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The Mussel Shell Powder as Natural Preservation for Swordfish by Using Smearing Method

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ABSTRACT

Processing fish in order to be more lasting and be able to be still consumed by the people was needed good preservation. Fish could be lasting if the bacterial decomposition in the fish could be prevented. All this time, the people only used the waste of mussel shells for animal feed. Moreover, the mussel shells were not only used as animal feed, but also as additional material for concrete compound and natural preservation. Therefore, this research aimed at analyzing the use of mussel shells as natural preservation for swordfish. This research was experimental research with static group comparison design that aimed at knowing the use of mussel shell powder as natural preservation for swordfish. Organoleptic test conducted to the fresh fish, which included eyes, gill, mucus, meat, and smell. Time interaction and the concentration of mussel shell powder which was smeared on the swordfish gave significant influenced toward the number of total germ rate with determination coefficient (R2) was 99.8%. Besides, there was a difference of preservation of swordfish among 3:1 was the fish could be preserved until in 24 hours and the fish was able to be consumed and still in fresh condition with organoleptic value in average of 7.00, meanwhile, the fishes which were in the comparison between 1:1 and 2:1 were in rather spoiled condition. Furthermore, there was no significant difference of germ rate in swordfish after being smeared by mussel shell powder among 1:1, 2:1, and 3:1 in 12 hours, 24 hours,and 30 hours, in which the germ rate qualified the qualification. However, there was a significant difference when it was in 36 hours but the germ rate still did not qualify the qualification.

Keywords: Swordfish**,** Mussel shell, Germ rate

INTRODUCTION

Fish is a perishable food product. The decomposing fish that was occurred was begun after the fish was caught and it was supported by temperature condition in Indonesia which was tropical climate that caused very high humidity. High humidity caused the fish began to undergo a decomposition in 12-24 hours, depended on species, tools or how to catch them.The decomposition could be avoided through the way that was usually done by either the fishermen or sellers, which was through cooling(1).

Quick decomposition process for fishes could hinder the marketing effort of fishery result and it frequently caused great loss, thus, it was needed an effort in order to increase either storability or durability of the fishes through either processing or preserving(2). For the processing fish so that it would be more lasting and could be still consumed by the people, commonly when the fishes were caught, they were cooled or given forbidden preservative, such as formalin and borax(3). Various efforts were conducted in order to reduce the use of dangerous preservatives for food product. One of them was through searching and finding an alternative preservative, such as natural preservative which was the use of anti-microbe.

Natural anti-microbial material was an alternative that had to be developed so that it would not be dangerous for the consumers. Conducted research by Silvia et al. (2014), who used chitosan from the blue crab shell on bloated fish and catfish. Moreover, the result of their research was the preservation of fish through the smearing by adding chitosan in 1.5% could extend the time in saving the fish for more than 5 hours. Meanwhile, the preservation of fish through spraying by adding chitosan in 2.5% could extend the time in saving the fish for less than 5 hours(4).

Based on previous researches, they stated that the material that contained chitin was processed to be chitosan before, hence, it needed much time, cost, and energy. Therefore, in conducted research by Marlik, Ratna Dewi LA (2016) , they used mussel shell powder as natural preservation for tilapia fish and in the mussel shell powder, it contained chitin in 26.82%(5).

Hastuti (2009) stated that chitin had low solubility in water and it could be digested by mammals and it was polycationic (positiveload)[6]. Mahatmanti et al. (2001) stated that material that was polycationic caused the material could bind with negative loadon the surface of bacterial cell that would cause a damage on the bacteria's cell wall and then finally, it would cause death for the bacteria[1].

Swordfish was one of seafood and it was really liked by Indonesian people, either down class or upper class people because the swordfish was easy to be found either in traditional market or modern market (supermarket). All this time, the swordfish was often sold after having preservation through marinating. Besides, swordfish was protein source, vitamin source, and other good nutrition sources. The content of fresh fish, such as protein, fatty acid, and high water content made the fish became one of commodities which could decompose quickly, even, quicker rather than other animal protein sources[7].

The Eastern area of Sidoarjo City had been known as fisherman village of mussel specialist before which the total of mussel production was around 8,540,400 kg until 8,675,300 kg per year[7]. Great mussel production could cause new problem, such as the waste of mussel shell that piled without any process before. Along this time, the people in Balongdowo Village, Candi Sub-district, Sidoarjo City only used the waste of mussel shell as animal feed. Moreover, the use of mussel shell was not only as animal feed, but also as additional material for concrete compound and natural preservatives.

Mahatmanti, Sugiyo, & Sunarto, (2001), stated that chitosan that was synthesized from giant tiger (prawn) shell could be used as anti-microbial for fresh Nile tilapia fish with the most optimum condition. In addition, the smearing on the fresh Nile tilapia fish used chitosan emulsion on 1:1 for 10 hours[1].

The purpose of this research was analyzing the use of mussel shell as natural preservative for swordfish.

METHODS

The design of this research was the static group comparison and the object in this research was swordfish that was gotten from Pabean market, Surabaya, with three repetition. The procedures of this research were:

a. The swordfish that was caught recently by fisherman was cleaned and put into the sink.
b. The swordfish was smeared by mussel shell powder that had been mixed by aquades (control, 1:1, 2:1, 3:1).
c. The swordfish that had been smeared was waited for 12 hours, 24 hours, 30 hours, 36 hoursand was continued until the fish underwent decomposition.
d. After for 12, 24, 30,and 36 hours, the fish was processed in order to be conducted a laboratory check for knowing the total of germ rate and conducted an organoleptic observation.

The data of observation result of germ rate in swordfish was quantitative data that was processed in tabulation form and was examined statistically by utilizing Two Way Anova.

RESULTS

Table 1. Analysis of organoleptic value of swordfish after being smeared by mussel shell powder

Time	Comparison	Mean	St.Dev.	Interval Value	Final Value	Note
12 hours	Control	5.28	0.10	5.24 – 5.31	5.00	Rather spoiled
	1 : 1	6.67	0.29	6.57 – 6.76	7.00	Fresh
	2 : 1	7.67	0.17	7.61 – 7.72	8.00	Fresh
	3 : 1	7.83	0.29	7.74 – 7.93	8.00	Fresh
24 hours	Control	3.89	0.82	3.62 – 4.16	4.00	Spoiled & unfeasible for consumption
	1 : 1	5.61	0.19	5.55 – 5.67	6.00	Rather spoiled
	2 : 1	6.56	0.19	6.49 – 6.62	6.00	Rather spoiled
	3 : 1	7.00	0.29	6.91 – 7.09	7.00	Fresh
30 hours	Control	1.33	0.33	1.22 – 1.44	1.00	Spoiled & unfeasible for consumption
	1 : 1	4.61	0.35	4.50 – 4.72	4.50	Spoiled & unfeasible for consumption
	2 : 1	4.44	0.25	4.36 – 4.53	4.00	Spoiled & unfeasible for consumption
	3 : 1	5.83	0.29	5.74 – 5.93	6.00	Rather spoiled
36 hours	Control	1.00	0.00	1.00 – 1.00	1.00	Spoiled & unfeasible for consumption
	1 : 1	2.83	0.60	2.64 – 3.03	3.00	Spoiled & unfeasible for consumption
	2 : 1	2.89	0.19	2.83 – 2.95	3.00	Spoiled & unfeasible for consumption
	3 : 1	4.50	0.93	4.20 – 4.80	4.00	Spoiled & unfeasible for consumption
42 hours	1 : 1	1.22	0.19	1.16 – 1.29	1.00	Spoiled & unfeasible for consumption
	2 : 1	1.67	0.00	1.67 – 1.67	2.00	Spoiled & unfeasible for consumption
	3 : 1	2.72	0.10	2.69 – 2.75	3.00	Spoiled & unfeasible for consumption
48 hours	2 : 1	1.11	0.19	1.05 – 1.17	1.00	Spoiled & unfeasible for consumption
	3 : 1	1.67	0.33	1.56 – 1.78	2.00	Spoiled & unfeasible for consumption
54 hours	3 : 1	1.00	0.00	1.00 – 1.00	1.00	Spoiled & unfeasible for consumption

The analysis of organoleptic value of swordfish was obtained from assessment sheet regarding eyes, gill, mucus, meat, smell, and texture that was tabulated and determined its quality value by searching the mean result on each panelist in the confidence level of 95%.

From the Table 1, it could be obtained that the swordfish was still fresh if it was smeared by mussel shell powder in comparison of 1 : 1, 2 : 1, 3 : 1 for 12 hours and it was smeared by the mussel shell powder in comparison of 3 : 1 for 24 hours. The swordfish was rather spoiled if it was smeared by mussel shell powder with control comparison (12 hours), 1 : 1 and 2 : 1 (24 hours),and 3 : 1 (30 hours). Besides, the swordfish would be spoiled and unfeasible for consumption if it was smeared by mussel shell powder in more than 30 hours.

Table 2. The total plate rate on swordfish after being smeared by mussel shell powder

Comparison	Mean of Total Plate Rate (coloni/gr)						
	12 hours	24 hours	30 hours	36 hours	42 hours	48 hours	54 hours
Control	6.1×10^3	2.2×10^4	2.1×10^6	3.6×10^7	-	-	-
1 : 1	3.6×10^3	5.3×10^3	3.9×10^4	2.8×10^6	1.2×10^7	-	-
2 : 1	1.4×10^3	2.2×10^3	1.3×10^4	6.0×10^5	7.2×10^6	2.6×10^7	-
3 : 1	9.3×10^2	1.6×10^3	6.8×10^3	4.3×10^4	6.1×10^5	8.3×10^6	1.1×10^7

According to Table 2, it was obtained that swordfish that was smeared by mussel shell powder for 12 hours, 24 hours had mean of total plate rate under 5.0×10^5 which was appropriate with the qualification of Indonesian National Standard 7388 (2009) for fresh fish. Thus, the total plate rate on swordfish that had been smeared for 12 hours, 24 hours still qualified the qualification[8]. This case showed that the higher the comparison of mussel shell powder, the lower the total plate rate on swordfish and this was in accordance with stated theory by Mahatmanti et al. (2001) which stated that the effectiveness of anti-microbe correlated exponentially with the comparison[1].

DISCUSSION

Good organoleptic was consumed for the longest time after being smeared by mussel shell powder in comparison of 3:1 for 24 hours. Similar research was conducted by Marlik, Ratna Dewi LA (2016) who conducted preservation on tilapia fish through emulsion of mussel shell powder with percentage of 0.5%, 1:1 and 1.5 % for 12 hoursand 16 hours[5]. Furthermore, there was a difference of the emulsion and the biggest percentage of the concentration which proved that it could preserve the fish only in 12 hours. When it was in 16 hours, the tilapia fish underwent decomposition. The difference between smearing of mussel shell powder and emulsion of mussel shell gave real impact. In the organoleptic of swordfish by natural preservative through smearing process, the swordfish still could be consumed longer until 24 hours with percentage of smearing in 3:1 and the fish was still in fresh condition. In addition, one of the contents in mussel shell powder was chitin. In journal Food Technology and Biotechnology by Arbia et al. (2013) explained that characteristic of physical chemistry of chitin had main character in influencing the process of solubility, chemical reactivity, and biological activity which had biodegradable ability[9]. Besides, it had important role in anti-bacteria activity in chitin in either shrimp shell or crab shell. Chitin in mussel shell powder proved that it could be used as anti-bacteria until for 24 hours in mud form of 3:1. If the comparison was enlarged, the time of preservation would be longer with the expectation that organoleptic on the swordfish did not change. However, the similar way for preserving the fish naturally by emulsion form of mussel shell powder was less effective rather than by the mud form. The mussel shell powder had character of insoluble and the powder was only suspended if it was in emulsion form. The shell powder would settle if it was in emulsion form. Thus, the fish was only submerged in water, meanwhile, the chitin in the emulsion would also settle. Furthermore, the bacteria would grow quickly even more quickly if it was in humid condition. This condition caused bacteria in water could damage organoleptic in the fish.

Based on the result of statistical test of anova two way, it was obtained that time (12 hours, 24 hours, 30 hours, and 36 hours) with the concentration of mussel shell powder that was smeared on swordfish (control; 1:1; 2:1; and 3:1) really influenced against the number of total germ rate with the determination coefficient (R2) in 99.8% ($P = 0.00 < 0.05$). Meanwhile, from the result of t-test, it was obtained the result that in the swordfish which after being smeared by mussel shell powder with the comparison of 1:1 and 2:1, there was a significant difference of the mean of total plate rate on swordfish for 12 hours - 36 hours, 24 hours – 36 hours, 30 hours – 36 hours. In the comparison of 3:1, there was a significant difference of the mean of total plate rate on swordfish for 12 hours – 30 hours, 24 hours – 30 hours, 24 hours – 36 hours.

Moreover, without any preservation, the value of total plate rate on swordfish still qualified the qualification until 24 hours. Meanwhile, the swordfish with the smearing process of mussel shell powder basically among 1:1, 2:1, and 3:1 were not different (same) and there was a difference when it was in 36 hours, meanwhile, in 12, 24, and 30 hours, the total plate rate could still be hindered. The value of total plate rate in the smearing of 1:1, 2:1, and 3:1 still qualified the standard qualification that was settled byIndonesian National Standard (2009) regarding maximum limit of total plate rate of fresh fish which was 5.0 x 105 colony/gr and the highest value of

the total plate rate on percentage of 1:1 was 3.1 x 103[8]. The time of the preservation by using mussel shell powder was until 30 hours. Therefore, it could be concluded that the preservation naturally by using mussel shell powder in any percentages could preserve the fish until < 36 hours from the swordfish that was not preserved. Meanwhile, above 36 hours, the value of total plate germ rate had exceeded the limit, above 5 x 105. The chitin that was contained in mussel shell powder either in much number or in a little one was still effective in doing preservation. Moreover, in this case that needed to be clarified was the media that was used by the chitin. The media was not in emulsion form, which meant that in making the media, the comparison of shell powder that contained chitin was minimum in 1:1 (b/v). The making media by using shell powder that contained chitin in its making contained much water. Therefore, the chitin was less maximal in reacting to form chitinolytic. Conducted research by Marlik, Ratna Dewi LA (2016)who used emulsion media of mussel shell powder with minimal percentage of 1:1, the result was the powder could be used as preservation, but the time for preservation was less maximal[5].

CONCLUSION

According to the research, analysis, and discussion which were conducted above, it could be concluded that Mussel shell powder could be used as natural preservation. There was an interaction between time and concentration of mussel shell powder that was smeared on swordfish. It really influenced against the number of total germ rate.

Therefore, the researchers could suggest that the smearing fish by mussel shell powder could be used by the people who were fish sellers and fishermen as natural preservation for fishes, mussel shell powder could be continued again in other themes of the researchin which the mussel shell powder contained chitin and the chitin could hinder microorganism. However recently, we researched that chitin in mussel shell powder could be used as coagulant and flocculants.

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