Application of “Atung” (Parinarium glaberimum Hassk) Natural Preservative Towards the Quantity and Quality of Enzimatic Fish Sauce of Tuna Loin Production Waste in Parigi Wahai Village, North Seram, Central Maluku District

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Abstract. The aim of this study was to determine the effect of using Atung (Parinarium glaberimum Hassk) on the quantity and quality of the tuna sauce by using pineapple extract. Also, to determine the treatment that produces the best quality of fish sauce with the testing parameters, which consists of yield, protein content, density, viscosity, TPC and sensory. The research is based on a fully randomized design with fermentation of 2, 3, 4 days and a salt concentration of 15 and 20% respectively. The results of the fish sauce applied with atung showed that the duration of fermentation for 2-4 days and concentration of salt 15-20% provided significant difference in α0.05 on the yield, protein content, density, viscosity, TPC and sensory. The highest yield was applied with breath, with 3% salt and 2 days of fermentation, which was about 340%, protein 3.62%, density 1.16, viscosity 17.2 PaS and TPC 1.90 × 101 CFU / g or 2.355 (log X). These treatments have a sensory value when the smell has a value of 7.5, the taste has a value of 7.4 and the color has a value of 7.3. The fish sauce treatment is applied for 2 days, fermentation with 20% salt and selected as the treatment with the best product. The Atung treatment may produce the result of the fish sauce and a lower CPR than other treatment.

Keywords: natural preservative, Parinarium glaberimum Hassk, pineapple extract, quantity/yield, quality, Parigi Wahai North Seram

1. Introduction

The need for spices in the community continues to grow, including soy sauce. Initially, sow sauce was made from soybean ingredients, and the development of sauce is mostly carried out by other ingredients to increase its variety. A fermented food product is processed through a fermentation of fish and fish waste using salt. The traditional processing of fish sauce requires a lot of time and a high salt content. To accelerate the fermentation of fish sauce, this can be conducted by adding proteolytic enzymes and reducing salt levels. Therefore, the research on the manufacture of fermented products generally comes from land plants, it usually uses non fish product such as soybean, peanut and milk,
the process is carried out traditionally by using a high concentrations of salt, accompanied by long fermentation time [1].

The red (dark) meat of tuna loin waste serves as a base for fish sauce. For early handling in ships and loin production places, the function of ice is replaced by atung powder. In washing process, atung solution was used for washing the fish meat, afterward, and fish sauce is produced using red meat. From one piece of gross tuna loin about 72.2% can be produced on a net tuna loin (named “real loin”) and pieces of red meat 18.0%, the rest bone skin/spines 9.8%. [2].

Fermentation is a metabolic process associated with microbial enzymes to carry out oxidation, hydrolysis and other chemical reactions, which causes the chemical changes in an organic substrate by producing certain products and causing the changes of the raw materials properties [3]. The aim of this research was to determine the effect of the application of natural preservative atung solution (Parinarium glaberrimum, Hassk), tuna red meat washing, salt concentration and fermentation period on the quantity and quality of tuna sauce.

2. Material and Method

2.1. Material

Tuna was obtained as a raw material from the group of fishermen in Parigi, Wahai village, North Seram District. The research was conducted from July-August 2020 at Parigi Wahai Village, North Seram Sub-district and product testing was carried out at the Industrial Research and Standardization Center, Ambon.

2.2. Research procedure

Tuna is prepared in the form of loin, and a red (dark) meat was obtained. Red (dark) meat is partially soaked in 4% atung solution, while others was prepared without the application of atung solution. The fermentation of red (dark) was performed using pineapple extract (1: 3). The results of this hydrolyzate were cooked by adding spices. Seasoning for hydrolyzate 1000 ml: 1 clove garlic, 4 cm ginger, 4 cm galangal, 1/2 tablespoon cumin, 1 roll of bay leaves, 1 stick of lemon grass, 1 hazelnut, 3 tablespoons of granulated sugar, 300 g of brown sugar and 1 gram of jelly. After boiling, it was picked up and cooled, and finally bottled.

2.3. Treatment

The research applied 2 (two) treatments, namely: washing treatment of red (dark) meat using “atung” solution and washing treatment without application of “atung” solution. K1: washing without atung solution, 15% salt was added, and the fermentation ranges for 3 days; K2 washing without atung solution, 20% salt was added, and the fermentation ranges for 4 days; K3: washing without atung solution, 15% salt was added, and the fermentation ranges for 3 days; K4: washing without atung solution, 20% salt was added, and the fermentation ranges for 3 days; K5 washing without atung solution, 20% was added, and the fermentation ranges for 2 days; K6: washing by applied atung solution 4% (w / v), 20% salt was added, and the fermentation ranges for 2 days.

2.4. Observation

The tests were conducted using quantity tests, also known as the Performance and Quality Tests, which includes density, viscosity, protein content (SNI 01-297-1992) and TPC-total plate count (SNI 01-28891-1992). While the sensory test used the hedonic test (preference test used 20 person semy trained panellists) on a scale of 1-9, which includes color, taste and smell [4].

2.5. Data analysis

The data were analysed using factorial experiments designed in a randomized block design (RBD), by applying 4 replications [5].
3. Result and Discussion

Recapitulation of the Honest Real Difference test (HRD) of the objective parameters presented in Table 1.

| Treatments | Yield (%) | Protein Content (%) | Density | Viscosity (PaS) | TPC (log x) |
|------------|-----------|---------------------|---------|----------------|-------------|
| K1         | 274d      | 5.68a               | 1.15a   | 64.2 bc         | 2.355a      |
| K2         | 295cd     | 5.36a               | 1.11b   | 87.5 b          | 2.675a      |
| K3         | 303bc     | 5.62a               | 1.12b   | 115.8a          | 2.210 b     |
| K4         | 308b      | 5.53a               | 1.17a   | 42.5 c          | 1.645 b     |
| K5         | 304bc     | 3.51b               | 1.15a   | 11.8 d          | 1.557 b     |
| K6         | 340a      | 3.62 b              | 1.16a   | 17.2 d          | 1.280 b     |
| BNJ 0.05   | 11.0      | 0.37                | 0.17    | 25.0            | 0.53        |
| BNJ 0.01   | 15.0      | 0.51                | 0.24    | 34.6            | 0.74        |

3.1. Yield of Fish Sauce

Table 1 showed that the highest yield value was obtained in treatment K6 where 4% of the tuna loin washing (w/v) atung solution was applied, 20% salt was added, and the fermentation ranges for 2 days followed by treatment K2 where the red (dark) meat is washed without atung solution, 20% salt was added, and the fermentation ranges for 4 days. This indicates that the yield of fish sauce is influenced by the addition of atung solution while it was washed. The increased of osmotic moisture extraction of the red (dark) meat was influenced by the salt. The salt in this process fuction to absorb the moisture from the fish tissue and to kill the unwanted microbial growth in such a way that only the microbes that play a role in the fermentation process can survive [6].

3.2. Protein Content

Table 1 showed that the protein content obtained from the k6 and k5 treatment reduced the protein content of treatments K1, K2, K3 and K4. Statistically, the K5 and K6 treatments were not significantly different and the K1, K2, K3 and K4 treatments were not significantly different in such a way that there are significant differences between treatments K1, K2, K3, K4 and K5, K6. This indicated that a long period of fermentation affected the protein content of the fish sauce. As indicated by the protein content of the fish sauce during day 3 and 4 of fermentation, the protein content obtained is 5.36-5.68%, while the protein content obtained in 2 days of fermentation varies from 3.51 to 3.62%. When compared between K6 and K5 with the same 2 days fermentation, K6 treatment applied by atung solution obtained the higher protein content. However, the protein content of all treatments is at the threshold suggested by SNI -01-4271- 1996 where the maximum protein content was 5%.

The protein content of the fish sauce obtained by all the treatment applied to the red (dark) meat is higher than the protein content of fish sauce branded “Bango” with the protein content of 3.90% [2]. According to the quality factor of the fish sauce obtained, the quality protein content is classified in grade 2 by the minimally protein content of at least 4%, while the high grade was >6% [6]. The tendency of the lower protein content towards the higher salt concentration was due to the enzymatic denaturation of the proteins and also to the protein profile in which it was soluble in salt. Klomklao et al (2005) [7] reported that the concentration of salt directly affected the proteolytic activity on fish sauce samples.
3.3. Density

Table 1 showed that there were no significant differences between treatments K1, K4, K5 and K6 and that there was also no significant difference between treatments K2 and K3. However, there was a significant difference between treatment K1, K4, K5, K6, and K2, K3. This indicated that applying atung solution in tuna sauce processing was more practical due to its less production time of 2 days. This is because the addition of a thin lead to a change in texture during fermentation in such a way that the resulting filtrate is different in density. Furthermore, atung helps to degrade fish protein into simpler amino acids, which are responsible for the density of fish sauce

3.4. Viscosity

Table 1 showed that there was an effect on the treatment of the viscosity value, the treatment K3 was the most viscous 115.8 Pa.s, followed by K2 and K1 at 87.5 and 64.2 Pa.s; and then K5 and K6 at 17.2 and 11.8 Pa.s. This indicates that 4 days of fermentation obtained the tuna sauce with the best viscosity, in other words the

3.5. Total Plate Count (TPC)

The TPC of tuna sauce mentioned in Table 1, indicated that application of atung solution during washing process obtained the lowest TPC 1.280 (logX CFU/g) or 1.90 x 101, and this proves that atung can inhibit microbes [8]. The TPC of the tuna sauce in all treatments is below the threshold suggested by SNI where the number was 104.

3.5.1 Subjective Parameters (sensory)

The recapitulation of Friedman test along with multiple comparison of the sensory value of fish sauce can be seen in Table 2.

Table 2. Recapitulation of Friedman test and multiple comparison of sensory test value of tuna sauce.

| Treatment | Smell | Average | Taste | Average | Colour | Average |
|-----------|-------|---------|-------|---------|--------|---------|
| K1        | 16,0abc | 7,8       | 20,5a | 7,7       | 12,5abc | 7,4       |
| K2        | 22,5a | 7,9       | 22,0a | 7,7       | 20,0ab | 7,6       |
| K3        | 15,0abc | 7,8       | 12,5abc | 7,5       | 20,5a | 7,6       |
| K4        | 18,5a | 7,9       | 16,5ab | 7,6       | 16,5ab | 7,5       |
| K5        | 5,0 c | 7,3       | 4,0 c | 7,2       | 4,5 c | 7,1       |
| K6        | 7,0 bc | 7,5       | 8,5 bc | 7,4       | 10,0 bc | 7,3       |

\( \chi^2 \) Table = 10.4

The value of the Multiple Comparison Test is at the degree of \( \alpha 0.05 \)

Table 2 showed that all the treatments were significantly different on the sensory value of colour, smell and taste. Where the color of the tuna sauce value of treatment K3 and K5 is higher than other with an average value of 7.6 followed by treatment K5 and K6 with an average value of 7.2. The taste values of treatments K1 and K2 were higher than other with an average value of 7.7 followed by K4 with a value of 7.6. Meanwhile, the smell parameter value of treatment K4 and K2 were higher than other, followed by K5 and K6 with an average value of 7.5 and 7.3 respectively.

3.6. Colour Value

The treatment K2 and K3 had a higher colour value than others with an average of 7.6, followed by treatment K4 and K1 with an average value of 7.4 and 7.2 respectively. In addition, it seems that the panelis prefer the standard tuna sauce colour derive from treatment without atung solution, this was
due to the panellist habit as they prefer the brown colour. According to National standardization institution. 1996 [9] this colour was normal, and this different from Ferika et al (2014) [10] where the product colour is brownish yellow and the hedonic value is 6.97 (preferred by panellis).

The brownish colour of the fish sauce is due to a non-enzymatic reaction, namely the Maillard reaction Lopetcharat et al (2001) [11]. Furthermore, it was stated that as the fermentation last longer, the colour of the fish sauce will be more turbid due to an increase in the number of components present in the fermented liquid in such a way that the liquid is viscous and cloudier (Ginting et al, 2002) [12].

The brown color is cloudier than the 2-day fermentation treatment. This is due to the effect of adding the enzyme from the bromineline (pineapple extract) and the occurrence of a browning reaction. The heating process after fermentation can cause a maillard reaction between amino compounds and reducing sugars that form melanoide, a brown polymer that reduces the appearance of the product. Browning also occurs due to the reaction between proteins, peptides, and amino acids with the results of the decomposition of fat. Buckle et al (1987) [13] added that the addition of fermentation time resulted in a darker colour of fish sauce.

3.7. Taste Value
In Table 2 it is mentioned that the K3 treatment has a high taste score with an average of 7.6, followed by K2, K4 and K1 with an average of 7.6 to 7.4. It can be seen that K6 and K5 have lower values with an average of 7.3 and 7.1. This indicates that the longer the fermentation time with a high salt concentration, the more it is acceptable because it has become a habit to consume products that undergo such a process, namely the long fermentation time and the treatment without atung solution. Therefore, the panelists prefer the distinctive taste of soy sauce. According to National standardization institution 1996 [9] the taste value was unique.

The results of panellists acceptability of the taste value of the treatment by applying atung and the short fermentation time were lower than the taste of another treatments. According to Buckle et al (1987) [13], the enzyme bromeline is able to break down protein into several components, such as peptides, peptones and amino acids by interacting to create a unique taste.

3.8. Smell Value
Table 2 shows that the treatment of K2 and K4 has the same effect on the taste value with an average value of 7.9. Followed by K3 and K1 with an average value of 7.8. Finally, K6 and K5 with an average value of 7.5 and 7.3. This shows that the longer the treatment, the longer the fermentation has a more acceptable effect, and the 2-day fermentation treatment is more acceptable using atung. The smell is distinctive and fragrant National standardization institution 1996 [9]. Compared with the research results ( Moniharapon et al, 2014; Moniharapon and Pattipeilohy, 2016) [2,14], the value of the smell of soy sauce is more acceptable to the panellis. The aroma formed in tuna sauce is strongly influenced by the distinctive aroma of fish and pineapple raw materials in such a way that the aroma produced is different from commercial fish sauce, as is the case with small pelagic fish of the fish.

4. Conclusion
The treatment of tuna sauce without the application of atung solution during washing process and by applying a salt concentration and fermentation period were significantly different on the yield, density, viscosity, protein content and TPC. The test result for all parameters were at the trashold allowed by National standardization institution. 1996 SNI-01-4271- 1996. Furthermore, a high protein was obtained using the treatment without applying atung solution and low salt concentration, as well as high fermentation period. The tuna sauce applied with atung solution obtained the high yield and the low TPC, which is beneficial. The treatment with atung, which has a high yield value and a lower TPC value is beneficial. The tuna sauce result is better than soy sauce with branded bango combined with both protein content and TPC value.
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