentration of 15% the freshness acceptance limit is only until the 3rd day. Results From the organoleptic aspect of carp meat,

adding a garlic extract concentration of 25% can make carp meat remain within acceptable freshness limits until the 9th day, whereas at a concentration of 20% only until the 7th day, and at a concentration of 15% only until day 3. The results of the organoleptic aroma of carp, the addition of a garlic extract concentration of 25% can make the aroma of carp remain within acceptable freshness limits until day 9, and the addition of garlic extract of 20% and 15% only until day 9. 7th. Organoleptic results of carp texture, the addition of extracts of 25% and 20% can maintain the texture until the 9th day, while the addition of 15% only until the 7th day.

The pH of carp when they first die has a pH of 6.6 - 6.8. After 3 days of storage, the pH of the carp fell to the range of 5.8 - 6.1. Meanwhile, on the 7th day, the pH of the carp began to increase, which was in the range of 6.0 - 6.3. The effect of garlic on reducing pH, namely, the addition of garlic affects the growth speed of lactic acid bacteria as a source of carbohydrates used for their growth so that the amount of lactic acid produced increases. This causes the product to become acidic and causes the pH value to decrease. And the increase in pH occurs due to the activity of microorganisms which break down amino acids into basic compounds such as ammonia, causing acids and basic compounds to interact and produce inconsistent pH values.For further research, tests can be added such as testing TBARS, TVBN, microbial analyzes or chemical composition of carp.

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