Journal of Food Science and Technology (Iran)

Homepage:www.fsct.modares.ir

Scientific Research

The effect of different concentrations of Aloe vera gel on sensory, microbial and chemical characteristics of Asian sea bass (*Lates calcarifer* (Bloch, 1790)) during refrigerated storage

Fekrandish, H.[1], Jamshidi, A.[2*], Shamsi zade, M.[3]

1- Department of Fisheries,Bushehr Branch, Islmaic Azad University, Bushehr, Iran.
2*-Department of Fish Processing, Gorgan University of Agricultural Sciences and Natural Resources, Iran.
3-Department of Seafood Processing, Kherad Institute Of Higher Education.

ABSTRACT

This study aimed to investigate the effects of different concentrations of Aloe vera gel on the quality and shelf life of Asian sea bass fillets during refrigerated storage. Treatments were contained of fresh Asian sea bass fillets coated by 40, 70 and 100 percent of aloe vera gel (dilution by distilled water) and control (without aloe vera gel) which were subjected to chemical and microbial examinations including TVN, TBA, pH, Total count and sensory evaluation during 16 days of storage. There were significant differences between the control and coated treatments in the amounts of TVN and TBA from the day sixteenth day of storage, and at the end of storage the lowest level of oxidation indices was observed in the 40% treatment. The pH value showed an increasing trend during the storage period, which was higher in the control sample than other samples, and at the end of the storage period, the 70% treatment showed the lowest pH value. The total bacterial count was also significantly ($P<0.05$) higher in control in comparison with the coated treatments at the sixth day, and the 40% treatment showed the lowest bacterial count among other treatments. At the end storage, the control was in an unacceptable condition in terms of sensory evaluation indices, so that other treatments showed higher sensory evaluation indices than the control. According to the obtained results, the application of 40% and 70% aloe vera gel coating, not only can improve the chemical factors of fish fillet, but also can show positive effects on the sensory indicators of Asian seabass fillets.

ARTICLE INFO

Article History:

Received: 2018/11/9
Accepted: 2023/6/28

Keywords:

Aloe vera gel coating,

Asian Sea bass,

Gel concentration,

Shelf life.

DOI: **10.22034/FSCT.20.137.143**
DOR:20.1001.1.20088787.1402.20.137.11.1

*Corresponding Author E-Mail:
a.jamshidi1382@gmail.com

1- Introduction

The most important characteristic of aquatic animals in terms of nutritional value, in addition to having a significant amount of protein (15-25%), is the abundant presence of unsaturated fatty acids in the fat in their tissues. Fish and their products, despite their high nutritional value, are very sensitive to oxidative spoilage, which leads to a decrease in their quality and nutritional value during storage.[1] . In this regard, the use of antioxidants is one of the best solutions to prevent oxidation and the harm caused by it. Nowadays, due to the side effects of synthetic antioxidants and consumer demand for natural preservatives, the use of natural antioxidants in food products has increased.[2] . The use of vegetation is among the natural compounds containing antioxidants, which due to their high bioactive content, their use in protecting marine products against oxidation reactions has increased. By creating a barrier against external factors such as oxygen, moisture, and light, these vegetation improves the quality and shelf life of the food product. Aloe vera is one of the plants that has the ability to form an edible coating and has shown good results in food applications during the last decade.[3] .

Aloe vera plant with scientific name*Aloe Barbadensis Miller* (Aloe vera)It belongs to the lily family and the aloe genus. This plant has a short stem that contains about 12 to 16 leaves. The leaves thatIT CONSISTS OF THICK EPIDERMIS SURROUNDED BY MESOPHYLL, IT CONTAINS TWO TYPES OF CELLS, CHLORENCHYMA AND PARENCHYMA. Aloe vera gel consists of soft and slippery tissues containing parenchyma cells. Ain Gel is a transparent gel substance that has a complex composition and includes a variety of bioactive compounds including carbohydrates, proteins, fibers, soluble sugars, vitamins, minerals, amino acids, organic acids and It is a phenolic compound[4] . Aloe vera coating can change the internal atmosphere and conditions like controlled atmosphere packaging(MAP) created[5] . Aloe vera gel is clear, odorless and has high absorption power. This gel is completely healthy and environmentally friendlypH It is about 4/5.

Asian seabass fish with scientific name *Lates calcarifer* It is one of the valuable sea fish known as barramundi, one of the important and commercial species of aquaculture in Southeast Asia, which is grown in large quantities in Australia, Thailand and Indonesia.[6] . The range of distribution of this fish is from the North Indian Ocean to the Western Pacific Ocean and extends from Iran to the northern part of Australia and lives at an optimum temperature of 28 to 30 degrees Celsius.[7] . In Bushehr province, the propagation and breeding of this species has started since 2008. At present, Ramoz company is active in the field of seabass fish breeding in Chahpahn region of the province. This company procures the fishes it needs from Australia, Thailand and Singapore and rears them in a closed circuit system. After reaching the market weight, the fish are caught and sent to the domestic market by ice coating method.

Considering the increasing marketability of this fish and the need to maintain its quality during storage using natural compounds, this research aims to increase the shelf life and improve the quality of seabass fish fillets by immersion in aloe vera gel during storage. It was done in the refrigerator.

2- Materials and methods

A number of 15 Asian seabass fish with an approximate weight of 1 kg to 900 grams were transported from Chah Pan to Bushehr in an ice container. Then, preparation operations including washing with water, scaling, emptying the abdomen, separating

the head and tail, filleting and final rinsing were done on the fish.

Fresh leaves of aloe barbadensis species(*Aloe barbadensis Miller*) It was taken from Afzal Aloe Vera farm in Ab Tawal village of Bushehr city and transported to Bushehr. The leaves were washed with water and the tips, ends and sharp edge of the leaves were separated. Then, using a hand knife, the middle part of the leaf was cut lengthwise and the upper skin of the leaves was separated from the jelly tissue in the middle of the leaf. After separation, the gels were crushed and mixed well by a blender for 3 minutes. After passing the homogenized mixture through a metal sieve, the desired gel was collected. In the last step, the pure gel was pasteurized at 70 degrees Celsius for 45 minutes using the Bain-Marie method.[8] .

For the purpose of coating, the prepared seabass fish fillets were divided into four separate parts. Three parts were immersed in gel with concentrations of 40, 70 and 100% for 10 minutes.[9] . The fourth part was placed in distilled water as a control treatment. After the desired time, the fillets were taken out and drained in a colander and finally packed in zip-top bags and glued. The coated fillets were stored in the refrigerator at 4°C for 16 days. The experiment started on the first day and on days 1, 6, 11 and 16 with an interval of 5 days, chemical, microbial and sensory tests were performed on the treatments with three repetitions. [10].

Amounts of moisture, fat, ash and protein according to AOC method (12)[11] were obtained and the amount of moisture was expressed based on dry weight. to measurepH Treatments, five grams of samples were homogenized in a beaker with 45 ml of distilled water for one minute by a homogenizer and with the help of the devicepH Meter (Stirrer Metrohm) ،pH The treatments were measured at room temperature[12] . LevelTBA Using a distillation device and collecting vapors from the sample at a wavelength of 538 nm, it was calculated in terms of milligrams of malondialdehyde. In order to measure volatile titrogenic bases(TVN) Extraction from the sample was done using a distillation apparatus, after adding magnesium oxide to the homogenized sample, and finally the sample was titrated.[13] . To measure the total bacterial load, the samples prepared in different dilutions using 0.9% physiological serum were transferred to a disposable sterile plate with a diameter of eight centimeters and then added to 12-15 ml of medium Cultivation of Kant agar plate culture medium(PCA) Pre-prepared with a temperature of about 42-44 degrees Celsius was added to the plate and the plates were kept at different temperatures.[14] . In order to evaluate the indicators of texture, color, smell and overall acceptance of raw fish fillets, they were evaluated by six people. The evaluation of the samples was done with 5 points: the score of each feature was done as follows: texture (5: firm and firm texture / 1: very soft texture) color (5: no color change / 1: completely colorless) Smell (5: completely pleasant / 1: smell of corruption) overall acceptability (5: completely acceptable / 1: completely unacceptable) score of 3 for fillets in sensory evaluation was considered as the limit of acceptability for human consumption.[15].

For the purpose of statistical analysis, the normality of the data was checked with the Kolmograph-Smirnov test, and the results of the chemical tests were performed using one-way analysis of variance with the help of software.SPSS was analyzed. To compare the pairwise differences of means from Tukey's multi-range test at the probability level = 0.05a was used The corresponding graphs were drawn in Excel software.

3- Results and discussion

3-1- Approximate analyses

The results of approximate analysis of sea bass immersed in different percentages of aloe vera gel (on the first day) are shown in Table 1. According to the results of this table, the amounts of ash and fat between the control treatment and other treatments did not show any significant difference($P>0.05$). The control and 70% treatments showed higher moisture values than the 40% and 100% treatments.($P<0.05$). The results of the humidity on the first day of the experiment were contrary to the expectation that it was stated that the humidity will be maintained in the fish tissue during coating. As a result, to confirm this claim, the moisture content of the coated fillets was also measured during the storage period. Treatments immersed in aloe vera gel showed a higher amount of protein than the control treatment($P<0.05$) ،So that the 40% treatment had the highest amount of protein and the 70% and 100% treatments showed a lower amount of protein than the 40% treatment and higher than the control treatment.($P<0.05$) (Table 1). This high amount of protein in the 40% treatment shows the inhibitory effect of the diluted aloe vera gel in the degradation of fish fillet protein.

Table 1 Approximate analysis values (moisture, fat, protein and ash) in sea bass fillets immersed in different percentages of aloe vera gel

Ash	Protein	Lipid(%)	Moisture	Treatments
$0.07^{a}\pm1.55$	$0.05^{c}\pm20.60$	$0.16^{a}\pm1.59$	$0.11^{a}\pm75.01$	control
$0/08^{a}\pm1.26$	$0.20^{a}\pm22.04$	$0.07^{a}\pm1.68$	$0.99^{b}\pm72.61$	40%
$0.04^{a}\pm1.46$	$0.15^{ab}\pm21.51$	$0.03^{a}\pm1.38$	$0.32^{a}\pm74.73$	70%
$0.03^{a}\pm1.35$	$0.17^{b}\pm21.29$	$0.09^{a}\pm1.43$	$0.1^{b}\pm72.14$	100%

Control treatment: Asian seabass fish fillet without aloe vera gel; 40% treatment: Asian seabass fillet immersed in 40% concentration of aloe vera gel; 70% treatment: Asian seabass fillet immersed in 70% concentration of aloe vera gel; 100% treatment: Asian seabass fish fillet immersed in 100% concentration of aloe vera gel. 2- The values are expressed based on the average of thre14.1e repetitions with ± standard deviation with 95% confidence (a, b and c lowercase letters indicate a significant difference at the level of $p < 0.05$ in different treatments).

During 16 days of storage, changes in moisture level (Figure 1) in the control treatments, 40% and 70% did not show any significant difference.($p>0.05$) But in the 100% treatment, the amount of moisture on the sixth and eleventh days of storage was lower than on the sixteenth day.($p<0.05$) And the amount of moisture on the first day of storage was not significantly different from other times($p>0.05$).

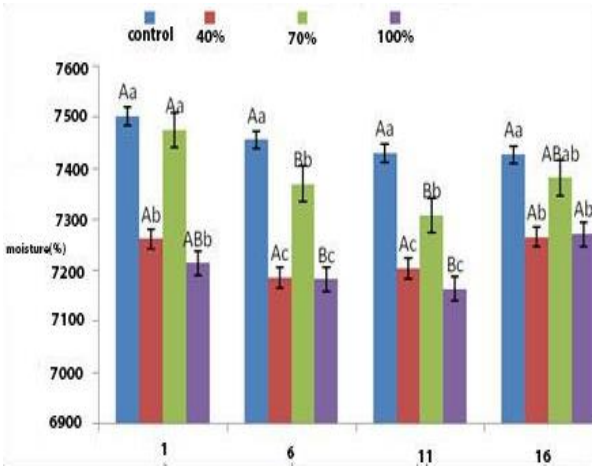

Fig 1 Values of the percentage of moisture in fillets coated with different percentages of aloe vera gel during the storage period in the refrigerator.

Control treatment: Asian seabass fish fillet without aloe vera gel; 40% treatment: Asian seabass fillet immersed in 40% concentration of aloe vera gel; 70% treatment: Asian seabass fillet immersed in 70% concentration of aloe vera gel; 100% treatment: Asian seabass fish fillet immersed in 100% concentration of aloe vera gel. 2- The values are expressed based on the average of three repetitions with ± standard deviation with 95% confidence (a, b and c lowercase letters indicate a significant difference at the level of $p < 0.05$ in different treatments and A, B and C uppercase letters It indicates a significant difference at the level of $P<0.05$ in different times).

In this study, the amount of moisture on different days of the experiment decreased with the passage of time until the end of the storage period, and on all the days of storage, the control sample showed the highest amount of moisture compared to the treatments coated with aloe vera gel.($p<0.05$). The 70% treatment showed a higher moisture content than the 40% and 100% treatments.($p<0.05$). Due to its gel properties, aloe vera gel provides more water absorption index in the coating[16] . In addition, it has been reported that the hydrophilic compounds present in aloe vera gel lead to an increase in the amount of water and moisture absorption in films and edible coatings prepared from this gel.[17] . It seems that in this study, aloe vera gel absorbed more moisture in the coated treatments compared to the control treatment, and for this reason, the control treatment showed higher moisture than the other treatments. Different percentages of aloe vera gel showed different results in the amount of moisture absorption of fish fillets, so that treatment 70showed a higher moisture % than the 40% and 100% treatments, which seems that increasing the concentration of the gel used in the coating of seabass fish fillets had an inverse effect on the amount of moisture absorption by the aloe vera gel coating. .

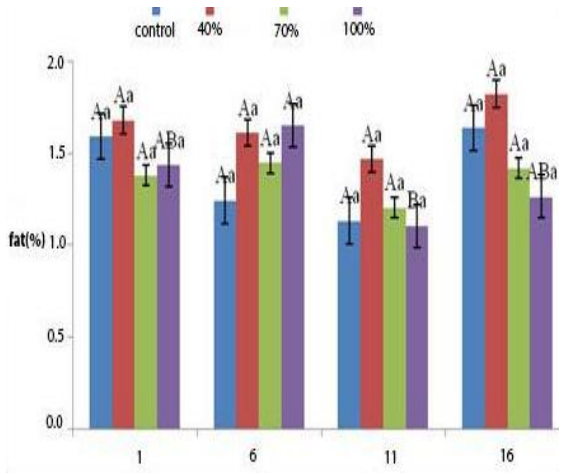

Fig 2 Values of the percentage of fat in fillets coated with different percentages of aloe vera gel during the storage period in the refrigerator.

Control treatment: Asian seabass fish fillet without aloe vera gel; 40% treatment: Asian seabass fillet immersed in 40% concentration of aloe vera gel; 70% treatment: Asian seabass fillet immersed in 70% concentration of aloe vera gel; 100% treatment: Asian seabass fish fillet immersed in 100% concentration of aloe vera gel. 2- The values are expressed based on the average of three repetitions with ± standard deviation with 95% confidence (a, b and c lowercase letters indicate a significant difference at the level of $p < 0.05$ in different treatments and A, B and C uppercase letters It indicates a significant difference at the level of $P<0.05$ in different times).

The amounts of fat in sea bass fillets immersed in different percentages of aloe vera gel during storage in the refrigerator are shown in Figure 2. According to the results, on different days of storage, no significant difference was observed in the amount of fat between the control treatment and other treatments($p>0.05$).

In the measurement of fish fat, different values are reported that such differences in the chemical composition of fish meat can be largely related to nutrition, fishing season (spawning period), sex difference, fish size, rearing environment and environmental conditions [18] . The difference in chemical compounds, especially the amount of fat, for the reasons mentioned above, can bring changes in sensory characteristics such as taste, smell, texture, color and appearance characteristics that determine the

acceptability of fish. It may also affect microbial growth. In this study, the effect of coating on the amount of fish fat among treatments and also during storage time did not show any significant effect.

3-2- pH

The results obtained according to Figure 3 showed that the amountpH In the control treatments, 100%, 70% had an increasing trend during 16 days of storage in the refrigerator. on all the days of the testpH In the control treatment, it was more than other treatments, and this difference was not significant on the eleventh and sixteenth day of the experiment($P<0.05$). On the sixth day of the experiment, control treatments, 100%, 70% and 40%, respectively, from the highest to the lowestpH showed($P>0.05$).

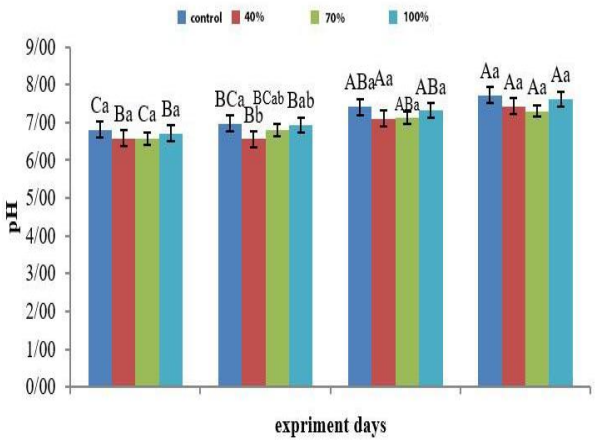

Fig 3 pH values in fillets coated with different percentages of aloe vera gel during the storage period in the refrigerator.

Control treatment: Asian seabass fish fillet without aloe vera gel; 40% treatment: Asian seabass fillet immersed in 40% concentration of aloe vera gel; 70% treatment: Asian seabass fillet immersed in 70% concentration of aloe vera gel; 100% treatment: Asian seabass fish fillet immersed in 100% concentration of aloe vera gel. 2- The values are expressed based on the average of three repetitions with ± standard deviation with 95% confidence (a, b and c lowercase letters indicate a significant difference at the level of $p < 0.05$ in different treatments and A, B and C uppercase letters It indicates a significant difference at the level of $P<0.05$ in different times).

IncreasepH During the storage of fish in the refrigerator, it depends on the accumulation of alkaline compounds such as ammonia and trimethylamine, etc[19] . These compounds can be attributed to the activity of spoilage bacteria and their products. The results showed that with the passage of time and due to bacterial activities, the amount ofpH On different days of storage, there was a significant increase for each treatment, but the comparison of treatments showed that only on the sixth day of storage, the coverage significantly decreased.pH has played a role Past studies showed that aloe vera gel haspH It is acidic and the results ofpH Coated fillets can also be partially affected by this coating[20 , 21] . As seen in the results, during the maintenance period of the control treatment, the amountpH It showed higher compared to coated treatments. Significant effect of reductionpH Aloe vera gel was not observed in the treatments coated with different percentages of this gel, so that the treatment40% of the amountpH compared to the two treatments of 70% and 100%, while it was expected that with the increase in the percentage of aloe vera gel, the amount of reductionpH It will also increase in covered treatments. Similar results were observed in adding different percentages of aloe vera gel powder to chicken noodle formulation[16] . that despite being highpH In the control treatment, there was no significant difference between the treatments containing aloe vera gel.

3-3- Amount of volatile nitrogen bases (TVB-N)

Table 2 shows the results of volatile nitrogen bases between treatments and during the period of storage in the refrigerator. During the storage period, the amount of volatile nitrogenous bases in all experimental treatments showed an increasing trend and in

On the 16th day, they exceeded the limit of volatile nitrogen bases($p<0.05$) The limit of acceptance for fresh fish is 30 mgTVB-N It is in 100 grams of meat] [22 , 23 . During the storage period, the highest intensity of changes in the amount of volatile nitrogenous bases was observed in the control treatment and the lowest intensity was observed in the 40% treatment.($p<0.05$). Among the treatments coated with aloe vera gel, the 40% and 70% treatments, respectively, showed a lower amount of volatile nitrogenous bases compared to the 100% aloe vera gel treatment.($p<0.05$) So that the lowest amount of volatile nitrogenous bases was observed in the treatments covered with 40% aloe vera gel.($p<0.05$).

The change process of volatile nitrogen bases followed the change process of total microbial load. Based on the results, it seems that the application of diluted aloe vera gel was more effective on the amount of volatile nitrogenous bases in seabass fillets, because with the increase in the concentration of the gel used in coating, the amount of volatile nitrogenous bases also increased. found While the results of the studySoltanizadeh AndMousavinejad (2015) [24] On the coating of shrimp with aloe vera gel, it was contrary to the results of the present study, so that the percentages of 100% and 70% aloe vera gel showed the lowest amount of volatile nitrogenous bases. As a result, it seems that the highest anti-spoilage effect in aloe vera gel is variable according to the test conditions and the food used.

Table 2 Values of volatile nitrogen bases, TBA and total bacterial count in sea bass fillets coated with different percentages of aloe vera gel

Chemical factors				test day
Bacterial count	TBA	TVN	treatment	
5.79±0.08[a]	2.34±0.11[a]	18.60±0.04[a]	control	0
4.77±0.04[b]	1.74±0.08[b]	15.80±0.18[b]	40%	
4.72±0.03[b]	1.58±0.09[b]	11.31±0.38[c]	70%	
4.87±0.05[b]	1.64±0.07[b]	11.52±0.03[c]	100%	
6.94±0.02[a]	3.27±0.08[a]	28.63±0.05[a]	control	6
5.64±0.05[b]	2.55±0.13[b]	22.65±0.16[d]	40%	
5.81±0.06[c]	2.50±0.18[b]	25.03±0.21[c]	70%	
6.37±0.04[b]	2.77±0.04[ab]	27.01±0.34[b]	100%	

7.76±0.09[a]	4.84±0.04[a]	42.54±0.04[a]	control	11
6.76±0.1[c]	3.76±0.6[b]	26.26±0.29[c]	40%	
6.02±0.03[d]	3.78±0.09[b]	30.56±0.02[b]	70%	
7.26±0.05[b]	3.76±0.13[b]	31.54±0.2[b]	100%	
8.29±0.09[a]	6.37±0.09[a]	80.55±0.23[a]	control	16
7.44±0.07[b]	4.07±0.04[c]	42.58±0.16[d]	40%	
7.69±0.07[b]	4.65±0.09[b]	70.08±0.04[c]	70%	
8.96±0.07[a]	4.96±0.02[b]	72.20±0.04[b]	100%	

Control treatment: Asian seabass fish fillet without aloe vera gel; 40% treatment: Asian seabass fillet immersed in 40% concentration of aloe vera gel; 70% treatment: Asian seabass fillet immersed in 70% concentration of aloe vera gel; 100% treatment: Asian seabass fish fillet immersed in 100% concentration of aloe vera gel. The values are expressed based on the average of three repetitions with ± standard deviation with 95% confidence (unlike letters in each column of the test day indicate significance and similar letters indicate non-significance).

4-3- Thiobarbituric acid (TBA)

According to Table 2, the results of measuring the changes in the amount of thiobarbituric acid in the experimental treatments showed an increasing trend during the maintenance period. In general, the control treatment valuesTBA It showed higher than the treatments coated with aloe vera gel($p<0.05$). Although all three treatments 40%, 70% and 100% during the maintenance period significant difference in valuesTBA They did not show, but at the end of the maintenance period, the amountTBA In the 40% and 70% treatments, it was lower than the 100% treatment($p<0.05$). Fat oxidation is one of the important factors of oxidative degradation during the storage period of marine products, which leads to the destruction of the taste and smell of the product and the production of toxic compounds.[13]. Aloe vera gel has a high antioxidant capacity due to the presence of polyphenol, indole and alkaloid antioxidant compounds.[25] And the antioxidant capacity of aloe vera gel has been reported in various studies[26 , 21] . The results of the present research were consistent with the results of coating the chicken pieces with aloe vera gel, which led to a decrease in fat oxidation compared to the control treatment.[27]. It seems that the antioxidant effect of aloe vera gel in the coating process, up to a certain concentration, will exert its highest effect during the storage period, as in the present research, at the end of the storage period, treatments of 40 % and 70% of the amountTBA They showed less compared to 100% treatment. The results of this research, unlike the results of the studySoltanizadeh AndMousavinejad (2015) [24] by investigating the effects of aloe vera gel coating with different concentrations on the quality of green tiger shrimp during storage in the refrigerator, they stated that the shrimp coated with high concentrations of aloe vera gel (75 and 100%) had a lower oxidation rate. Showed. As a result, it seems that the highest oxidation effect of aloe vera gel varies according to the test conditions and the food used.

5-3- Measurement of total bacterial load (TVC)

The results of the total bacterial load (Table 2) showed that on the first day of storage, the control treatment had a

significantly higher total bacterial load than the coated treatments.($p<0.05$) so that from the amount log(cfu/g)5 on the first day of maintenance tolog(cfu/g) 8 arrived at the end of the maintenance period. It has been reported that the count of total bacterial load in Asian seabass fish starts from 4.5 log(cfu/g) on the first day of storage and reaches the highest level after 12 days.log(cfu/g) 9/7 arrived[28] ،As a result, the coated fillets were out of the allowed limit at the end of the storage period. No significant difference was observed among other treatments coated with aloe vera gel($p>0.05$). During the storage period, changes in the total bacterial load in all experimental treatments showed an increasing trend, and the intensity of these changes in all treatments was almost the same.($p<0.05$). From the sixth day to the end of the storage period, the 40% and 70% treatments showed lower bacterial load than the 100% treatment.($p<0.05$). Probably, the reason for these changes can be attributed to the antibacterial effects of aloe vera gel, which is known to inhibit the activity of pathogenic bacteria.[29]. In the current study, the control treatment showed a higher bacterial load than the coated treatments, which is in agreement with the results of reducing the bacterial load in the coated treatments of chicken pieces.[27] and nugget[20] It was consistent with aloe vera gel. On the other hand, considering that the treatments of 40% and 70% showed the lowest amount of total bacterial load, it seems that the use of higher concentrations of aloe vera gel will not have much effect on this factor.

6-3- Investigating the sensory evaluation in the samples

The results of sensory evaluation showed that color, smell, texture and overall acceptance indicators did not show any significant difference in all treatments at the beginning of the test period.($p>0.05$) which indicated high acceptance of treatments. In this study, changes in sensory evaluation indices showed variable and diverse results and did not follow a specific trend (Table 3). In the odor factor, the 40% treatment showed the highest acceptance in all days compared to the control and the 70% and 100% treatments.($p<0.05$) Also, during the storage time, the smell index had a decreasing trend in all treatments, but this trend showed a milder decrease in the 40% treatment than the other treatments. In terms of color and texture indices, the 70% and 100% treatments often had higher values than the control and the 40% treatment.($p<0.05$) And during the storage period, a decreasing trend was observed in the color and texture indices, but in general, the severity of this decreasing trend was higher in the control treatment than in the treatments coated with different percentages of aloe vera gel. In the overall acceptance index, the 40% and 100% treatments showed higher acceptance than the control and 70% treatment.($p<0.05$). The general result of the sensory evaluation showed that from the eleventh day, the control treatment had completely unfavorable conditions and was unusable, while the quality of the other treatments was acceptable, and on the sixteenth day, almost all the samples were unacceptable, and the score of the control sample was also at the end of the period. Maintenance was the lowest amount.

Table 3 Sensory evaluation of seabass fish fillet coated with different concentrations of aloe vera gel during storage in the refrigerator

Overall acceptability	texture	odor	color	treatments	Storage time(day)
5.17±0.11 Aa	5.04±0.03 Aa	5.10±0.1 Aa	5.17±0.1 Aa	control	0

5.15±0.09 Aa	5.15±0.11 Aa	5.17±0.11 Aa	5.17±0.11 Aa	40%	
5.05±0.06 Aa	5.17±0.11 Aa	5.15±0.11 Aa	5.04±0.03 Aa	70%	
5.15±0.09 Aa	5.15±0.11 Aa	5.05±0.06 Aa	5.1±0.05 Aa	100%	
3.73±0.06 Bc	3.99±0.04 Bb	3.55±0.06 Bc	3.57±0.33 Bb	control	6
4.13±0.08 Bb	4.08±0.05 Bb	5.01±0.02 Aa	4.20±0.1 Bb	40%	
4.09±0.08 Bb	4.03±0.05 Bb	4.15±0.1 Bb	4.11±0.08 Bb	70%	
5.07±0.12 Aa	5.07±0.12 Aa	4.00±0.01 Bb	5.12±0.07 Aa	100%	
2.04±0.07 Cc	2.02±0.03 Cc	2.02±0.03 Cc	3.00±0.05 Bc	control	11
3.99±0.03 Not	3.05±0.03 Cb	4.01±0.01 Not	4.01±0.08 Bb	40%	
4.1±0.07 Not	4.06±0.05 Not	3/58±0.09 Cb	5.02±0.07 Aa	70%	
3.03±0.06 Bb	3.13±0.08 Bb	3.03±0.05 Cb	4.98±0.06 Aa	100%	
1.07±0.21 Dc	1.21±0.16 And	1.01±0.02 Dc	1.99±0.03 Cc	control	16
2.77± 0.06 That	1.98±0.01 Db	2.35±0.09 That	4.07±0.04 Not	40%	
1.98±0.15 That	2.09±0.14 Cb	2.07±0.05 Db	3.99±0.05 Not	70%	
2.00±0.02 Cab	2.44±0.08 Not	2.06±0.08 Db	3.16±0.08 Bb	100%	

Control treatment: Asian seabass fish fillet without aloe vera gel; 40% treatment: Asian seabass fillet immersed in 40% concentration of aloe vera gel; 70% treatment: Asian seabass fillet immersed in 70% concentration of aloe vera gel; 100% treatment: Asian seabass fish fillet immersed in 100% concentration of aloe vera gel. 2- The values are expressed based on the average of three repetitions with ± standard deviation with 95% confidence (a, b and c lowercase letters indicate a significant difference at the level of $p < 0.05$ in different treatments and A, B and C uppercase letters It indicates a significant difference at the level of $P<0.05$ in different times).

The process of changing the state of the sensory evaluation traits in the treatments during the storage period is coordinated and consistent with the oxidation changes in the tested treatments, which can be said to be because the oxidation of fat leads to the destruction and loss of sensory quality and the reduction of the amount of nutrients, including the reduction of acids. Polyunsaturated fatty acids are essential and produce oxidation products[30] The results of the sensory evaluation also showed that the improvement of the tissue score of the samples coated with aloe vera gel is probably due to the effect of this coating on the activity of microorganisms and as a result reducing the degradation and denaturation of proteins. The results of this part of the study with resultsChauhan (2016) [27] It matched.

4- General conclusion

The results of chemical analyzes showed that the use of aloe vera gel coating played a role in reducing the increasing trend of oxidative damage indicators (thiobarbituric acid and total volatile nitrogenous bases) compared to the control treatment and also led to a decrease in the total bacterial load. In terms of sensory evaluation, the control treatment had an unacceptable condition on the eleventh day of the experiment, while the treatments coated with aloe vera gel had better quality. On the other hand, the results of this study show that aloe vera gel when diluted with distilled water (concentrations of 40% and 70%) was more effective in maintaining the quality of fish fillet.

5- Resources

[1] Mexis S.F,. Chouliara E., Kontominas M.G. 2009. Combined effect of an oxygen absorber and oregano essential oil on shelf life extension of rainbow trout fillets stored at 4 degrees C. Food Microbiology 26(6), 598-605.

[2] Hashemi, M., Hashemi, M., Daneshamooz, S., Raeisi, M., Jannat, B., Taheri, S., & Noori, S. M. A. 2020. An overview on antioxidants activity of polysaccharide edible films and coatings contains essential oils and herb extracts in meat and meat products. Advances in Animal and Veterinary Sciences, 8(2), 198-207.

[3] Maan, A. A., Ahmed, Z. F. R., Khan, M. K. I., Riaz, A., & Nazir, A. 2021. Aloe vera gel, an excellent base material for edible films and coatings. Trends in Food Science & Technology, 116, 329-341.

[4] Maan, A. A., Nazir, A., Khan, M. K. I., Ahmad, T., Zia, R., Murid, M., & Abrar, M. 2018. The therapeutic properties and applications of aloe vera: A review. Journal of Herbal Medicine, 12, 1–10.

[5] Valverde J M, Valero D, Martinez-Romero D, Guillen F, Castillo S, Serrano M. 2005. Novel edible coating based on Aloe vera gel to maintain table grape quality and safety. Agri Food Chem, 53: 7807-7813.

[6] Larson, H. 1999. Perciform orders. Suborder Percoidei. Centropomidae. Be per ches.pp 2429-2
51. Lin C.C., Lin C.S; 2005 Enhancement of the storage quality of frozen bonito fillet by glazing with tea extracts. Food Control 16(2), 169-175.

[7] Tian, X., Qin, J.G, 2003. A single phase of food deprivation provoked compensatory growth in barramundi, Lates calcarifer. Aquaculture. 33(3): 53-59.

[8] Adetunji CO , Fawole OB , Arowora KA , Nwaubani SI , Ajayi ES, Oloke JK , Majolagbe OM , Ogundele BA , Aina JA , Adetunji JB . 2012. Effects of Edible Coatings from Aloe Vera Gel on Quality and Postharvest hysiology of Pineapple Comosus (L.) Fruit During Ambient Storage. Global Journal of Science Frontier ResearchBio-Tech & GeneticsVolume 12 Issue 5 Version 1.0 .pp 38-43.

[9] Emamifar, A. 2015. Evaluation of Aloe vera gel effect as an edible coating on microbial, physicochemical and sensorial characteristics of fresh strawberry during storage. Innovative Food Technologies, 2(2), 15-29.

[10] Javaheri Baboli, M., Velayatzadeh, M., Jagir, M., & Pashaei, A. 2015. Effect of vacuum packaging on the shelf-life and quality of Hypophthalmichthys molitrix fillets during storage in refrigerator temperature. Food Hygiene, 5(1 (17)), 91-101.

[11] AOAC. Official methods of analysis (17th ed.). 2000. Gaithersberg, Maryland: Association of Official Chemists.

[12] Das AK, Anjaneyulu ASR, VermaAK, KondaiahN .2008. Physicochemical, textural, sensory characteristics and storage stability of goat meat patties extended with full-fat soy paste and soy granules. Int J Food Sci Tech 43:383-392.

[13] Khalafalla, F.A., Ali, F.H. and Hassan, A.R. 2015. Quality improvement and shelf-life extension of refrigerated Nile tilapia (Oreochromis niloticus) fillets using natural herbs. Journal Basic and Applied Sciences. 4(1): 33-40.

[14] Arashisar, Ş., Hisar, O., Kaya, M., & Yanik, T. 2004. Effects of modified atmosphere and vacuum packaging on microbiological and chemical properties of rainbow trout (Oncorynchus mykiss) fillets. *International journal of food microbiology*, *97*(2), 209-214.

[15] Ojagh SM., Rezaei M., Razavi SH., Hosseini S.M.H. 2010. Effect of chitosan coatings enriched with cinnamon oil on the quality of refrigerated rainbow trout. J Food Chem; 120: pp193-198.

[16] Pavan, M., Sathu, T., Sunil, B., Vasudevan, V. N., Irshad, A., & Sasi, S. 2019. Effect of Different Level of Natural Antioxidant Aloe vera in Instant Functional Chicken Noodles. Int. J. Curr. Microbiol. App. Sci, 8(10), 1850-1857.

[17] Saibuatong, O.A. and Phisalaphong, M. 2010. Novo aloe vera–bacterial cellulose composite film from biosynthesis. Carbohydrate Polymers, 79(2). pp.455-460.

[18] Pacheco-Aguilar, R., Lugo-Sanchez, M. E., & Robles-Burgueno, M. R. 2000. Post-mortem biochemical and functional characteristic of Monterey sardine muscle stored at 0 ℃, Journal of Food Science, 65, 40–40. 47.

[19] Lopez-Caballero, M.E., Martinez-Alvarez, O., Gomez-Guillen, M.C., Montero, P. 2007.Quality of thawed deepwater pink shrimp (Parapenaeus longirostris) treated with melanosis-inhibiting formulations during chilled storage. International Journal of Food Science and Technology 42, 1029–1038.

[20] Das A, Rajkumar V, Verma AK, Patra G, Pradhan S. 2016. Quality and acceptability of meat nuggets with fresh Aloe vera gel. Asian-Australasian J Animal Sci 25 (9): 702-708.

[21] Soltanizadeh N,Ghiasi-Esfahani H. 2015. Qualitative improvement of low meat beef burger using *Aloe vera*. Meat Sci 99: 75-80.

[22] Harpaz, S., Glatman, L., Drabkin, V., & Gelman, A. 2003. Effects of herbal essential oils used to extend the shelf life of freshwater-reared Asian sea bass fish (Lates calcarifer). Journal of food protection, 66(3), 410-417.

[23] Bensid, A., Ucar, Y., Bendeddouche, B., & Özogul, F. 2014. Effect of the icing with thyme, oregano and clove extracts on quality parameters of gutted and beheaded anchovy (Engraulis encrasicholus) during chilled storage. Food Chemistry, 145, 681-686.

[24] Soltanizadeh,N; Mousavinejad,S M. 2015. The effects of Aloe vera (Aloe barbadensis) coating on the quality of shrimp during cold storage. journal of food science and technology mysore .

[25] Nejatzadeh-Barandozi F. 2013. Anti-bacterial activities and antioxidant capacity of *Aloe vera*.Org Med Chem Letters 3: 1-8.

[26] Jairath G, Chatli MK, Biswas AK. 2016. Comparative study on in vitro and invivo evaluation of antioxidant potential of apple peel extract and Aloe vera gel. J Food Process Preserv doi: 10.1111/jfpp.12639.

[27] Chauhan, P., Das, A. K., Kandeepan, G., Nanda, P. K., Pradhan, S. R., Kumbhar, V., Yadav, J.P., & Bhattacharya, D. 2016. Effect of Aloe vera gel based edible coating containing Moringa oleifera leaf extract on the quality of chicken bites. J Food Process Technol, 7(627), 2.

[28] Ahmad, M; Benjakul, S; Sumpavapol, P ; Nirmal, N.P. 2012. Quality changes of sea bass slices wrapped with gelatin film incorporated with lemongrass essential oil, International Journal of Food Microbiology 155 .PP171–178.

[29] Saritha V, Anilakumar K R, Khanum F. 2010. Antioxidant and antibacterial activity of*Aloe vera*gel extracts. Int J Pharm BiolArch1: 376-384.

[30] Sonawane, S. K., Gokhale, J. S., Mulla, M. Z., Kandu, V. R., & Patil, S. 2021. A comprehensive overview of functional and rheological properties of aloe vera and its application in foods. *Journal of Food Science and Technology*, *58*, 1217-1226.

مجله علوم و صنایع غذایی ایران

سایت مجله: www.fsct.modares.ac.ir

مقاله علمی_پژوهشی

مطالعه تاثیر غلظت‌های مختلف ژل آلوئه ورا بر شاخص‌های حسی، میکروبی و شیمیایی ماهی سی باس آسیایی (*Lates calcarife* (Bloch,۱۷۹۰)) طی دوره‌ی نگهداری در یخچال

حکیمه فکراندیش [۱]، انیسه جمشیدی [۲*] و ماندانا شمسی زاده [۳]

۱- گروه شیلات، واحد بوشهر، دانشگاه آزاد اسلامی، بوشهر، ایران.

۲*-گروه عمل‌آوری فراورده‌های شیلاتی، دانشگاه علوم کشاورزی و منابع طبیعی گرگان، ایران.

۳-گروه فراوری محصولات شیلاتی موسسه آموزش عالی خرد- بوشهر-ایران.

اطلاعات مقاله

تاریخ های مقاله :

تاریخ دریافت: ۱۳۹۷/۶/۲۰

تاریخ پذیرش: ۱۴۰۲/۴/۷

کلمات کلیدی:

پوشش ژل آلوئه‌ورا،

ماهی سی‌باس آسیایی،

غلظت ژل،

مدت ماندگاری

DOI: 10.22034/FSCT.20.137.143

DOR:20.1001.1.20088787.1402.20.137.11.1

* مسئول مکاتبات:

a.jamshidi1382@gmail.com

چکیده

مطالعه حاضر به منظور بررسی تاثیر پوشش ژل آلوئه ورا (*Aloe barbadensis* Miller) با غلظت های مختلف بر حفظ کیفیت و ماندگاری فیله تازه ماهی سی‌باس آسیایی (*Lates calcarifer*) طی نگهداری در یخچال (۴ C^o) انجام شد. تیمارها شامل فیله‌های تازه ماهی سی باس پوشش‌دهی شده با غلظت‌های مختلف ۴۰٪، ۷۰٪ و ۱۰۰٪ ژل آلوئه ورا (رقیق سازی با استفاده از آب مقطر) و تیمار شاهد (بدون ژل آلوئه ورا) بودند که در روزهای ۱، ۶، ۱۱ و ۱۶ نگهداری، تحت آزمایش‌های شیمیایی و میکروبی شامل مجموع بازهای نیتروژنی فرار، تیو باربیتوریک اسید، pH، بار کل باکتریایی و همچنین ارزیابی حسی قرار گرفتند. در نمونه‌های پوشیده شده با ژل میزان بازهای نیتروژنی فرار و تیوباربیتوریک اسید از روز ششم اختلاف معنی‌داری را با نمونه شاهد نشان دادند ($P<0.05$) و در روز شانزدهم نگهداری کمترین میزان شاخص‌های اکسیداسیون در تیمار ۴۰٪ مشاهده شد. مقدار pH روند افزایشی را طی دوره نگهداری نشان داد که مقدار آن در نمونه شاهد از سایر نمونه ها بالاتر بود و در پایان دوره نگهداری، تیمار ۷۰٪ کمترین مقدار pH را به نمایش گذاشت. شمارش بار باکتریایی کل نیز به طور معنی‌داری ($P<0.05$) از روز ششم در نمونه شاهد بیشتر از نمونه‌های دیگر بود و کمترین میزان شمارش بار باکتریایی در پایان دوره نگهداری، در تیمار ۴۰٪ مشاهده شد. در انتهای دوره نگهداری، تیمار شاهد از لحاظ شاخص‌های ارزیابی حسی در وضعیت غیر قابل قبولی بود به طوری که سایر تیمارها شاخص‌های ارزیابی حسی بالاتری را نسبت به شاهد نشان دادند. مطابق نتیجه حاصل از این تحقیق کاربرد پوشش ژل آلوئه ورا ۴۰٪ و ۷۰٪ علاوه بر بهبود فاکتورهای شیمیایی فیله ماهی، اثر مطلوبی بر شاخص‌های حسی فیله ماهی سی باس آسیایی نشان داد.