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ENVIRONMENTAL CONTROL OF LOW SALT MACKEREL PEDA FERMENTATION WITH DIFFERENT LEVELS

Karakteristik Organoleptik Peda Kembung Rendah Garam Selama Pengendalian Lingkungan Dengan Penggunaan Kadar Garam Yang Berbeda

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ABSTRACT

Peda is one of the fermented products made through a spontaneous fermentation process, namely fermentation without starter bacteria. Environmental control is one of the important stages in peda fermentation because at this stage it requires the growth of fermentation bacteria originating from within the fish body. Salt is used during environmental control because salt can inhibit the growth of spoilage microbes and provide a suitable environment for fermentation microbes. The purpose of this study was to determine the use of appropriate salt levels to control the environment for the growth of fermentation bacteria so that the final product produced has uniform quality and the most favorable organoleptic characteristics. This research was conducted in December 2022 at the Fishery Product Processing Laboratory, Faculty of Fisheries and Marine Science, Padjadjaran University. The method used in this research is an experimental method by controlling the fermentation environment for 7 days consisting of six treatments, namely using salt in levels of 0%, 15%, 20%, 25%, 30%, and 35%, with observations made on day 1 to day 7, organoleptic tests were conducted by 15 semi trained panelists. The results of the organoleptic test were analyzed using non-parametric statistics with the Friedman test, if there is a significant difference then a further test of multiple comparison is carried out and the Bayes test is carried out for decision making. The results showed that the best treatment was the treatment using 20% salt content for 7 days with a pH value of 6.3; moisture content of 61.5%; salt content of 11.79% with a median characteristic value of appearance 5, aroma 7, texture 5, and taste 7 which was the most preferred treatment by panelists.

Keywords: Mackarel Peda, Organoleptic, Salt

ABSTRAK

Peda merupakan salah satu produk fermentasi yang dubuat melalui proses fermentasi spontan yaitu fermentasi tanpa bakter starter. Pengendalian lingkungan merupakan salah satu tahapan penting dalam fermentasi peda karena pada tahap ini dibutuhkan pertumbuhan bakteri fermentasi yang berasal dari dalam tubuh ikan tersebut. Garam digunakan selama pengendalian lingkungan karena garam dapat menghambat pertumbuhan mikroba pembusuk dan memberi

lingkungan yang sesui untuk mikriba fermentasi. Tujuan dari penelitian ini adalah untuk mengetahui penggunaan kadar garam yang sesuai untuk mengendalikan lingkungan bagi pertumbuhan bakteri fermentasi sehingga hasil akhir produk yang dihasilkan memiliki mutu yang seragam dan karakteristik organoleptik paling disukai. Penelitian ini dilaksanakan pada bulan Desember 2022 bertempat di Laboratorium Pengolahan Hasil Perikanan, Fakultas Perikanan dan Ilmu Keluatan Universitas Padjadjaran. Metode yang digunakan pada riset ini adalah metode eksperimental dengan pengendalian lingkungan fermentasi selama 7 hari yang terdiri dari enam perlakuan yaitu menggunakan garam dalam kadar 0%, 15%, 20%, 25%, 30%, dan 35%, dengan pengamatan dilakukan pada hari ke 1 sampai hari ke 7, uji organoleptik dilakukan oleh 15 orang panelis semi terlatih. Hasil uji organoleptik dianalisis menggunakan statistik non-parametrik dengan uji Friedman, apabila terdapat perbedaan yang nyata maka dilakukan uji lanjutan perbandingan berganda (multiple comparison) dan dilakukan uji Bayes untuk pengambilan keputusan. Hasil penelitian menunjukan bahwa perlakuan terbaik terdapat pada perlakuan penggunaan kadar garam 20% selama 7 hari dengan nilai pH 6,3; kadar air 61,5%; kadar garam 11,79% dengan nilai median karakteristik kenampakan 5, aroma 7, tekstur 5, dan rasa 7 yang merupakan perlakuan paling disukai oleh panelis.

Kata kunci: Garam, Organoleptik, Peda kembung

INTRODUCTION

Peda is a fishery product produced through a fermentation process and is very popular with the public because it has a distinctive flavor and aroma and has a long shelf life (Juharni, 2013). The appearance, texture, aroma and taste of peda are the main factors that determine consumers' decisions to buy peda fish. Among the factors that determine the final quality of peda, besides the freshness of the raw materials, are the length of salting and the amount of salt used during the fermentation process because the amount of salt given will affect environmental conditions and the number of microbes that play a role in fermentation (Ijong & Ohta, 1996).

Salt can be used as an environmental control during the process of making peda because salt has bacteriostatic properties which can inhibit the growth of spoilage bacteria (Thariq et al., 2014). Making peda usually uses a fairly high salt content, namely 40%. Excessive salt consumption can pose a risk to health, various diseases can occur due to consuming high amounts of salt, one of which is high blood pressure or hypertension (Elvivin et al., 2016). This could be overcome by reducing the use of salt and adjusting the salting time in the peda fish fermentation process, but reducing the amount of salt can disrupt the fermentation process to the point where it fails (Nafianti, 2016).

Based on the explanation above regarding the use of quite a lot of salt during the manufacture of peda which is feared to have an adverse impact on consumer health, further research needs to be carried out. The aim of this research is to find a salt level that is suitable for use in environmental control with a relatively low salt content but produces a peda that is well fermented and liked by consumers.

METHODS

This research was carried out in December 2022, organoleptic tests, water content tests and pH measurements were carried out at the Fisheries Product Processing Laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University and salt content tests were carried out at the Test Services Laboratory, Faculty of Agricultural Industrial Technology, Padjadjaran University.

The treatments used in this research were control (0% salt content), 15%, 20%, 25%, 30% and 35% salt content. The pH value and water content were tested every day from day 1 to day 7, salt content was tested on day 1, day 3 and day 7 while organoleptic tests were carried

out on day 1 for the control treatment (0% salt content) and on day 3 (initial fermentation period) and day 7 (last day of environmental control) for treatments with salt levels of 15%, 20%, 25%, 30% and 35%.

pH value, water content, salt content and organoleptic characteristics which include appearance, aroma, texture and taste. The pH values, water content and salt content were analyzed descriptively while the organoleptic characteristics were analyzed using the Friedman test to see which treatment the panelists preferred most and the Bayes method was used to find out the characteristics that most influenced the panelists in assessing the peda fish.

RESULT

pH Value

The pH values observed from each treatment varied, the observed pH values ranged from 7.1 to 5.9. The pH value of each treatment observed from day 1 to day 7 can be seen in full in table 1.

Table 1. pH value of peda fish in each treatment

Treatment salt content	Day of observation						
(%)	1	2	3	4	5	6	7
0	6,7	6,9	7,1	7,1	6,9	6,8	6,8
15	6,7	6,6	6,6	6,6	6,5	6,5	6,4
20	6,7	6,6	6,6	6,5	6,4	6,4	6,3
25	6,6	6,5	6,3	6,3	6,2	6,2	6,2
30	6,5	6,4	6,3	6,3	6,2	6,2	6
35	6,4	6,1	6,1	6	6	5,9	5,9

Water Content

The water content contained in peda fish will affect the nutritional value of the product because enzymatic, microorganism and chemical metabolic activities will have an effect depending on the water content contained in the product (Winarni in Nafiati, 2016). The water content of each treatment on each observation day can be seen in Table 2.

Table 2. Water content values for peda fish in each treatment

Treatment salt content	Day of observation (%)						
(%)	1	2	3	4	5	6	7
0	79,5	81	82,5	84	85	87	88,5
15	78	73,5	71	71	70	67,5	66,5
20	77	72	70,5	68	65	61,5	61,5
25	77,7	71,5	71	66	61	59,5	58,5
30	77	71	67	64,5	62	58,5	57
35	75,5	66,5	63	63	63	57,5	55

Salinity

The salt content in peda fish is an important factor in the success of the fermentation control process. Differences in salt levels will influence the types of microorganisms that live (Desrosier, 1988). The salt content of each treatment can be seen in Table 3.

Table 3. Salt content values for peda fish in each treatment

Treatment salt content (%)	Day of observation (%)		
	1	3	7
0	0,81	-	-
15	1,23	5,99	10,54
20	1,81	8,55	11,79
25	2,12	10,17	13,08
30	4,55	10,41	14,76
35	5,49	14,7	16

Note: (-) no observations were made

Appearance

Appearance gives rise to the first impression of the product which is seen whether the panelist assesses the product as good or not before he decides to observe other parameters (Soekarto, 1985 in Rochima, 2005). The average value of the hedonic test on the appearance of peda fish is presented in Table 4.

Table 4. Appearance value of peda fish in each treatment

Treatment salt content (%)	Day to-	Median	Average
0	1	7	7,4 b
15	3	5	5,4 ab
	7	5	4,7 a
20	3	5	4,9 ab
	7	5	5,7 ab
25	3	7	5,9 ab
	7	5	5,3 ab
30	3	5	5,8 ab
	7	5	4,7 a
35	3	5	4,5 a
	7	5	5,4 ab

Note: Numbers followed by the same letters in the treatment averages indicate there is no significant difference according to the multiple comparison test with a significance level of 5%.

Scent

The emergence of aroma is caused by the presence of volatile compounds from a food that enter the nasal cavity and are felt by the olfactory receptors, thus forming a response (Kemp et al., 2009 in Tarwendah, 2017). The average value of spicy aroma in each treatment can be seen in Table 5.

Table 5. Flavor value of peda fish in each treatment

Treatment salt content (%)	Day to-	Median	Average
0	1	3	4,5 ab
15	3	3	3,7 a
	7	5	5,7 ab
20	3	5	5,4 ab
	7	7	6,2 b
25	3	7	6,5 b
	7	5	5,1 ab

Treatment salt content (%)	Day to-	Median	Average
30	3	5	5,3 ab
	7	5	5,3 ab
35	3	5	5,3 ab
	7	5	5,1 ab

Note: Numbers followed by the same letters in the treatment averages indicate there is no significant difference according to the multiple comparison test with a significance level of 5%.

Texture

Texture is the physical characteristic of food that is obtained from the response of the sense of touch when it comes into contact with the surface of the food (Tarwendah, 2017). The average value of the peda fish texture test by panelists from various treatments can be seen in Table 6.

Table 6. Texture value of peda fish in each treatment

Treatment salt content (%)	Day to-	Median	Average
0	1	5	6,3 a
15	3	5	5,1 a
	7	5	5,7 a
20	3	5	4,9 a
	7	5	5,8 a
25	3	7	6,2 a
	7	5	5,5 a
30	3	5	5,1 a
	7	5	4,2 a
35	3	5	5,0 a
	7	5	4,5 a

Note: Numbers followed by the same letters in the treatment averages indicate there is no significant difference according to the multiple comparison test with a significance level of 5%.

Flavor

Taste is one of the important factors that determines whether a consumer likes a product or not. The consumer's final decision to accept or reject a product is greatly influenced by taste. If other parameters in a product are felt to be good but the taste is considered unpleasant then it is very likely that consumers will reject the product (Martianto & Soekirman, 2006 in Nirmala et al., 2016). The average value of the spicy fish taste test is presented in Table 7.

Table 7. Taste value of peda fish in each treatment

Treatment salt content (%)	Day to-	Median	Average
0	1	5	5,1 a
15	3	5	6,3 a
	7	7	6,1 a
20	3	7	6,3 a
	7	7	6,6 a
25	3	7	7,3 a
	7	7	6,5 a
30	3	7	5,8 a

Treatment salt content (%)	Day to-	Median	Average
	7	5	5,4 a
35	3	7	7,1 a
	7	5	5,5 a

Note: Numbers followed by the same letters in the treatment averages indicate there is no significant difference according to the multiple comparison test with a significance level of 5%.

Decision making using the Bayes method

The Bayes method allows us to know which criteria are the most important criteria in decision making seen from the highest weight values of the criteria. The criteria weight values for each ogranoleptic characteristic of peda fish can be seen in Table 8.

Table 8. Weight values for organoleptic characteristic criteria for peda fish

Criteria	Criteria Weight
Appearance	0,14
Aroma	0,28
Texture	0,07
Flavor	0,50

Decision making in determining the best treatment using the Bayes method is carried out by creating an assessment decision matrix using the median value as a representation of the value of each criterion. The higher the priority value, the more the panelists like the peda fish in this treatment, and vice versa (Marimin, 2004). The decision matrix for assessing peda fish in each treatment is presented in Table 9.

Table 9. Decision matrix for assessing peda fish in each treatment

Treatment salt content (%)	Criteria					Alternative value	Priority value
	Day to-	Appearance	Scent	Texture	Flavor		
0	1	7,00	3,00	5,00	5,00	4,72	0,07
15	3	5,00	3,00	5,00	7,00	5,44	0,09
	7	5,00	5,00	5,00	7,00	6,00	0,09
20	3	5,00	5,00	5,00	7,00	6,00	0,09
	7	5,00	7,00	5,00	7,00	6,57	0,10
25	3	7,00	7,00	7,00	7,00	7,00	0,11
	7	5,00	5,00	5,00	7,00	6,00	0,09
30	3	5,00	5,00	5,00	7,00	6,00	0,09
	7	5,00	5,00	5,00	5,00	5,00	0,08
35	3	5,00	5,00	5,00	7,00	6,00	0,09
	7	5,00	5,00	5,00	5,00	5,00	0,08
Criteria weight		**0,14**	**0,28**	**0,07**	**0,50**	**63,73**	**1,00**

DISCUSSION

pH Value

Indirectly, the pH value can determine the shelf life of a food because differences in pH value also result in differences in the microorganisms that live in a food (Fardiaz, 1992 in Wijatur, 2007). The decrease in pH value will tend to be faster as the amount of salt given increases (Sastra, 2008). This is in line with the results that can be observed in the table above

that the higher the salt content used, the pH value will tend to be smaller compared to other treatments with lower salt levels. The lowest pH value in the table above is in the treatment with a salt content of 35% on the 6th and 7th observation days, which is the treatment with the most salt added, while the highest pH in the table is in the 0% salt treatment. day 3 and day 4 with a pH value of 7.1.

The pH value of peda that was not given additional salt was seen to increase on days 2 to 4, then fell again on days 5 and 7. The increase in pH occurred in the initial phase of storage of peda because during that phase the fish were still in the rigor mortis phase and products from the activity of the ATP (adenosine diphosphate) degradation process such as creatine, ammonia and phosphate resulting in an increase in pH (Budiharjo, 2005). The decrease in pH on days 5 to 7 occurred due to the activity of putrefactive bacteria which produced more organic acid products such as butyric acid than the previous day, resulting in a decrease in pH. Peda with added salt content of 15%, 20%, 25%, 30% and 35% did not experience rot. This can be observed from the pH value which is not in the range of 6.5-7.5, which is the optimal pH for the growth of putrefactive bacteria (Fardiaz, 1992).

Water Content

The water content contained in peda fish will influence the aspects of consumer assessment when considering consuming peda fish, especially because water content can affect the texture and aroma of peda fish. Water content can be a fairly precise indicator of a product's susceptibility to quality deterioration (Jeyasanta et al., 2014). According to (Rochima, 2005), the addition of salt in the fermentation process results in a decrease in the water content of the final product because salt is hygroscopic (the ability of salt to absorb water in its environment) so that salt can draw water out of the material through the osmosis process. Juharni (2013) stated that the higher the salt content used, the more water content can be removed.

The lowest water content was in the treatment that used a salt content of 35%, which was the treatment that used the highest salt content and was on the 7th day of observation, which was the last day of observation with a water content of 55%. Peda fish treated with 0% salt experienced spoilage until there was a consistent increase in water content from day 1 to day 7. According to Lestari eta al. (2015), the increase in water content is caused by the activity of putrefactive bacteria which erode fish tissue during the autolysis process. Peda treated without salt is not suitable for consumption because it has already rotted and can be toxic to the human body. Until the 7th day, the peda in each treatment using different levels of salt other than 0% salt content still showed good water content quality. Water content in peda during traditional environmental control processes usually ranges from 55% to 70% (Hui & Evranuz, 2008)

Salinity

Based on the results of the salt content test, it was found that the lowest salt content was in the treatment using 0% salt content with a salt content value of 0.81%. The highest salt content was in the treatment using a salt content of 35%, which on the 7th day of observation had a salt content value of 16%. The salt content in peda fish is inversely proportional to the water content, the lower the water content in peda fish, the higher the salt content. This situation occurs because during salting there is penetration of salt into the flesh of the fish, then an osmosis process occurs where the water in the flesh will be drawn out and the salt will fill the empty flesh tissue so that the more salt used, the higher the salt content and the more low water content in peda fish meat (Adawyah, 2008).

Appearance

Test results using the Friedman test show that differences in the use of salt levels in controlling the environment of peda fish have different influences on the appearance of peda fish with average values ranging from 4.5 to 7.5. The lowest average appearance value was in

the treatment using 35% salt content on the 3rd day of storage because there was a layer of skin that peeled off and some of it disappeared when served to the panelists. The highest average appearance value was in the control sample (0% salt), the fish was still very fresh and intact both before and after frying.

The results of the Friedman test at the 5% level showed that there was a significant difference between the control treatment and the treatment using 35% salt content on day 3, using 15% salt content and 30% on day 7. Peda fish treated with 20% salt addition for 7 days and 25% for 3 days showed the highest value among treatments with other salt levels. In both treatments, peda fish were produced with the appearance of a bright brownish red color which is the typical color of mackerel peda. Between the two treatments there were no real differences so we can conclude that the best treatment was the treatment using a salt content of 20% on day 7. This result is in line with research conducted by Jefri et al. (2017), who found that peda using a salt content of 20% produced a bright brownish red color and is the typical color of mackerel peda fish.

Scent

The results of the Friedman test showed that differences in the use of salt levels during the environmental control period made a difference to the aroma of peda fish. Table 8 above shows that the average value for the aroma of peda fish is in the range of 3.7 to 6.5. The lowest average value was 3.7, which was the treatment using 15% salt content on day 3 of storage. The highest average value was in the treatment using 25% salt content on day 3.

The results of the Friedman test at the 5% level showed that there were significant differences in the treatment using 20% salt on day 3 and salt content 25% on day 3 compared to the treatment using 15% salt on day 3. Meanwhile, in the other treatments, no significant differences were found. real between the treatments. The median and average values of the aroma test showed that the treatment most preferred by the panelists was the use of salt content of 20% on day 7 and 25% on day 3 with the value among the other treatments being the highest and not significantly different between the two, so the best treatment was when using a salt content of 20% for 7 days, the one that the panelists disliked the most was the 15% salt treatment on day 3. Peda fish in the treatment using a salt content of 15% on day 3 gave off a rancid aroma which was unpleasant to the nose. This is in line with what was stated by Yuktika et al. (2017), that making peda fish should use salt with a minimum content of 20%. Using salt at levels below 20% will cause the quality of the fish to decrease because the salt level provided is not sufficient to help the fermentation process. The use of salt levels of 20% and 25% produces the best aroma, namely the distinctive aroma of fermented pepper compared to the use of salt below which produces a rancid aroma (Fajri et al., 2014).

Texture

The results of the Friedman test showed that there were differences between the peda fish treatments tested. The average value of the aroma of spicy fish is in the range of 4.2 which is the lowest average value to 6.6 which is the highest average value. The highest average value was in the treatment using 25% salt content on day 3. The texture of peda fish was closely related to the salt content used. Salt has the ability to absorb water so that it can draw out the water in food ingredients (Rochima, 2005). How little or how much water is contained in peda fish will affect the texture that can be felt, so that different treatments using salt levels will make the texture of peda fish different.

The results of the Friedman test at the 5% level showed that there was no real difference between the treatments using the salt levels given. The highest median and average values of the treatment on day 7 were in the treatment using 20% salt content with a median value of 5 and an average of 5.8. When using a salt content of 20%, it was found that the peda had a chewy texture but felt fibrous, not soft and not hard. In peda treated with a salt content of 15%,

the texture was found to be soft and less fibrous, so the panelists didn't really like it, whereas when using a salt content above 20%, the texture of the peda fish became harder than when using a salt content of 20%, so the panelists preferred peda with a texture. which is not too hard but also not too soft so you can still feel the fish meat fibers. According to Juharni (2013), the difference in texture of peda fish is closely related to the use of the salt content given and the water content contained in peda fish. The use of lower salt levels means that less water can be removed from the fish's body so that the presence of high water levels in the fish's body makes the peda fish have a softer texture. Using a higher salt content results in more water coming out of the fish's body so that less water content is contained in the fish's body, as a result the texture of the fish becomes harder and drier than when using a lower salt content.

Flavor

The results of the Friedman test showed that there were differences between treatments, marked by differences in the median and average values for each peda fish treatment. The average taste test scores ranged from 5.1 to 7.3. The control treatment got the lowest average value because in the 0% treatment the taste of the spicy fish was considered bland by the panelists. The bland taste is caused by not adding the slightest salt, which is different from other treatments that use salt so that the taste of the spicy fish appears. The treatment using a salt content of 25% on day 3 got the highest average value.

The results of the Friedman test at the 5% level showed that there were no significant differences between the peda fish treatments. This could have happened because the panelists who assessed each had their own perceptions so that preferences for the taste of spicy fish were spread more evenly across each treatment, both those that did not use salt and those that used salt in different levels. According to Soekarto (2012) in Noviyanti et al. (2016), differences in taste assessments can occur among panelists due to differences in the level of sensitivity of the sensory organs, lack of knowledge of certain flavors or also due to differences in taste. Until the 7th day of environmental control, the highest score was found in the treatment using a salt content of 20% with a median of 7 and an average of 6.6, making the peda fish using a salt content of 20% produce the taste most liked by the panelists. These results are in line with research conducted by Thariq et al. (2014), where peda using a salt content of 20% produces glutamic acid which produces the highest savory taste (umami) compared to using a salt content of 30% and 40%.

Decision making using the Bayes method

Assessing the weight of the criteria for peda fish against the criteria of appearance, aroma, texture and taste using different levels of salt, the results showed that the most important criterion for the panelists to determine the acceptability of peda fish was taste with the highest criteria weight, namely 0.50. This is then followed by other criteria in succession, namely aroma with a criteria weight of 0.28, appearance with a criteria weight of 0.14, and finally texture with a criteria weight of 0.07. This means that if the peda fish is judged to have an acceptable appearance, aroma and texture but the taste is unacceptable then the peda fish is still unacceptable because taste is the most important criterion. The results of the Bayes method calculations are in accordance with what was stated by Martianto and Soekirman (2006) in Nirmala et al. (2016), that taste is the most important criterion for consumers in accepting a food product. If a consumer already knows the taste of a product and accepts it, other criteria tend to be ignored.

The highest priority value on day 7 of environmental control for peda fish was obtained when using a salt content of 20% with a priority value of 0.11. The next highest priority value in succession is followed by the multiplication of using salt levels of 15% and 25% with a priority value of 0.09 and finally there is the treatment using salt levels of 30% and 35% with a priority value of 0.08. The data presented above provides the conclusion that the results of

the Bayes method show that peda fish using 20% salt content during the 7 day environmental control period is the most preferred treatment by the panelists.

In this section, the researcher systematically compiles rational arguments about the scientific information obtained in the research. Especially information that is relevant to the research problem. Discussion of the research results obtained can be presented in the form of theoretical descriptions, both qualitatively and quantitatively. In practice, this section can be used to compare research results obtained in research currently being conducted with research results reported by previous researchers. Scientifically, research results obtained in research can be in the form of new findings or improvements, confirmations, or rejection of interpretations of a scientific phenomenon from previous researchers.

CONCLUSION

The treatment most preferred by the panelists was peda fish which used a salt content of 20% with an environmental control period of 7 days with a median value of 5 for appearance and texture characteristics, and a median value of 7 for aroma and taste characteristics. Peda fish in this treatment has a bright reddish-brown color, the typical aroma of peda fish is slightly sour, there is no rancid aroma, the texture is slightly chewy and fibrous, the flesh is not hard and there are no broken parts, it has an umami taste and a slightly salty taste too dominant.

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