Quality Profiles of the Traditional Shrimp Paste of Lombok

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Quality Profiles of the Traditional Shrimp Paste of Lombok

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Abstract. Shrimp paste is very much needed in NTB culinary. Several Micro small and Medium Enterprises (MSMEs) in Lombok produce shrimp paste. This study aimed to determine the chemical and physical quality of shrimp paste produced by MSMEs on the island of Lombok. The method used in this study was an experimental method with a Randomized Block Design and a single factor experiment with sampling locations, namely Shrimp paste of Putri Nyale (Jerowaru), Jero Acan (Jerowaru), TelukJor (Jerowaru), Lakara Salwa (Pringgabaya), Udang Rebon (Lembar) and SasakMaiq (BatuLayar). Each treatment was repeated three times to obtain 21 experimental units. The data were analyzed by analysis of variance at a 5% significance level using Co-Stat software. Significant different data were further tested with HSD test. The results showed that the moisture content, pH, hardness (texture) and color (Hue o) of shrimp paste from all producers were significantly different. There was a tendency that the higher the moisture content, the lower the hardness value (shrimp texture). Shrimp paste of Sasaq Maiq has the highest hardness of 39631. 98 kg/cm2 with the lowest moisture content of 23.21 %. Shrimp paste of Putri Nyale has the lowest hardness with the highest moisture content of 37. 55 %. Moisture content of Lakara Salwa shrimp paste and SasakMaiq does not meet the quality standards of shrimp paste (SNI 01-2716.1-2009). The acidity level of shrimp paste produced by MSMEs in Lombok is significantly different with a range of 6.4 to 7.57 which is influenced by the length of fermentation applied. Based on Hue^{o}, the Lakara Salwa shrimp paste produces a red color range due to the use of dyes and other shrimp paste has a yellow red color with the use of natural raw materials.

Keywords: shrimp, belacan, fermented food, Lombok

1. Introduction

Shrimp paste according to the definition of [1] is a type of food flavoring material in the form of solid, distinctive smell, fermented shrimp with salt, with or without other permitted additives. Shrimp paste has a strong aroma and is usually used as a raw material for making chili paste, and can be used in various traditional Indonesian food recipes [2]. Shrimp paste has a distinctive reddish brown color which is influenced by the astaxanthin pigment in shrimp shells. [3] stated that some products were added with food color. The traditional shrimp paste processing is done in a simple way. The process starts from washing bamboo shoots, drying bamboo shoots, and pounding, mixing with auxiliary materials, drying, printing and fermentation processes. [4] and [5] added that the fermentation process in the manufacture of shrimp paste can take place due to the activity of enzymes originating from the shrimp body itself.

The quality of shrimp paste is influenced by several things, including processing methods, raw materials and handling of the final product as well as the types of natural microbes that grow during fermentation [6]. Traditional shrimp paste processing in general has not been able to meet good quality standards, in terms of nutrition, sensory value and shelf life [7]. The different types of raw materials in the manufacture of shrimp paste affect the organoleptic quality of the shrimp paste produced. The

fresher and more uniform the raw materials used in making shrimp paste, the better quality and taste will be obtained stated that shrimp paste with bamboo shoots as raw material has the most preferred sensory characteristics by consumers in terms of taste, aroma, color and texture [8]. [9] also added that good quality shrimp paste is usually dark brown in color, has a distinctive smell of shrimp paste, does not smell rancid, and does not contain impurities. In addition to the production process, the handling of the final product such as packaging and storage is a factor that affects the quality of shrimp paste. The packaging of shrimp paste that is not good or not closed results in direct contact between the shrimp paste and the outside air. In addition, most of the shrimp paste is stored in containers with high humidity, causing the shrimp paste to be easily contaminated. [10] reported that from 15 samples of unpackaged shrimp paste obtained at the Karang Menjangan market, Surabaya, there were 12 samples (80%) of shrimp paste containing the MPN index. Coliforms exceed the maximum limit of microbial contamination in food. In addition, [11] showed that in shrimp paste there was also mold contamination as evidenced by the discovery of 8 isolates of the genus Aspergillus in shrimp paste.

Shrimp paste is mostly produced by medium to low-end industries because the shrimp paste processing technique is easy to do [12], as evidenced by the large number of shrimp paste producers on the island of Lombok, which are spread over several areas such as East Lombok Regency, West Lombok Regency and Mataram City. The largest shrimp paste production center on Lombok Island is located in East Lombok Regency, namely is Teluk Jor, Jerowaru Village, Jerowaru District. The famous shrimp pastes in this area include Putri Nyale shrimp paste, Jero Acan shrimp paste and Teluk Jor shrimp paste. In addition to Jerowaru District, shrimp paste producers are also found in Pringgabaya District, namely Lakara Salwa shrimp paste. Meanwhile, shrimp paste producers in West Lombok Regency are located on the coast of Cemara Lembar Beach, Batu Layar Village. Shrimp paste producers on the coast of Cemara Lembar Beach market unbranded products, while shrimp paste producers in Batu Layar Village market products under the Sasak Maiq brand.

Most of the shrimp paste producers on the island of Lombok are still processing shrimp paste using simple methods and equipments. The pounding process and the shrimp paste molding process are generally carried out using traditional equipments. Traditional shrimp paste after being fermented or without fermentation can be sold in blocks using banana leaf packaging, plastic, paper or containers in the form of woven pandan leaves. In addition, there is a type of cooked shrimp paste that has been heated or baked in the oven after being dried, this shrimp paste is usually called ready-to-use shrimp paste [13]. Differences in producers and experience allow differences in the quality of shrimp paste produced due to differences in the use of raw materials, processing methods and additional materials used by shrimp paste producers, so research is needed to determine the quality of shrimp paste produced by several MSMEs in Lombok.

2. Material and Mehods

2.1 Tools

The tools used in this study include analytical balance (Kern abj, Germany), Fruit Hardness tester/fruit penetrometer (Lutron FR-5120, Taiwan), desiccator (Duran, Germany) oven (Memmert Germany), pH meter (Schott Handylab pH 11, Germany), Colorimeter (FRU WR10, China).

2.2 Material

The materials used in this study included: Shrimp paste Putri Nyale, shrimp paste Jero Acan, Shrimp paste Teluk Jor, shrimp paste Lembar, Shrim paste SasakMaiq, and shrimppaste Lakara Salwa.

2.3 Research Implementation

This study uses a non-probability sampling technique with the convenience sampling method, which is a type of non-random sampling method that is carried out freely without certain restrictions or systematics on the part of the researcher. This technique is based on the availability and ease of obtaining it [14]. The steps taken in this research are field surveys and interviews with shrimp paste producers. Interviews were conducted to find out the process of making shrimp paste. The shrimp paste samples were obtained from several producers, namely Putri Nyale shrimp paste (MSME Putri Nyale) Jor Jerowaru, Jero Acan shrimp paste (UD Satria) Jor Jerowaru, Jor Bay shrimp paste (UD. Pesisir Mandiri)

Jor Jerowaru, rebon shrimp paste (UD. Putri Pesisir Mandiri) Lembar, Shrimp paste Sasak Maiq (UKM Sasaq Maiq) Batu Layar and Shrimp paste Lakara Salwa (UD Lakara Salwa) Pringgabaya.

2.4 Parameters and Observation Method

The parameters observed in this study were physical quality parameters: texture [15], chemical quality: pH and moisture content [16] and color ^{o}Hue/lightness using [17].

3. Result and Discuccions

3.1. Texture (Hardness)

Texture is one of the properties of food products that can be determined through pressure either from a tool or a touch of the hand [18]. The shrimp paste texture is generally dense and has a slightly roughtexture. The Texture value measurement is obtained from the results of measurements with a penetrometer. The higher the value displayed on the tool, the harder the texture of the shrimp paste being tested is. The texture of the shrimp paste produced by MSMEs on the island of Lombok can be seen in Figure 1. Figure 1 shows that the texture of the shrimp paste produced were significantly different between producers. This difference is due to variations in the processing techniques. The hardest shrimp paste texture was produced by UD Sasak Maiq producer with a texture value of 39,631.98 kg/cm2, followed by UD Lakara Salwa, UD. Satria, UD. Putri Pesisir Samudra, UD Pesisir Mandiri, and shrimp paste with the softest texture were produced by MSME Putri Nyale with a texture value of 7,501.76 kg/cm2. The level of hardness of the shrimp paste is strongly influenced by the moisture content in the shrimp paste. The higher the moisture content in the shrimp paste, the lower
the texture value will be.

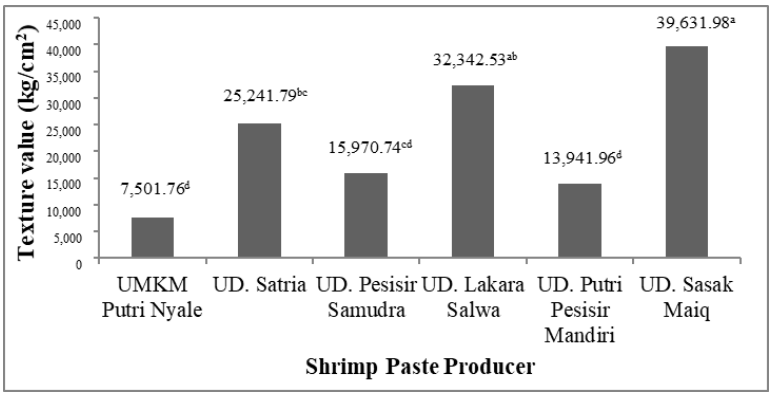

Figure 1. Texture of Shrimp paste produced by MMSMEs on Lombok Island.

The low value of the shrimp paste texture produced by the Putri Nyale MSME is thought to be related to the moisture content. Putri Nyale Shrimp paste is known to have a fairly high moisture content of 37.55%. This could be due to the fact that in the processing, rebon shrimp were soaked in a salt solution for 1 night which might allow the moisture content in this shrimp paste to increase and cause the texture to become soft even though the drying process had been carried out by drying for 2-3 days and in the oven at 150^{o}C for 30 minutes. This drying process was thought to have not been able to improve the texture of the shrimp paste. Shrimp paste production UD. Putri Pesisir Mandiri also had a low texture value (13,941.96 kg/cm2) with a moisture content of 35.58%. The results of interviews with producers indicated that producers carry out processing by steaming without oven and followed by drying for 3 days. Shrimp paste production UD. Putri Pesisir Mandiri has a texture that is relatively the same as the shrimp paste produced by Putri Nyale and UD Pesisir Samudra. The similarity in texture between the two shrimp pastes is supported by data on moisture content which is not much different between the two. Shrimp paste production UD. Pesisir Samudra has a moisture content of 35.21%. The shrimp paste processing at this location is done by soaking the rebon shrimp for 12 hours in a salt solution and followed by drying for 2 days and oven for 25 minutes at a temperature of 100^{o}C. This process is

also suspected to be not effective enough to reduce the moisture content so that the resulting shrimp paste texture is slightly soft. Drying carried out by several MSMEs is shorter than the drying time carried out by shrimp paste producers outside Lombok Island. According to [19] the time needed to dry the local shrimp paste in Karawang with a dryer at a temperature of 40^{o}C ranges from 210 hours with an estimated drying time of 6 days to produce shrimp paste with a moisture content of 35%.

Shrimp paste production UD. Lakara Salwa and MSMEs Sasak Maiq have textures that are not significantly different. Based on Figure 1, the value of the texture of shrimp paste produced by UD Satria is 25.241.79 kg/cm2 with a moisture content of 30.81%. These two types of shrimp paste have a harder texture than the other types. The results of interviews with producers showed that the producers only added about 100 l of water for 500 kg of rebon shrimp and carried out a drying process for 3 days and an oven for 2 hours at a temperature of 150oC so as to produce a texture that was not too hard and not too soft. The texture value of shrimp paste production by UD Lakara Salwa is 32.342.53 kg/cm2 with a moisture content of 25.82%. The low moisture content contained in the shrimp paste produced by UD Lakara Salwa causes the resulting shrimp paste texture to be hard. This is presumably because the oven was carried out for 1 hour at a temperature of 260^{o}C. The hardest shrimp paste texture was found in the shrimp paste production of Sasak Maiq MSMEs, which was 39.631.98 kg/cm2 with the lowest moisture content compared to all the shrimp paste tested, which was 23.21%. The hard texture of the Sasak Maiq shrimp paste is thought to be caused by the addition of sugar in the process of making this shrimp paste.

Figure 1 generally shows that the lower the moisture content in the product, the harder or higher the value of the shrimp paste texture is. The moisture content is greatly influenced by the drying process. [20] stated that the increase in texture value was influenced by the length of the fermentation process, as well as the handling of materials before fermentation, namely the drying and pounding stages. [21] also explained that the drying process will facilitate pounding so that the quality of the dough affects the texture of the shrimp paste.

3.2. Color

Color is one of the important parameters seen by consumers, so color can be used as the first reference in assessing the quality of a food product. In some types of products, color changes can indicate changes in nutritional value, so that color changes can be an indicator to indicate the maximum acceptable level of nutritional value [22]. Color diversity of shrimp paste produced by MSMEs on the island of Lombok can be seen in Figure 2.

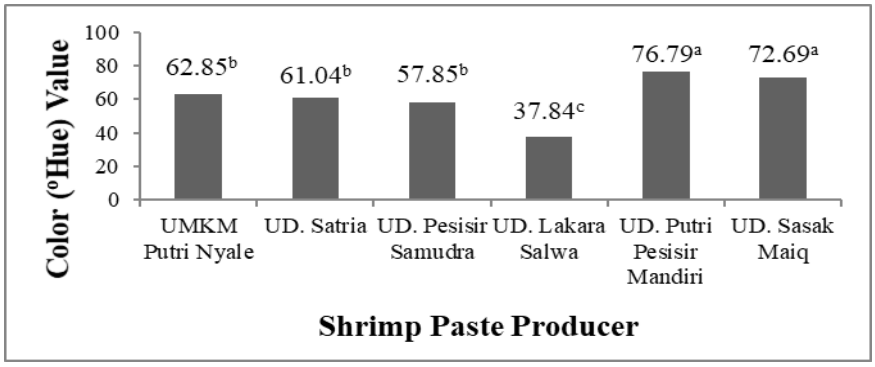

Figure 2. Color of Shrimp pasteproduced byMSMEs on Lombok Island.

The color of the shrimp paste can be determined by measuring the value of a* (component (+) red to (-) green) and b* (component (+) yellow to (-) blue) so that the oHue value is obtained [2]. The ^{o}Hue value is a color characteristic based on the light reflected by the object which is the overall value that is dominated by the main color of the product [23]. Based on Figure 2, the ^{o}Hue value of shrimp paste produced by Lakara Salwa is significantly different from all the shrimp paste produced b MSMEs on the island of Lombok because in the processing process the producer adds food coloring to the shrimp

paste processing so that the oHue value obtained is 37.84 (Red), which means the shrimp paste shows a red color.

Value of °Hue MSMEs Putri Nyale, UD Satria and UD Pesisir Samudra are not significantly different, ranging from 57.85-62.85 (Yellow Red) with a reddish yellow color. The results of interviews with producers showed that the three shrimp paste producers did not add dye in the process of making the shrimp paste and the color that appeared was only obtained from the color of the rebon shrimp used. Likewise, the °Hue value for the shrimp paste produced by UD.Putri Pesisir Mandiri and MSMEs SasakMaiq is 76.79-72.69 (Yellow Red), which means that the two shrimp pastes have a yellow-red color on the surface. The group production process shows that the shrimp paste producer UD. Putri Pesisir Mandiri does not add coloring agents to the shrimp paste processing process, while the small-scale shrimp paste producer Sasak Maiq adds brown sugar so that the shrimp paste produced has a slightly browner color. [24] stated that the shrimp paste without the addition of dye had a brownish red color. [6] also stated that the shrimp paste circulating in one of the markets in Kendari that panelists liked the most was reddish brown and somewhat brilliant. The color produced by this shrimp paste is thought to be due to the influence of the length of fermentation. [25] also stated that the longer the fermentation process, the darker the color of the shrimp paste produced. The resulting color is also thought to be due to the astaxanthin pigment which is naturally contained in shrimp as a raw material for shrimp paste. Astaxanthin is the source of the red color found in shrimp. This is also confirmed by [3], who said that a brownish color is formed in shrimp paste because it contains astaxanthin

3.3. pH Value

The pH value is the degree of acidity used to express the level of acidity or alkalinity possessed by a solution [26]. The smaller the pH value of the solution, the greater the degree of acidity of the solution and the greater the pH of the solution, the smaller the degree of acidity of the solution [27]. Based on the results of observations and statistical analysis, it can be seen that the pH value of shrimp paste produced by MSMEs on the island of Lombok can be seen in Figure 3.

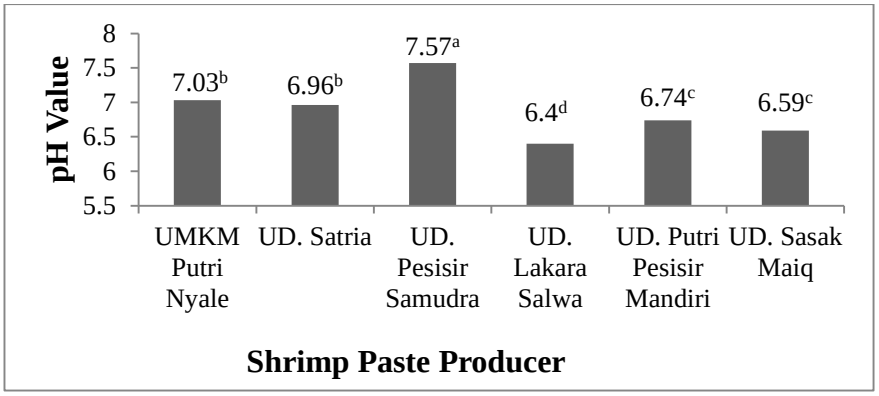

Figure 3. Acidity (pH) value of Shrimp paste produced by MSMEs on Lombok Island.

Figure 3 shows that the pH value of shrimp paste produced by MSMEs in Lombok Island is significantly different between producers. The difference in pH values in some of the shrimp paste produced by MSMEs is caused by the difference in the duration of the fermentation process carried out. The highest pH value was obtained from UD shrimp paste. Pesisir Samudra, which was followed by the shrimp paste production of MSMEs Putri Nyale, UD Satria, UD Putri Pesisir Mandiri and Sasak Maiq with pH values of 7.57, respectively; 7.03; 6.96; 6.74, 6.59. All of these shrimp pastes were processed by a similar method in the form of soaking in salt water with fermentation time varying from 3 hours to 1 day. A different procedure is applied to UD's shrimp paste production. Lakara Salwa. Producers carry out the fermentation process after the repeated pounding process and the process of standing for 1 week. The long duration of the standing process has the potential to reduce the pH value. This can be

seen from the pH value of UD shrimp paste production. Lakara Salwa which is lower than other producers are 6.40.

The pH value of shrimp paste which is almost the same is also shown by the research of [28], which is in the range of 7.3-7.5 in shrimp paste processing with various levels of salt, while in the study of [29] the pH value of anchovy shrimp paste with salt addition treatment at various concentrations ranged from 6.6-6.7. The pH value of shrimp paste produced by MSMEs on the island of Lombok that meets the quality requirements for the pH quality of fermented products is shrimp paste produced by UD Lakara Salwa, UD Satria, UD Putri Pesisir Mandiri and UD Sasak Maiq. [30] states that basically, fermented products have a pH of 7 (acidic). The pH value is a normal value for fermented products. This statement is in accordance with research [31] which states that the longer the fermentation, the lower the pH value of the salty chili sauce. This is also reinforced by the research of [32] which states that the longer the fermentation time, the lower the pH value of the rice drink. This decrease in pH is thought to be due to the presence of a number of lactic acid produced by the metabolism of lactic acid bacteria in the fermentation process. This is in accordance with [33] that the addition of salt content in the shrimp paste making process will inhibit spoilage bacteria and help the activity of lactic acid bacteria and halophilic fermentative bacteria in converting carbohydrates, proteins, and fats into lactic acid, volatile acids, alcohol, and esters which can lower the pH product. [34] also added that the splitting of NaCl ions into Na+ and Cl where Na+ ions are needed by lactic acid bacteria for substitution of K+ ions during diffusion. Then the Cl- ions will bind with water to form HCl so that the amount of water in the material decreases and forms an acidic atmosphere in the food media.

3.4. Moisture Content

Water is an important component in foodstuffs because water can affect the appearance, texture and taste of the resulting food. The moisture content in food also determines the acceptability, freshness and durability of the ingredients [5]. Moisture content is the amount of water contained in food ingredients expressed in percent. Measurement of moisture content in food is very important because the high and low moisture content in a food product will determine the final quality of a product [35]. The moisture content of shrimp paste produced by MSMEs on the island of Lombok can be seen in Figure 4.

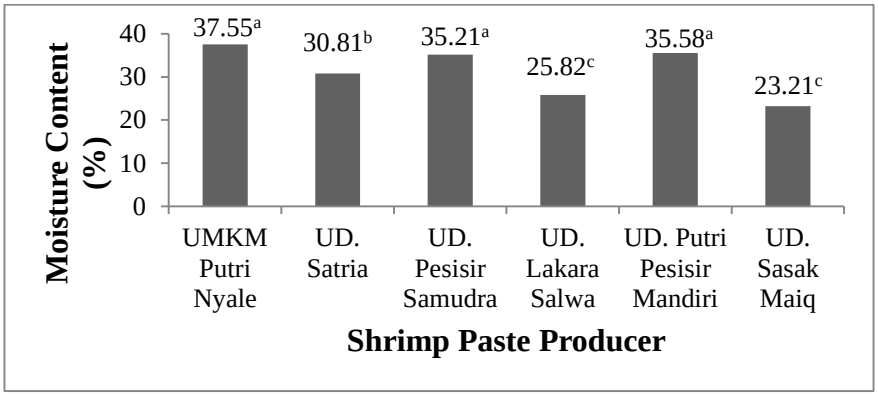

Figure 4. Graph of Shrimp pastes Moisture Content produced by MSMEs on Lombok Island.

The moisture content of shrimp paste obtained from several MSMEs on the island of Lombok based on the ANOVA test showed significantly different results. This can happen because the processing process of each manufacturer is different. Based on the results of interviews with shrimp paste producers, the moisture content of the shrimp paste is influenced by the addition of salt, the length of the drying time and the oven process for the shrimp paste. Salt added to the process of making shrimp paste, besides functioning as a shaper on the texture, also functions as a method of preserving shrimp paste, because the higher the concentration of salt added, the lower the moisture content produced. This is because the salt that binds water so that the moisture content contained in the shrimp paste is also getting lower. Besides the addition of salt, the duration of drying time can also affect the moisture

content. The length of the drying duration from each shrimp paste producer varies, ranging from 2-3 days and there are even shrimp paste producers who do not carry out the drying process but directly carry out the oven process. According to Winarno (1995) in [36], the higher the drying temperature, the faster evaporation will occur. In addition, the longer and higher the temperature used in the oven will reduce the moisture content of the shrimp paste. This is also reinforced by the statement [13], which states that the longer the oven is used, the lower the moisture content of the shrimp paste.

Shrimp production of MSME Putri Nyale, UD Putri Pesisir Mandiri and UD Pesisir Samudra has the highest moisture content with a total moisture content of 37.55%, 35.58% and 35.21%, respectively. The results of the interview showed that the producers of these three shrimp pastes all dried for 2-3 days, followed by oven at 150ºC for 30 minutes at Putri Nyale MSMEs, oven at 100º C for 25 minutes at UD PesisirSamudra and without oven at UD Pesisir mandiri. The relatively short oven duration results in high moisture content in the product, while longer oven duration has been shown to be able to produce shrimp paste with lower moisture content. Shrimp paste production UD. Satria has lower moisture content than the three previous producers, which is 30.81% by applying a drying process for 3 days followed by oven at 150oC for 2 hours. In addition to longer oven duration, the use of higher temperatures in the oven also has the potential to reduce moisture content. This can be seen in the production of UD shrimp paste. Lakara Salwa which has a lower moisture content than the shrimp paste produced by UD. Satria that is equal to 25.82%. Although not doing the drying process, but UD. Lakara Salwa did a one week curing process followed by a printing process and an oven at a high temperature of 260ºC for 1 hour. Different conditions occur in the production of shrimp paste for MSMEs Sasak Maiq which has the lowest moisture content of 23.21%. The process of making this shrimp paste does not go through a high temperature oven and a long duration because it only undergoes drying for 3 days and an oven for 30 minutes at a temperature of 60ºC. However, in the shrimp paste processing, producers add 2% brown sugar and 1% granulated sugar. Sugar has the ability to bind water in foodstuffs due to hydrogen bonds which result in reduced water activity in foodstuffs [37]. This is in accordance with [38] which shows that carp wadi fermented products with added sugar have lowermoisture content than carp wadi without added sugar. According to SNI 2716:2016, the maximum moisture content of dry solid shrimp paste is 35%. Based on these requirements, the moisture content of the shrimp paste produced by MSME Putri Nyale, UD Pesisir Samudra and UD Putri Pesisir Mandiri exceeds the maximum required moisture content, while the shrimp paste produced by UD Satria, UD Lakara Salwa and UD Sasak Maiq meet the requirements for the maximum moisture content. Food products with low moisture content will have a longer shelf life. [39] states that, the less moisture content in an ingredient or food product, the more durable the product.

4. Conclusion

Micro, small and medium Enterprises (MSMEs) in Lombok produce shrimp paste that differs in chemical quality (moisture content and pH) and physical quality (texture and color). There is a tendency that the higher the moisture content, the lower the hardness value (textured shrimp paste). Sasaq Maiq Shrimp paste has the highest hardness with the lowest moisture content of 23.21%. Putri Nyale Shrimp paste has the lowest hardness value with the highest moisture content of 37.55%. The moisture content of Lakara Salwa and Sasaq Maiq shrimp paste does not meet the shrimp paste quality standard (SNI 01-2716.1-2009). The acidity level of shrimp paste produced by MSMEs in Lombok was significantly different with a range of 6.4-7.57 which was influenced by the lenght of fermentation applied. Based on ºHue, Lakara Salwa shrimp paste produces a red color range due to the use of dyes and other shrimp paste has a yellow-red color with the use of natural raw materials.

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References

[1] Badan Standar Nasional 2016 *Syarat Mutu Terasi*. SNI 2716.1:2016. Badan Standar Nasional. Jakarta.

[2] Sanjaya Y D, Sumardianto and Riyadi P H 2016 Pengaruh Penambahan Ekstrak Rosella (*Hibiscus sabdariffa Linn.)* Terhadap Warna Dan Kualitas Pada Terasi Udang Rebon (*Acetes Sp.) Jurnal Pengolahan and Bioteknologi Hasil Perikanan.* 5(2): 1-9.
[3] Rahmayati R, Putut H R and Laras R 2014 Perbedaan Konsentrasi Garam terhadap Pembentukan Warna Terasi Udang Rebon (*Acetes sp.*) Basah. *Jurnal Pengolahan dan Bioteknologi Hasil Perikanan.* 3(1): 108-117
[4] Junianto 2011 Studi Karakteristik Pengolahan Terasi Cirebon dalam Upaya Mendapatkan Perlindungan Indikasi Geografis. *Jurnal Akuatika*. 2(1): 1-14.
[5] Anggo A D, Swastawati F, Ma'ruf W F and Rianingsih L 2014 Mutu Organoleptik dan Kimiawi Terasi Udang Rebon dengan Kadar Garam Berbeda dan Lama Fermentasi *JPHPI*. 17(1): 53-59.
[6] Kadir M R S, Asnani A and Suwarjoyowirayatno 2020 Mutu Terasi Udang Rebon (*Acetes indicus)* yang di Perdagangkan di Beberapa Pasar Kota Kendari *Jurnal Fish Protech*.3(2): 16-27.
[7] Rosida A F 2013 *Kontaminasi Mikroba pada Terasi yang Beredar di Pasar Wilayah Surabaya Timur.* [Jurnal]. *Alumni Program Studi Teknologi Pangan*. Fakultas Teknologi Industri Universitas Pembangunan Nasional.
[8] Karim F A, Swastawati F and Anggo AD. 2014 Pengaruh Perbedaan Bahan Baku Terhadap Kandungan Asam Glutamat Pada Terasi *Jurnal Pengolahan dan Bioteknologi Hasil Perikanan* 3(4): 51-58.
[9] Indriati N and Fairdiana A 2012 Pemanfaatan Angkak Sebagai Pewarna Alami pada Terasi Udang *JPB Perikanan*. 7(1): 11–20.
[10] Yamani 2006 Pemeriksaan MPN Coliform pada Terasi Tanpa Kemasan di Pasar Karang Mejangan Kelurahan Mojo Surabaya *Jurnal Analisis Kesehatan TRPUNK* 2(1): 25-28.
[11] Kristanti D, Lutfita P and Nurjannati K 2015 Identifikasi Kapang dan Deteksi Aflatoksin B1 terhadap Terasi Udang Komersil *Jurnal Teknologi Hasil perikanan.* 2(1): 25-34.
[12] Sumardianto, Wijayanti I and Swastawati F 2019 Karakteristik Fisikokimia Dan Mikrobiologi Terasi Udang Rebon Dengan Variasi Konsentrasi Gula Merah *JPHPI.* 22(2): 287-298.
[13] Handayani B R, Dipokusumo B, Werdiningsih W and Rahmadhina S F 2020 Partial properties of ready-to-use shrimp paste affected by heating time *Current Research on Biosciences and Biotechnology*. 1(2): 57-61.
[14] Murti B 2015 Populasi Sampel dan Pemilihan Subyek Prodi Ilmu Kesehatan Masyarakat Program Pascasarjana. Universitas Sebelas Maret. Surakarta.
[15] Permata D A and Sayuti K 2015 Pembuatan manisan Dari Berbagai Bagian Tanaman Meniran (*Phyllanthus niruri*) *Jurnal Teknologi Pertanian Andalas.* 20(1): 44–49.
[16] Sudarmadji B, Haryono and Suhardi 1984 *Analisa Bahan Makanan dan Pertanian* Liberty Yogyakarta.
[17] Hutchings J B 1994 *Food Colour and Appearance.* Blackie Academic and Professional. Chapman and Hill. London.
[18] Rosiani N, Basito and Widowati E 2015 Kajian Karakteristik Sensoris Fisik dan Kimia Kerupuk Fortifikasi Daging Lidah Buaya (*Aloe vera*) dengan metode Pemanggangan Menggunakan Microwave. *Jurnal Teknologi Hasil Pertanian*. 8(2): 84-94.
[19] Sari D A, Hakiim A and Sukanta 2017 Pengeringan Terasi Lokal Karawang : Sinar Matahari – Tray Dryer. *Jurnal Sains dan Teknologi* , P-ISSN : 2303-3142 E-ISSN : 2548-8570, Vol. 6, No. 2, Oktober 201
[20] Nooryantini S, Yuspihana F and Rita K 2010 Kualitas Terasi Udang Dengan *Suplementasi Pediococcus halophilus* (FNCC-0033) *Jurnal Hasil Perikanan* 1:55-56.
[21] Hestiani, Asnani and Isamu K T 2019 Pengaruh Lama Fermentasi Terhadap Nilai Sensori, Komposisi Proksimat, Dan Total Bakteri Terasi Ikan Bete-Bete (*Leiognathus equulus*), *J. Fish Protech*, Vol. 2 No. 2
[22] Arpah 2001 *Penentuan Kadaluwarsa Produk* Pangan. Program Studi Ilmu Pangan. Institut Pertanian Bogor.

[23] Noviyanti R, Suksmono A, Mengko T and Putri A (2018) Segmentasi Warna Menggunakan Metode Clustering untuk Identifikasi *Mycobacterium tuberculosis Jurnal Biosains*. 17(1): 19-25.
[24] Chaijan M and Panpipat W 2012 *Darkening Prevention of Fermented Shrimp Paste by pre-soaking Whole Shrimp With pyrophosphate.* AJOFAI.
[25] Ulya S, Lutifah and Ria D S 2016 Pemanfaatan Limbah Kepala Udang Windu (*Penaeus monodon*) Untuk Pembuatan Terasi Dengan Kajian Penambahan Garam dan Lama Fermentasi. *Jurnal Rekapangan*. 10 : 67-72.
[26] Zulius A 2017 Rancang Bangun Monitoring pH Air Menggunakan Soil Moisture Sensor di SMKN 1 Tebing Tinggi Kabupaten Empat Lawang. *JUSIKOM*. 2(1): 37-48
[27] Aminah N, Dewi K, Ariesta N I and Samsuci S 2016. Rancang Bangun Alat Pengukur Kadar Keasaman Minuman Kemasan dan Kematangan Buah. *Jurnal Teknologi Elekterika*. 13(1): 28-35
[28] Aristyan I, Ratna I, and Laras R 2014 Pengaruh Perbedaan Kadar Garam terhadap Mutu Organoleptik dan Mikrobiologis Terasi Rebon (*Acetes sp*.) *Jurnal Pengolahan dan Bioteknologi Hasil Perikanan*. 3(2): 60-66
[29] Majid A, Agustini TW and Rianingsih 2014 Pengaruh Perbedaan Konsentrasi Garam terhadap Mutu Sensori dan Kandungan Senyawa Volatil pada Terasi Ikan Teri (*Srolephorus sp*.). *Jurnal Pengolahan dan Bioteknologi Hasil perikanan.* 3 (2): 17-24.
[30] Ukhty U, Anhar R and Andini S 2017 Mutu Kimiawi Terasi dengan Formulasi Udang Rebon (*Acetes sp*.) dan ikan rucah yang berbeda. *Jurnal Perikanan Tropis*. 4(2):166-176.
[31] Juliarsi M, Nazzaruddin and Werdiningsih W. (2018). Pengaruh Konsentrasi Garam dan Lama Fermentasi Terhadap Mutu Sambal Masin Khas Sumbawa *Jurnal Reka Pangan*. 12(1): 1-8.
[32] Kusuma G P A W, Nocianitri K A and Pratiwi I D P K 2020 Pengaruh Lama Fermentasi terhadap Karakteristik Fermented Rice Drink sebagai Minuman Probiotik dengan Isolat *Lactobacillus sp*. *Jurnal Ilmu dan Teknologi Pangan*. 9(2): 181-192
[33] Bertoldi F, Santanna C and Eeirao LH 2002 Reducing the Bitterness of Tuna (*Euthyrnus pelamis*) Dark Meat with *Lactobacillus casei subsp*. Casei ATCC 392, *Journal Food technology*. Biotechnol.
[34] Desniar P D and Timoryana D V P 2007 Studi Pembuatan Kecap Ikan Selar (*Caranx leptolepis*) dengan Fermentasi Spontan. Prosiding SEMNASKAN Tahun ke IV Hasil Penelitian Perikanan dan Kelautan. Universitas Gadjah Mada, Yogyakarta.
[35] Mainaliza I 2003 *Studi Pengolahan Burger Ikan Jambal Siam (Pangasius sutchi) dengan Jenis Tepung dan Berat Ikan yang Berbeda.* Skripsi Fakultas Perikanan dan Ilmu Kelautan Universitas Riau. Pekanbaru.
[36] Dariyani K T, Isamu and Suwarjoyowirayatno 2019 Pengaruh Lama Pengeringan terhadap Karakteristik Kimia dan Organoleptik Dendeng Ikan Teri (*Stolephorus sp*.). *Jurnal Fish Protech*. 2(2):202-209.
[37] Buckle K A , Edwards R A, Fleet G H and Wootton 2009 *Ilmu Pangan*. Terjemahan: Purnomo H dan Adiono. Jakarta. Universitas Indonesia Press.
[38] Restu 2017 Pegaruh penambahan Kombinasi Gula Aren dan Samu dalam Proses Fermentasi daging Ikan Mas (*Cyprinus carpio*). *Jurnal Ilmu Hewani Tropika*. 6(2): 78-81.
[39] Sulistyo B, Chairunnisa H and Wulandari E 2018 Pengaruh Penggunaan Enzim Papain dan Jus Lemon Sebagai Koagulan terhadap Kadar Air, Berat Rendeman dan Nilai Kesukaan *Fresh Cheese*. *Jurnal Ilmu Ternak*. 18(1): 8-15.