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TERASI (SHRIMP PASTE) ARTICLE REVIEW

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Rebon, shrimp paste, microbes, fermentation, fisheries, quality, nutrition

ABSTRACT

Shrimp paste is one of the traditional processed fish products. Shrimp paste is much loved by the public because of its distinctive taste and aroma, thus adding to the taste of the dish. The purpose of this review article is to determine the stages of the process of making shrimp paste, the bacteria involved in fermentation, and the quality of the shrimp paste product. Based on the results of a review of the stages of making shrimp paste, there are eight stages, namely: washing and sorting shrimp, drying, pounding, adding salt, fermentation, further pounding, printing, and drying. The bacteria involved in the shrimp paste fermentation process are *Micrococcus*, *Bacillus*, *Pediococcus*, *Corynebacterium*, and *Brevibacterium*. Good shrimp paste has a brownish red color and is not too soft or too hard. Based on the Indonesian National Standard number 2716:2006 concerning shrimp paste, the quality requirements for shrimp paste that are in accordance with food safety are those that have a maximum water content of 45%; its acid insoluble ash content is less than 1.5%; salt content is contained in the range of 12–20%; and have at least 15% protein.

INTRODUCTION

Terasi is one of the traditional processed fishery products that are often found in Southeast Asia. This shrimp paste is in the form of a paste, the processing process of which involves salting and fermentation processes. In addition to pasta, shrimp paste can also be found in solid form with a slightly rough texture and has a very distinctive aroma; it is sharp but has a savory taste (Pierson, 2013). Fermentation in shrimp paste is caused by various enzyme activities in the body of shrimp or fish as the raw material for shrimp paste (Liviawaty, 2005). Terasi is generally made from small shrimp, also known as rebon shrimp, and can also be made from small fish, anchovies, or anchovies. In various Indonesian food preparations, this shrimp paste is used as a spice or flavoring that adds a distinctive taste. Various dishes that add shrimp paste to the ingredients list include chili sauce, fried rice, stir-fried kale, grilled fish, and various processed noodles.

Shrimp paste has a distinctive color that is reddish brown. Shrimp is used as a raw material for making shrimp paste because of its nutritional content. Based on various studies, the shrimp body contains various nutrients that are good for the human body. According to Suprapti (2002), shrimp paste contains fat, protein, carbohydrates, phosphorus, calcium, minerals, water, and iron. It also contains vitamin B12 and amino acids. In addition to nutrition, the availability of shrimp as a raw material for shrimp paste is also very important, because the availability of raw materials is the main requirement for the sustainability of a business. According to statistical data from KKP in 2017, the production of rebon shrimp, which is used as a raw material for making shrimp paste, reaches 689.6 tons/year. And production then increased by 18% in the following year (2018), with an achievement of 702.1 tons/year. And this amount continues to increase every year. With this large production rate that continues to increase, it can be ascertained that the availability of shrimp, especially rebon shrimp, in the market, which is used as a raw material for making shrimp paste, can be controlled and always available. The purpose of this review article is to determine the stages of the process of making shrimp paste, the bacteria involved in fermentation, and the quality of the shrimp paste product.

REBON : SHRIMP RAW MATERIAL FOR TERASI

Image 1. Rebon
(Source : https://pixabay.com/images/id-727214/)

The rebon shrimp is one of many decapod crustaceans that are mostly distributed in the sea and have a slender, elongated body, a depressed abdomen, and a long spiny surface. They include some (especially the family Penaeidae) that are commercially important as food. In terms of nutrition, rebon shrimp has a high protein content, is low in saturated fat and calories, and has a neutral taste. Due to these characteristics, shrimp form a natural additive in salads, pastas, curries, soups, and stir-fry dishes. Rebon shrimp has also been identified as a rich source of vitamin B12, selenium, high unsaturated fatty acids (HUFA) and astaxanthin, which is a powerful natural antioxidant. A clinical study showed that moderate consumption of shrimp in normolipemic-demic subjects did not affect the overall lipoprotein profile and could be included in cardiovascular health nutrition guidelines.

Of course, as a raw material for making shrimp paste, the availability of rebon shrimp in the market must be stable and abundant. Because if the raw materials are difficult to find, the production process will be hampered. Rebon shrimp and other types of shrimp are superior commodities in fisheries.

Based on statistical data from the KKP, the amount of sea shrimp production from the provinces of West Java, Central Java, and East Java from 2014–2019 (Table 1) continues to increase every year. With the great opportunity from this shrimp resource, there is no need to worry anymore that this shrimp is available on the market as a raw material for shrimp paste.

Table 1. Shrimp Production in 3 Provinces of Indonesia from 2014 - 2019

Province	Type of Fish	Year	Production Volume	Production Value
West Java	shrimp	2014	7.800,00	232.126.363
West Java	shrimp	2015	19.545,00	1.007.791.092
West Java	shrimp	2016	14.887,00	824.859.101
West Java	shrimp	2017	5.978,08	643.563.401
West Java	shrimp	2018	20.815,65	1.817.748.288
West Java	shrimp	2019	19.982,78	1.393.908.859
Central Java	shrimp	2014	4.321,00	116.859.486
Central Java	shrimp	2015	10.871,00	351.558.468
Central Java	shrimp	2016	8.514,00	339.728.122
Central Java	shrimp	2017	18.389,97	1.954.712.343
Central Java	shrimp	2018	7.013,91	450.118.348
Central Java	shrimp	2019	8.926,74	273.370.097
East Java	shrimp	2014	7.356,00	292.747.217
East Java	shrimp	2015	7.229,00	386.278.477
East Java	shrimp	2016	15.917,00	443.866.985
East Java	shrimp	2017	31.491,93	1.556.375.031
East Java	shrimp	2018	17.468,96	801.208.386
East Java	shrimp	2019	5.370,94	290.063.020

SHRIMP PASTE

Shrimp paste is one of the processed fishery products whose manufacturing process uses the fermentation method. As we often see, the shape of the shrimp paste is usually solid with a slightly rough texture and has a very distinctive aroma and a sharp but savory taste (Pierson, 2013).

Image 2. Shrimp Paste
(Source : http://www.agrowindo.com/)

According to Adawiyah (2007), shrimp paste that has a good quality value will be dark in color and have a texture that is not too soft or too rough. Shrimp paste is a processed fishery product made from shrimp. The hallmark of shrimp paste is its reddish-brown color. The color that arises is influenced by the pigment in the shrimp, which is the raw material. This pigment, called *astaxanthin*, is found in the shell of the shrimp. In addition, other pigments such as *astaxanthin* also give a distinctive red color to shrimp paste. According to Suprapti (2002), shrimp paste contains fat, protein, carbohydrates, phosphorus, calcium, minerals, water, and iron. In addition, shrimp paste also contains vitamin B12 and amino acids. But basically, the quality of each shrimp paste in terms of texture, aroma, etc. is influenced by the duration of the fermentation process. The longer the time in the fermentation process, the higher the quality of the shrimp paste.

Several types of microbes found in shrimp paste after going through fermentation by adding salt are *Micrococcus*. The other *bacteria*, *Achromobacter*, *Pseudomonas*, and *Flavobacterium,* were found in small amounts at the end of fermentation. Bacteria isolated from shrimp paste include *Micrococcus*, *Corynebacterium*, *Bacillus*, and *Cytophaga*.

THE PROCESS OF MAKING SHRIMP PASTE

One of the products resulting from the processing of shrimp with microbes is shrimp paste. In the manufacture of shrimp paste, the fermentation process can take place due to the activity of enzymes originating from the shrimp body. Furthermore, the initial process of making shrimp paste begins with the process of washing and sorting the shrimp. In this process, it is carried out to separate the quality of the shrimp and their feces. After that, the shrimp drying process is carried out until the water content of the shrimp is reduced or the shrimp is half dry. After the shrimp is half dried, the pounding process is carried out until smooth using a traditional mash tool. And in the pounding process, salt is also added to taste (Maflahah, 2013).

After the pounding process is complete, the fermentation process is carried out for approximately 1 day. Then the results of the fermentation are ground again using traditional collisions and in this second pounding process, at the same time as the printing process. The shrimp paste is printed using a box-shaped shrimp paste printer and wrapped in banana leaves. And the last stage is the drying process, which aims to make the shrimp paste not too pungent nor too salty.

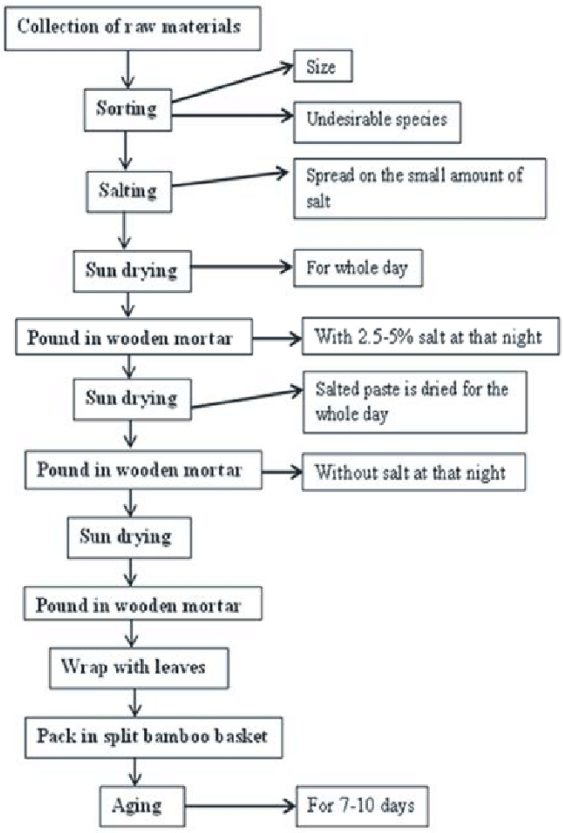

Image 3. Shrimp Paste Processing Stages
(Source : Turia Chakma, 2015)

Processing of shrimp paste is traditionally done in a simple way. The process starts with washing, drying, and pounding, then mixing with auxiliary materials, drying, molding, and fermentation processes. The fermentation process in making shrimp paste can take place because of the enzyme activity that comes from the shrimp body itself.

The various stages of this process can be described by:

1) Gathering raw materials in the form of rebon prawns, which are then sorted according to undesirable sizes and types;
2) A little salt is sprinkled into a large square container or in the shape of a board, followed by the shrimp;
3) The shrimp are then sun-dried for the entire day;
4) Shrimp that have been semi-dried are ground in a wood mortar with salt the next night;
5) On the next day, the salt paste is dried on the board all day and ground again at night;
6) During the second milling, no salt is added;
7) The product is dried for 3 days and finally ground into a paste at night with the addition of salt again;
8) Shrimp paste with a dark gray to blackish appearance is created;
9) After that, the paste is formed into squares or balls and wrapped in large leaves;
10) The shrimp paste is packed in a light basket made of split bamboo.

11) Then, the storage is carried out again for 7–10 days for the final fermentation process.

The addition of salt is done to control the fermentation process. Another function of salt is as a basic ingredient for salting fish. This is because there are fish that have high osmotic pressure, so there can be a process of absorption of free water in the fish meat. Other things can also cause plasmolysis, which will have an impact on the water of the microorganism cells being pulled out and can cause these microorganisms to die (Adawyah, 2008). Another function and role of salt in the fermentation process is as a texture maker. It can control the growth of microorganisms and can inhibit the growth of microorganisms that can cause spoilage and pathogenicity.

The initial pH value of a mixture of rebon, salt, and other ingredients needed in making shrimp paste is around 6. And during fermentation, the pH of the shrimp paste will rise to 6.5. And when the shrimp paste is finished, the pH value drops back to 4.5. When the fermentation is allowed to continue, the pH will increase again, and ammonia will be formed. However, when less salt is added during fermentation, spoilage occurs because large amounts of ammonia are formed. This condition occurs when the given salt concentration is less than 10%.

TYPE AND CHARACTERISTIC OF MICROBIAL FERMENTATION OF SHRIMP PASTE

From several existing studies, microorganisms can grow during the fermentation process. This will greatly affect the final product of fermentation. Microorganisms in existing studies were found to play a role in the differences in terms of number and type. Marlina (1992) found several types of microbes that were considered effective, namely, those from the genus Bacillus, Sarcina, Staphylococcus, and Clostridium. The bacteria that grow in fermentation vary, including both negative and positive bacteria. These bacteria can grow due to poor handling and the addition of salt, which is less than it should be (Junianto, 2011).

1) *Bacillus* sp.

Image 4. *Baciilus* spp.
(Source : Shouyong Ju, 2019)

The following is a classification of Bacillus bacteria according to Madigan (2005):
Kingdom : Bacteria
Phylum : Firmicutes
Class: Bacilli
Order: Bacillales
Family: Bacillaceae
Genus : Bacillus
Species: *Bacillus* sp.

This bacterium's morphology and characteristics *Bacillus* sp. has a whitish color and a round body shape. In addition to its round body shape, the shape of this bacterial colony is round and white in color, and if you look at the characteristics of this bacterium, it belongs to the Bacillus group of bacteria. According to Corbin in 2004, the characteristics of Bacillus bacteria are generally cream-white in color with irregular colony shapes. According to Hatmati in 2000, *Bacillus* sp. has various and uneven colony edges, rough surfaces, is not slimy, and includes dry and powdery. These bacterial colonies are large and do not look shiny. These bacteria are gram-positive bacteria that are expected to grow during the shrimp paste fermentation process.

2) *Pediococcus*

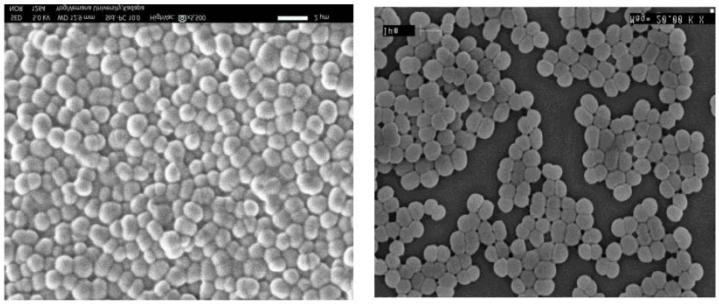

Image 5. *Pediococcus* spp.
(Source : Harika Katepogu, 2022)

Pediococcus spp. are lactic acid bacteria (LAB) found in the plant group together with Lactobacillus and Leuconostoc (Garvie, 1986). Because of this, they are often found in fermented plant foods, such as beer, cider, silage, sauerkraut, and other fermented vegetables. In addition, these bacteria are also found in other fermented foods, such as cheese, cured meats, raw sausages, and fresh and salted fish.

Pediococcus spp. are morphologically similar to *Tetragenococcus* spp. because they split into two planes at 90 degrees, forming a tetrad (Holzapfel *et al.*, 2006). As a result, *pediococcus* never form chains. Pediococcus is one of the main genera used in meat fermentation. The species used commercially are P. *acidilactici* and P. *pentosaceus*. Their maturation mechanism as *starters* has not been studied. However, their minimal oxidative activity in fermented foods wrapped in a normal way can maintain a low redox potential, which is thought to have a positive effect on taste.

3) *Corynebacterium*

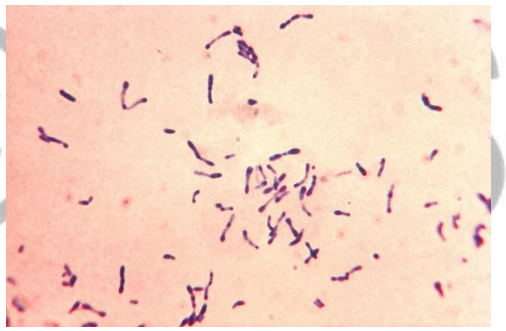

Image 6. *Corynebacterium*
(Source : Wikipedia)

Corynebacterium is a gram-positive, slender, rod-free bacterium that does not form spores. Some species may be slightly curved or have a club tip. Cell dimensions can be 0.3 to 0.8 m in diameter and 1.5 to 8.0 m in length. *Corynebacterium* is facultative anaerobic and catalase positive.

Corynebacterium glutamicum is an industrial microbe traditionally used for the production of amino acids. used for the fermentation process of various products through genetic-metabolic engineering. This bacterium was first discovered as a producer of glutamate. It is now used to make amino acids, such as lysine, threonine, and isoleucine, as well as vitamins such as pantothenate.

4) *Brevibacterium*

Image 7. *Brevibacterium*

(Source : https://microbiomology.org/)

Brevibacterium is a non-motile obligate aerobic organism that does not form spores, is acid fast, and belongs to the gram-positive bacteria with a growth temperature range of 4–42 °C and an optimum temperature of 2–28 °C. *Brevibacterium* grow in a wide pH range, starting from pH 5.5 and continuing up to 10, with an optimum of 7.0. As the salt concentration increases, the ability of organisms to grow at a lower pH decreases, but these organisms often produce large amounts of ammonia to raise the pH well above 7.0 during growth in laboratory and food conditions. *Brevibacterium* is found in dairy products, fresh and saltwater, marine organisms, insects, and decaying organic matter.

5) *Micrococcus*

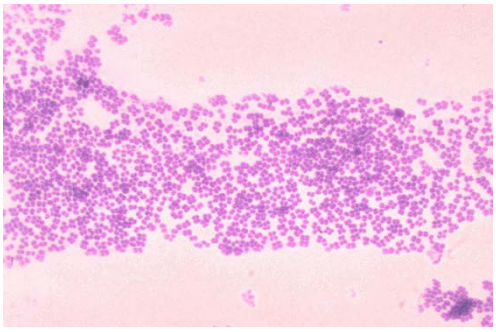

Image 8. *Micrococcus*
(Source : Wikipedia)

Micrococcus is a gram-positive bacterium that is generally strict aerobic and can reduce nitrate. *Micrococcus* luteus oxidizes carbohydrates to CO_2 and water, does not produce acid from glucose anaerobically, and does not synthesize or possess *arginine dihydrolase* or galactosidase.

SHRIMP PASTE QUALITY

Based on SNI 2716:2006 regarding shrimp paste, the quality requirements for shrimp paste according to food safety are those that have a maximum water content of 45%; its acid insoluble ash content is less than 1.5%; salt content is contained in the range of 12–20%; and have at least 15% protein.

Table 2. Quality of Shrimp Terasi according to SNI 2716:2006

Test Parameters	Unit	Condition
A Sensory	**-**	**Min. 7**
B. Chemical	**%**	
- Water content	%	Max. 45
- The ash content is not soluble in acid	%	Max. 1,5
- Sodium content	%	12-20
- Protein content	%	Min. 15

Good shrimp paste has a brilliant red-brown color, typical of the shrimp mixture. Not too soft and not too hard. According to Adawiyah (2007), shrimp paste that has a good quality value will be dark in color and have a texture that is not too soft or too rough. Protein hydrolysis occurs during fermentation. This protein will be broken down and form derivatives in the form of peptones, proteases, amino acids, and peptides. The water content of the shrimp paste, which is in the range of 26-42%, can be said to be good. If the water content is too low, the surface of the shrimp paste will appear covered with salt crystals, and the texture will no longer be chewy. Meanwhile, when the water content is too high, the shrimp paste will be soft.

The distinctive aroma of shrimp paste that arises is a combination of sour, savory, rotten, and the distinctive smell of shrimp. This happens because during the ripening process, 16 kinds of hydrocarbon compounds are produced, including 46 kinds of carbonyl, 7 kinds of alcohol, 7 kinds of fat, 15 kinds of sulfur compounds, 34 kinds of nitrogen compounds, and 10 kinds of other compounds.

To maintain its quality, the storage and packaging of shrimp paste also needs to be considered. According to Aryanto in 2000, shrimp paste is safe for consumption as long as the storage process is optimal. The shrimp paste should be stored in a dry place to avoid the growth of fungus. Terasi can last for one year if stored in a dry place.

Conclusion

Based on the results of a review of the stages of making shrimp paste, there are eight stages, namely: washing and sorting shrimp,

drying, pounding, adding salt, fermentation, further pounding, molding, and drying. The bacteria involved in the shrimp paste fermentation process are *Micrococcus*, *Bacillus*, *Pediococcus*, *Corynebacterium*, and *Brevibacterium*. Good shrimp paste has a brownish red color and is not too soft or too hard. Based on the Indonesian National Standard number 2716:2006 concerning shrimp paste, the quality requirements for shrimp paste that are in accordance with food safety are those that have a maximum water content of 45%; its acid insoluble ash content is less than 1.5%; salt content is contained in the range of 12–20%; and have at least 15% protein.

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