Global Scientific JOURNALS

GSJ: Volume 10, Issue 8, August 2022, Online: ISSN 2320-9186
www.globalscientificjournal.com

SHELF LIFE OF VANNAMEI SHRIMP (*LITOPENAEUS VANNAMEI*) USING *GRACILARIA* SP. AS EDIBLE COATING AT COLD TEMPERATURES

Anis Chairunnisa Nusantara[1], Iis Rostini[2], Sunarto[3] and Rusky Intan Pratama[2]

[1]Fisheries Program Study, Faculty of Fisheries and Marine Science, University of Padjadjaran, Indonesia.
[2]Fisheries Departement, Faculty of Fisheries and Marine Science, University of Padjadjaran, Indonesia.
[3]Marine Departement, Faculty of Fisheries and Marine Science, University of Padjadjaran, Indonesia.

E-mail: Chairunnisa.Nusantara42@gmail.com.

KeyWords
Vannamei Shrimp, *Gracilaria* sp., pH, water content, Weight loss, TVB, Bayes.

ABSTRACT

Fresh Vannamei Shrimp is a source of food with high protein and Fresh shrimp is a food that can be used as various types of food. Fresh shrimp is easy to decrease in quality that can be caused by the activity of microorganisms. This study aim to determine the optimal concentration and determine the effectiveness of *Gracilaria* sp. as edible coating on fresh vannamei shrimp for 8 days during cold temperature. This research was conducted at the Laboratory of Processing of Fishery Products, Faculty of Fisheries and Marine Sciences and the Laboratory of Ruminated Animal Nutrition and Feed Chemistry, Faculty of Animal Husbandry, Padjadjaran University. The research method was carried out experimentally consisting of 4 treatments, shrimp without coating, *Gracilaria* sp. 0.5% coating; 1%; and 1.5%, with 15 semi-trained panelists as replicates. Parameters observed in this study were the degree of acidity (pH), weight loss, water content, Total Volatile Base (TVB) were analyzed descriptively. Organoleptic test analysis using Friedman test and analysis of Bayes method. Based on the results of the study, it was concluded that the edible coating with the addition of *Gracilaria* sp. 1% is the optimal concentration to inhibit the deterioration of shrimp quality during storage and can improve the appearance, aroma and texture of shrimp, based on the Bayes method test, the priority value for the addition of *Gracilaria* sp. 1% is 0.27 and the alternative value is 2.80. with a TVB value of 25.55 mgN%, a water content of 82.08% and a pH of 7.6.

1Fisheries Program Study, Faculty of Fisheries and Marine Science, University of Padjadjaran
2Fisheries Departement, Faculty of Fisheries and Marine Science, University of Padjadjaran

1. INTRODUCTION

Vannamei Shrimp (*Litopenaeus vannamei*) is one of the leading fishery commodities with high economic value. More than 40% of fishery products and foreign exchange earnings are dominated by shrimp, with Japan and the United States being the destinations with the most export volumes. Most of the vaname shrimp exported from pond cultivation [1]. The main indicators of shrimp quality based on freshness can be seen physically, namely color, texture and smell. Decrease in the quality of shrimp can occur microbiologically and biochemically. This process can hinder the marketing of fishery products and can cause huge losses [2]. Therefore, it is necessary to make efforts to increase the shelf life and maintain product quality, one of which can be used to use seaweed as an edible coating for shrimp products.

Edible coating is a thin layer made of edible materials that can be eaten, which aims to extend shelf life and maintain quality during storage [3]. Edible coating is formed to coat food components that function as a barrier to reduce moisture in the product, controlling the exchange of gases, such as oxygen, carbon dioxide and ethylene. Edible coatings use biological materials such as proteins, lipids, and polysaccharides [4]. The compounds produced by seaweed are colloidal compounds called phytocolloids, namely agar, algin, and carrageenan [5]. *Gracilaria* sp. contains agarose and agaropectin which are good enough to produce agar with good gel strength. This seaweed also contains polysaccharides as inhibitors of microbial growth which can accelerate the process of damage to shrimp [6].

Vannamei shrimp with the addition of edible coating using *Gracilaria* sp. as the main ingredient. Agar content in *Gracilaria* sp. which combined with glycerol can produce edible coatings that are stronger and more elastic. The manufacture of edible coatings cannot be separated from the use of plasticizers such as glycerol [7]. Glycerol or also called glycerin has a no color, slightly sweet taste and glycerin is soluble in water but insoluble in ether. The use of glycerin will not affect the smell and taste of the edible coating [8].

Research by [9] regarding the active exopolysaccharide added with red seaweed extract (*Gracilaria gracilis*) to increase the shelf life of shrimp during cold storage with the results of research on the provision of seaweed *Gracilaria* sp. as much as 1 and 1.5% can affect the shelf life of shrimp during cold storage. However, research on the use of *Gracilaria* sp. as an edible coating is still rare. This research uses *Gracilaria* sp. without extracting, to see the effect given at each concentration on shrimp to determine its effectiveness on the shelf life of shrimp.

Based on the description above, a research was conducted on the shelf life of vannamei shrimp (*Litopenaeus vannamei*) at cold temperatures using seaweed *Gracilaria* sp. as a coating for shrimp to inhibit the decline in the quality of shrimp sold in the market.

2. METHODOLOGY

2.1 Research Place and Time

This research starts from December 2021 to March 2022. The stages in this research are coating seaweed *Gracilaria* sp, coating vannamei shrimp (*Litopenaeus vannamei*) and organoleptic testing, measuring pH and weight loss carried out at the Fishery Product Processing Laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University. The water content and Total Volatile Base tests were carried out at the Ruminant Feed Nutrition and Feed Chemistry Lab, Faculty of Animal Science, Padjadjaran University.

2.2 Tools and Materials

Plastic plate, plastic wrap, refrigerator, cool box, tissue, pH meter, blender, Digital scales, camera, petri dish, label, organoleptic test score sheet, laboratory oven, stove, mortar and pestle, measuring cylinders, beaker glass, tray, filter, dropping pipettes, thermometer lab, spatula, tweezers, magnetic stirrer, hot plate, food Wrapper, distilled water, glycerin, pH 4 buffer solution, pH 7 buffer solution, Vaname shrimp, *Gracilaria* sp., perchloric acid, ice.

2.3 Research Method

This research was conducted experimentally consisting of four treatments and 15 panelists as replicates, each treatment is a different concentration of seaweed Gracilaria sp. that is 0%; 0.5%;1%; and 1.5%. Vannamei shrimp storage with the addition of edible coating at cold temperatures was carried out for 8 days of observation. The parameters tested were pH and weight loss by testing samples every day, water content and TVB which were tested on days 3, 5 and 8, which would be analyzed descriptively, and organoleptic test using a scoring test sheet which will be analyzed using a two-way test of variance. the direction of the Friedman test with Chi-squared and the determination of the priority value of the product using the Bayes method.

Percentage *of Gracilaria* sp. using concentrations derived from studies conducted by [9] based on the volume of the solvent, namely water dissolved with *Gracilaria* sp. then the shrimp was dipped in a solution of *Gracilaria* sp. for 15 minutes at 4 ^{o}C.

2.4 Research Procedure

2.4.1 Making and Application *of Edible Coating Glacilaria* sp.

Preparation of Edible coating solution using the method used by [10], the seaweed is washed with clean water to remove impurities, then dried for ± 4 days in the open air. Dried seaweed (simplicia) was cut into small pieces with a size of ± 0.5 cm and then mashed using a blender to become seaweed powder. Seaweed powder was dissolved at 80°C and homogenized for 10 minutes, with a given concentration of 0% seaweed; 0.5%; 1% and 1.5%. The solution is then added a plasticizer (glycerol) and homogenized again. The formulations used in the manufacture of coating solutions can be seen in table 1.

Table 1. Formulation of coating solution *Gracilaria* sp.

Ingredient	Treatment		
	B (0.5%)	C (1%)	D (1.5%)
Aquades	300 ml	300 ml	300 ml
Gracilaria sp. (w/v)	1.5gram	3gram	4.5gram
Glycerol (1%)	2 ml	2 ml	2ml

Source: [10] with modification

Application of Edible Coating on white shrimp using the method [9], shrimp that have been cleaned and drained are dipped in a solution of edible coating solution according to the concentration in each treatment (0%; 0.5%; 1%; and 1.5%) for 15 minutes at 4 °C. shrimp then drained for 5 minutes at room temperature. Then the shrimp are weighed and placed in a plastic container and covered with plastic wrap. Furthermore, the shrimp are put in the refrigerator at a temperature of 5-10 °C for 8 days.

2.4.2 Observed parameters

Parameters observed include organoleptic test, which is a test method that uses the human senses as a tool in testing. Organoleptic testing was carried out according to SNI 01-2346-2006 [11]. The acceptance limit of the panelist's scoring level is ≥ 5, if the test product has a score equal to 5 or more than 5 then the test product is favored by the panelists.

The measurement of the value of the degree of acidity (pH), the pH measurement method used was derived from the [12] and was carried out 2 times. Testing the water content to determine the amount of water content in the sample using the drying method according to SNI-01-2345.2-2006 [13]. The water content in vannamei shrimp can be calculated using the following formula:

$$\%\ \text{Water Content} = \frac{B - C}{B - A} \times 100\%$$

Weight loss measurement parameters were carried out at the beginning and end of the observation by weighing each test sample. According to [14], weight loss in percent is calculated based on the following formula:

$$\text{Weight Loss}\ (\%) = \frac{\text{First Weight} - \text{Final Weight}}{\text{First Weight}} \times 100\%$$

Testing Levels of Total Volatile Base (TVB) is used to measure the freshness level of fish and the limits for consumption. The condition and amount of TVB depends on the freshness of the fish, if the quality of the fish is low, then the TVB level will increase. The TVB testing method in this study came from research conducted by [15] The TVB analysis procedure is divided into 3 stages:

1) Extraction

   A sample of 25 grams was weighed and then placed in a glass beaker. Then, 75 mL of 7% perchloric acid was added and homogenized with a *homogenizer* for 2 minutes. After homogeneous, the solution was filtered using coarse filter paper, so that the filtrate was produced.

2) Distillation

   1 mL of filtrate sample was taken, then the filtrate was put into the Outer chamber to the left of Conway, then 1ml of K_2CO_3 was inserted into the outer chamber to the right of Conway, then the Conway cup was tightly closed and incubated for 2 hours at 35°.

3) Titration

   Borate solution is titrated in the inner chamber with 0.02 N HCl solution. Value The end point of the titration is indicated by the formation of a green color.

   The formula used in the calculation of TVB-N levels is as follows:

$$\text{TVB}\ \left(\text{mg} - \frac{\text{N}}{100\text{g}}\right) = \frac{(\text{Vc} - \text{Vb})\text{x N HCl x } 14{,}007 \text{ x Fp x } 100}{\text{Bs}}$$

Information:
V c = Volume of HCl solution in sample titration (mL)
Vb = Volume of HCl solution in blank titration (mL)
Ar N = Atomic weight of nitrogen (14.007 g/mol)
Fp = Dilution factor
Bs = Sample weight(mg)

2.5 Data analysis

The data obtained from the observations were analyzed descriptively. The data obtained from organoleptic observations were analyzed using a two-way analysis of variance Friedman test with Chi-square test. The test was carried out to determine the effect of different concentrations of *Gracilaria* sp. as a coating for shrimp. The test method used to determine the priority value of the selected product is the Bayes method. Bayes method is a technique that can be used to analyze the best decision making from a number of alternatives with the aim of producing results that consider various criteria [16].

3 RESULTS AND DISCUSSION

3.1 Organoleptic Quality Test

3.1.1 Appearance

Appearance is very important in determining the selling price of a food ingredient, especially fresh food ingredients such as vaname shrimp. Organoleptic quality test is done by scoring method. The results of the quality test assessment carried out by the panelists can be seen in table 2.

Table 2. Value Appearance of Vaname Shrimp Organoleptic

Treatment	Storage Day							
	1	2	3	4	5	6	7	8
Gracilaria sp. 0% (A)	9.0	8.0	7.0	7.0	5.0	5.0	3.0	1.0
Gracilaria sp. 0.5% (B)	9.0	8.0	7.0	7.0	5.0	5.0	5.0	3.0
Gracilaria sp. 1% (C)	9.0	8.0	7.0	7.0	5.0	5.0	5.0	3.0
Gracilaria sp. 1.5% (D)	9.0	8.0	7.0	5.0	5.0	5.0	3.0	3.0

Vannamei shrimp on the first day of storage, all shrimps, either without coating or those given coating, there was still no difference, and got the highest scoring value, namely a value of 9. Until the day 3 all samples were still in the fresh category, with an average score of 7. The difference in the scoring results began to be seen on day 4 where sample C got a score of 5. Then onwards all samples experienced a decrease in quality values until day 8. The last day of storage was the day of rejection of all treatments with the appearance of shrimp being red in color, sturdy between segments, dull skin and lots of black spots.

During cold storage of vaname shrimp, the appearance of the shrimp can be seen clearly decreasing where the shrimp is still intact but the shrimp is starting to turn red and there are black spots. Giving a coating can have an effect on the appearance of shrimp with better appearance results than without coating. The color change that occurs indicates a decrease in the quality of the shrimp. According to [17], the presence of black spots on the shrimp body is a characteristic of shrimp that has experienced a decline in quality. The enzymatic process that can affect the appearance of shrimp during the cold storage process is the formation of black spots due to melanosis, which is characterized by blackening of the head, body segments, and tail of the shrimp. The cause of black spots is the enzymes found in shrimp with a series of reactions that will oxidize certain compounds, so that they can produce black pigment of melanin [18].

During cold storage for 8 days, the appearance of the shrimp can be seen clearly decreasing where the shrimp is still intact but the shrimp starts to turn red and there are black spots. Giving edible coating *Gracilaria* sp. proven to have an effect on the appearance of shrimp with better appearance results compared to shrimp that did not use edible coating during the storage process, especially in the application of coatings 0.5% and 1%, where until the day 7 the shrimp were still at the acceptance stage.

3.1.2 Odor

Odor is one of the influences on consumer tastes and can be used by consumers in choosing fresh fishery products. Fresh prawns have a species-specific fresh odor, while unfresh prawns have a neutral odor that can start to smell like ammonia.

Table 3. Value Odor of Vanname Shrimp Organoleptic

Treatment	Storage Day							
	1	2	3	4	5	6	7	8
***Gracilaria* sp. 0% (A)**	8.0	8.0	7.0	7.0	5.0	5.0	3.0	3.0
***Gracilaria* sp. 0.5% (B)**	8.0	8.0	7.0	5.0	5.0	5.0	3.0	3.0
***Gracilaria* sp. 1% (C)**	8.0	8.0	5.0	5.0	5.0	5.0	3.0	3.0
***Gracilaria* sp. 1.5% (D)**	9.0	8.0	8.0	7.0	5.0	5.0	3.0	3.0

The results of the organoleptic test for the odor of shrimp (table 3) that were carried out showed that the aroma of shrimp was rejected on the day 7 for all samples. The odor value for the organoleptic test on the first day for sample D got the highest value of 9, while the samples without treatment, B, and C, got a value of 8. The value odor of shrimp during storage for 8 days decreased where on the last day, all samples got a value of 3, which indicates the smell of fish has stung or smelled of indole.

It can be seen from the results of the table above that all samples have almost the same value, especially the aroma value which has entered the rejection limit or with a value of 3. At the beginning of shrimp storage, all samples still smelled of fresh shrimp. The longer the storage, the change in the aroma of shrimp decreases and the smell of ammonia begins to appear. Research conducted by [19], the deterioration of the quality of fishery products is characterized by an off odor that occurs due to the reshuffling of proteins into free volatile compounds by microbial spoilage. According to [20], the decomposition of protein and fat that occurs due to the activity of spoilage bacteria produces ammonia, indole, and H_2S compounds that cause foul odors. Shrimp that were treated with edible coating and without coating showed no significant difference to the decrease in quality in terms of aroma until the last day. The results of organoleptic test of shrimp aroma showed that the aroma of shrimp was acceptable up to day 6. These results indicate that the concentration of *Gracilaria* sp. as an edible coating on shrimp is still not able to inhibit the decrease in the value of aroma in shrimp.

3.1.3 Texture

Testing the texture of the shrimp can be felt by touching the shrimp meat which is pressed slowly. Changes in the texture of shrimp can be felt where in fresh shrimp when pressed it feels elastic, compact and dense, while in shrimp that has experienced a decrease in the quality of the texture of the shrimp it will feel inelastic, not dense, and not compact, until the shrimp feel soft during storage.

Table 4. Value Texture of Vaname Shrimp Organoleptic

Treatment	Storage Day							
	1	2	3	4	5	6	7	8
***Gracilaria* sp. 0% (A)**	8.0	8.0	7.0	7.0	7.0	7.0	5.0	3.0
***Gracilaria* sp. 0.5% (B)**	8.0	8.0	7.0	7.0	5.0	5.0	5.0	5.0
***Gracilaria* sp. 1% (C)**	8.0	8.0	7.0	7.0	7.0	5.0	5.0	5.0
***Gracilaria* sp. 1.5% (D)**	9.0	8.0	7.0	7.0	7.0	7.0	5.0	5.0

Organoleptic texture test on white shrimp (table 4) based on the panelist's assessment, it was found that the shrimp without coating on the 8th day got the lowest valueof 3, where this value was included in the category of rejection or poor texture conditions. During 8 days of storage, the yield of shrimp texture decreased relatively the same, where samples without additional treatment, C, and D on day 8 still got a value of 5, with texture characteristics that were less elastic, compact, and less dense.

Based on Friedman's two-way analysis of variance, it was found that there was an effect of using edible coating *Gracilaria* sp. on the organoleptic value of vaname shrimp texture during cold storage. Friedman's non-parametric test results were then followed by a multiple comparison test. The results obtained from the multiple test calculations show that treatment A is significantly different from treatment B, while treatments C and D are not significantly different from treatments A and B. This indicates that treatment A is without coating. *Gracilaria* sp. experienced a faster quality deterioration compared to other treatments.

The decline in the quality of shrimp can be seen from change the texture of the shrimp. In the prerigor phase, the muscle fibers are still compact and dense, the rigor mortis phase the muscle fibers begin to contract. Meanwhile, the post rigor phase, the muscle tissue fibers have been cut into pieces [17]. According to [21], the decline in quality occurs due to bacterial activity in the meat. Denaturation and autolysis that occur greatly affect the deterioration of shrimp quality. The reduced strength of the fibers that make up the threads in muscle tissue is caused by the denaturation of proteins that function as water retainers in muscle tissue [22]. The results of organoleptic test on shrimp texture showed that *Gracilaria* sp. As an edible coating, it has a significant effect on decreasing the quality of shrimp texture, giving edible coating can inhibit the cause of the shrimp texture to become soft, and not solid during cold storage.

3.2 Decision Making with Bayes Method

In making decision on a fishery product the best can be done in several ways, one of which is by using the Bayes method. Bayes method is one of the methods used to perform analysis in making the best decisions from a number of alternatives that aim to produce optimal results. The results of the criteria weights as well as in determining the best treatment by considering the appearance, odor, and texture of the shrimp are presented in table 5.

Table 5. Criteria Weight Value of Shrimp

Criteria	Criteria Weight
Appearance	0.39
Scent	**0.42**
Texture	0.18

Based on the calculation of the Bayes method on the appearance, odor and texture criteria above, it is known that the odor criterion has the highest value with a value of 0.42. The criteria for appearance are not too far away, which is 0.39, and the lowest criterion value is obtained on the texture criteria, which is 0.18. The results of the criteria values indicate that aroma is the most influential criterion on shrimp assessment, this can indicate that aroma is one of the most important criteria for shrimp. [23], every fish and fishery product had a distinctive aroma that can be used to assess the quality of fish. The human nose is a sensory tool used in assessing the quality of fish and fishery products. Everyone can tell the difference between the smell of fresh and rotten fish right away.

Multiple comparison test is carried out in making decisions on alternative weight values. The calculation of the weight of the appearance, aroma and texture criteria can be seen in table 6.

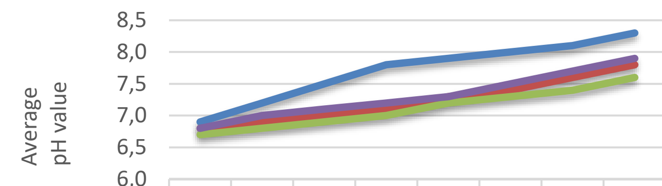
Table 6. Vaname Shrimp Assessment Decision Matrix

Treatment	**Criteria**			**Alternative value**	**Priority Value**
	Appearance	**Scent**	**Texture**		
***Gracilaria* sp. 0% (A)**	1.93	2.47	3.13	2.38	0.23
***Gracilaria* sp. 0.5% (B)**	2.47	2.07	4.93	2.75	0.26
***Gracilaria* sp. 1% (C)**	2.60	2.20	4.60	**2.80**	**0.27**
***Gracilaria* sp. 1.5% (D)**	2.33	2.33	3.93	2.62	0.25
Criteria Value	0.39	0.42	0.18	10.55	1.00

The results of the calculation of decision making using the Bayes method showed that vaname shrimp with 1% edible coating obtained the highest alternative value of 2.80 and priority value of 0.27. Based on these calculations, it is known that the shrimp with the addition of edible coating *Gracilaria* sp. as much as 1% is the best treatment, this is because the shrimp with the addition of edible coating *Gracilaria* sp. have better organoleptic characteristics than uncoated shrimp.

3.3 pH Value

Measurement of pH is one way to determine the freshness of shrimp. pH is a supporting factor for the productivity of the growth of bacteria and other microorganisms. pH 5-8 is the optimal growth range of microorganisms, only certain species can survive at lower pH [24]. Generally, the pH of fresh shrimp is close to neutral ranging from 6.8 to 7. Changes in pH in shrimp are the result of anaerobic glycolysis and lactic acid production that occurs after the shrimp die [25].



	1	2	3	4	5	6	7	8
gracilaria sp. 0% (A)	6,9	7,2	7,5	7,8	7,9	8,0	8,1	8,3
gracilaria sp. 0,5% (B)	6,8	6,9	7,0	7,1	7,3	7,4	7,6	7,8
gracilaria sp. 1% (C)	6,7	6,8	6,9	7,0	7,2	7,3	7,4	7,6
gracilaria sp. 1,5% (D)	6,8	7,0	7,1	7,2	7,3	7,5	7,7	7,9

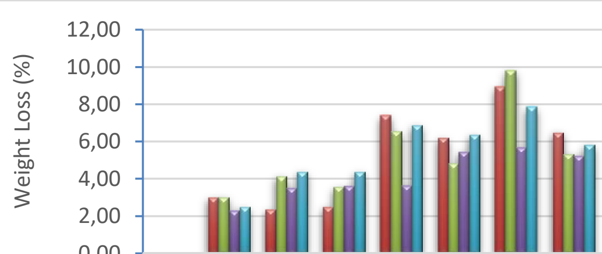
Figure 1. pH Value of Vaname Shrimp

During storage at cold temperatures for 8 days the pH value of shrimp continued to increase (figure 1). The highest increase in pH occurred in shrimp that were given control treatment or without coating on the last day with a pH value of 8.3. And treatment B (1%) was the treatment with the lowest increase in pH with pH 7.6. During storage, the activity of microorganisms causes the decomposition of chemical compounds, especially protein compounds that produce basic and strong alkaline compounds that cause the decay process, especially an increase in pH [26].

Giving *Gracilaria* sp. coating, storage time, and storage temperature can inhibit the growth of bacteria but the growth rate of bacteria cannot be stopped. The pH value of fresh shrimp has a standard of around 7-8. The accumulation of lactic acid in shrimp meat is determined by the condition of the shrimp at death. The more lactic acid content in shrimp meat causes a decrease in pH, thereby accelerating the performance of metabolic enzymes [25]. The high pH value in shrimp is related to the process of decreasing quality in shrimp where the enzyme formation process due to bacterial activity becomes faster. The autolysis process and bacterial activity that occurs in meat cause changes in the pH value [17]. Giving *Gracilaria* sp. as edible coating on vaname shrimp was proven to reduce and inhibit the increase in pH value during cold storage, this can be seen from the pH value of shrimp with the provision of edible coating *Gracilaria* sp. as much as 1% got the lowest value compared to other treatments, especially in the treatment without coating which got the highest value.

3.4 Weight Loss

Vaname shrimp weight loss is a decrease in the weight of shrimp that occurs after going through a certain process, one of which is the cooling process. Weight loss that occurs due to the loss of water content in the shrimp meat during the cooling process. Several things that can affect the occurrence of weight loss in fish are the type of fish, the handling process, the season, and the size of the fish.



	1	2	3	4	5	6	7	8
gracilaria sp. 0% (A)	0,00	3,00	2,35	2,51	7,41	6,20	8,94	6,48
gracilaria sp. 0,5% (B)	0,00	3,01	4,13	3,55	6,54	4,82	9,81	5,31
gracilaria sp. 1% (C)	0,00	2,31	3,51	3,62	3,65	5,45	5,69	5,24
Dgracilaria sp. 1,5% (D)	0,00	2,49	4,36	4,35	6,87	6,36	7,86	5,83

Figure 2. Vaname Shrimp Weight Loss

Shrimp cold storage on the day 7 was the highest weight loss compared to other days (figure 2). Shrimp with treatment A (0.5%) experienced the highest weight loss of 9.81% and shrimp B (1%) was the lowest weight loss on the 7th day of 5.69%. The overall result of shrimp weight loss is that shrimp with coating treatment B (1%) is the shrimp with the lowest weight loss compared to another shrimp. The increase in weight loss occurs due to the longer storage time at cold temperatures, causing water loss (dehydration), besides that one of the efforts to inhibit the occurrence of water loss in the material during storage is the use of good packaging [27].

Shrimp weight loss can also occur due to a decrease in pH in shrimp. A decrease in pH can lead to an autolysis process. Denaturation and protein reshuffling that occurs due to a decrease in pH will result in the strength of the fibers making up the meat thread as a water retainer decrease [28]. The increase in weight loss will be followed by an increase in the bacterial population. The increase in bacterial population occurs because spoilage bacteria will use drip as a growth medium.

3.5 Water Content

The composition high of water content in shrimp it caused by the water holding capacity (WHC) or the ability of the material to bind water. Shrimp has a fairly high water content so it is a perishable food ingredient [29]. The water content contained in foodstuffs is an important component because it can affect the texture, taste, and appearance of these foodstuffs [30].

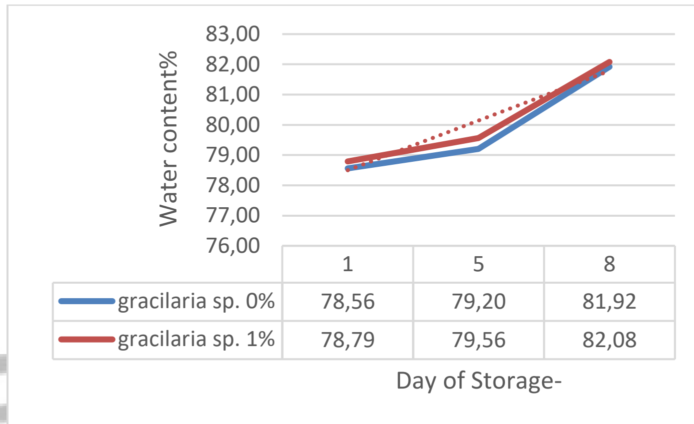


Figure 3. Vaname Shrimp Water Content

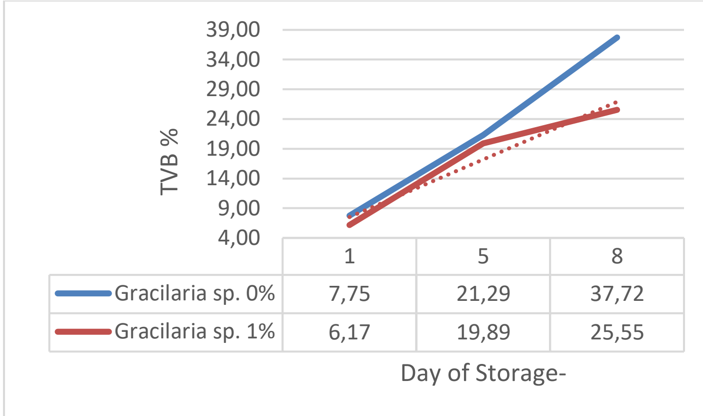
During the observation time in 8 days the water content in shrimp increased (Figure 3). On the day 5 observation of the water content test results obtained shrimp with treatment without coating water content of 79.20% and shrimp with coating (1%) 79.56%. The water content of coated vaname shrimp contains a higher water content than the water content of uncoated shrimp, namely 82.08% of coated shrimp (1%) and 81.92% of uncoated shrimp.

The results of the water content test showed that the water content of both uncoated and coated shrimp experienced an increase in water content during the shelf life. According to [31], the water content of fresh shrimp is 77.59%. The results of the water content test on vaname shrimp conducted by [19], namely the amount of water content as much as 81.35%. The higher the water content of the shrimp, the lower the protein content and levels of other components possessed by the shrimp [32].

The amount of water content possessed by shrimp with or without coating can be influenced by the use of the method in applying the coating, namely the dipping method. The shrimp dyeing process causes the coating solution to be absorbed by the material causing an increase in the water content [33]. The amount of water content contained in shrimp during storage has an effect on bacterial growth, where the higher the water content and a_w (water activity value), the higher the number of bacteria that will grow. Microbial growth will be easier by the availability of water [34].

3.6 Total Volatile Base (TVB)

Total volatile base is a test that aims to determine the level of damage or deterioration in food quality. TVB is the total volatile nitrogen formed in muscle tissue, including trimethylamine, dimethylamine, and ammonia obtained from the breakdown of protein and other nitrogen compounds. The TVB value was used as an index of microbiological deterioration with varying degrees of freshness in seafood storage [9]. The TVB content in shrimp stored at cold temperatures for 8 days showed a significant increase (figure 4).



	1	5	8
Gracilaria sp. 0%	7,75	21,29	37,72
Gracilaria sp. 1%	6,17	19,89	25,55

Figure 4. Value of TVB Vaname Shrimp

TVB testing on day 5, shrimp without treatment (0%) was included in the category still fit for consumption because the amount of TVB obtained had exceeded 20 mgN%, while shrimp with coating (1%) was still included in the category of fresh fish with high levels of TVB is still below 20 mgN%. Shrimp stored at cold temperatures with a coating (1%) on the last day is still included in the category of fit for consumption with the amount of TVB still below 30 mgN%. Shrimp without coating on day 8 with a TVB result of 37.72 mgN% was included in the category of fish not suitable for consumption where the limit of fish not suitable for consumption was more than 30 mgN%.

The increase in TVB that occurs in shrimp is due to an increase in microorganisms during storage in the material that can produce alkaline compounds. The increase in TVB content during cold storage occurs due to the degradation of proteins and their derivatives by microorganisms that produce volatile bases such as trimethylamine (TMA), Ammonia, and H_2S [27]. From the results of the TVB value in vaname shrimp with coating (1%) it can reduce the TVB value during cold storage. This can happen partly because of the anti-microbial effect found in *Gracilaria* sp. as a deterrent to protein decomposition by bacteria and inhibiting oxidative deamination of nitrogen compounds [9]. From the results of the Total Volatile Base (TVB) of vaname shrimp, the number of TVB of white vaname shrimp with *Gracilaria* sp. as edible coating (1%) can reduce the rate of increase in the value of TVB during cold storage, compared to other coating treatments and without coating.

Conclusion

Based on the results and discussion of the research, it can be concluded that the optimal concentration of the use of *Gracilaria* sp. seaweed is 1%. Edible coating *Gracilaria* sp. 1% in shrimp is the most preferred treatment with the highest alternative value of 2.80 and priority value of 0.27. The test results on each parameter showed that the Total Volatile Base (TVB) value of shrimp with a coating of 1% on the 8th day was 25.55 mgN% and still included in the shrimp which was still fit for consumption. The pH value of shrimp was 7.6 on the day 8, and the water content was 82.08%. Edible coating *Gracilaria* sp. which is applied to shrimp can improve the appearance, aroma and texture of shrimp and decrease the quality that occurs more slowly.

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