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FERMENTATIVE FISH SAUCE PRODUCT: A REVIEW

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ABSTRACT

Fish sauce is a product of fishery processing which is made through a fermentation process. Fermentation is one of the methods used to preserve food from raw materials with the help of microorganisms. After the fermentation of food, there will be changes in the aroma, texture and taste of the food. The purpose of this review article is to find out the bacteria involved, the method, the influencing factors, and the benefits of fermentative fish sauce. Bacteria that play a role in the fish sauce fermentation process are lactic acid bacteria. Methods in making fish sauce fermentation include preparing tools and materials, weeding fish, grinding, adding salt and enzymes, fermentation, sterilizing, filtering and finally packaging. Several factors that can affect the fish sauce fermentation process are temperature, microbial culture, oxygen, salt concentration, pH, and water concentration. The advantages of fermentation in fish sauce products are that it can form the desired texture, improve the taste of fish, control microorganisms.

INTRODUCTION

Fermentation is one of the ways used to preserve food from raw materials with the help of microorganisms. Microorganisms present in food may not be desirable if they can cause rot or damage to the food. But in the fermentation of food or drink, it is very necessary to grow the body of the renik. Because the microorganisms contained in the foodstuffs can change the existing components, so as to produce the product as desired. After fermentation of food ingredients there will be changes in the aroma, texture and taste of the food. Fermentation of foodstuffs can facilitate the digestive process in the body and can improve the quality of foods with high nutritional value.

In addition to the fermentation process, there are many benefits of the use of microorganisms, one of which is as a starter of food products whose function is able to inhibit decay and damage to these foodstuffs. The purpose of this review article is to find out the bacteria involved, the methods, influencing factors, and the advantages of fermentation in fish sauce.

Fermentation of fish sauce

Fermentation is a way of converting substrates into certain specific products produced with the help of biological components or microorganisms such as enzymes. Fermentation has been known since ancient times where it is used to make durable products both food and beverage. When fermentation requires several ingredients and tools, namely microbes as inoculum, containers (places) as a medium for the continuity of the fermentation process, substrate as a medium for the growth of microorganisms and as a source of nutrients.

In fishery products the fermentation process occurs biologically which is done to decompose compounds from complex proteins into simpler compounds using the help of enzymes derived from the body of fish and controlled microorganisms. During the fermentation process, proteins in fish will be hydrolyzed into peptides and amino acids which will then decompose further, creating a distinctive taste component in a fermented product. in the field of fisheries the utilization of the fermentation process can produce various products such as terasi, peda fish, jambal roti fish sauce etc.

Fish sauce is one of the products produced by fishery made through the fermentation process of rucah fish (petek, salem anchovies and layur) which takes 4-12 months for the manufacturing process (Desniar, 2004) and between 6-12 months for fermented in room temperature range of 30-40 °C (Lopetcharat et al., 2001). Fish sauce is generally clear brown which is hydrolyzed from fish that are given additional salt in a ratio of 1:2 to 1:3 (Lopetcharat et al., 2001). Nurhayati, 1995 stated that this fish sauce is made with the addition of high salt which is more than 30%, The addition of high salt levels gives the sensation of salty taste, a distinctive aroma and can be stored long-term (Purwaningsih and Nurhayai, 1995). In general, this fish sauce product is used for additional flavoring / flavor strengthening in various types of food.

The type of fermentation used in the process of making fish sauce is by the addition of enzymes using ficin, papain and bromelin (Basmal, 1974) Lactic acid bacteria (Tilarsih, 2008), koji and viscera (Dissaraphong et al., 2005). The manufacture of fish sauce enzymatically has several advantages where the manufacturing time is considered shorter to 3 days (Subroto et., al. 1985) and has a higher protein content of 10.52 grams / 100 ml (Muliati, 1985). In addition to the addition of enzymes, how to speed up the process of making fish sauce can be done by adding anti-bacterial salt, increasing the temperature during the fermentation process, and using plant proteases such as papain, fissine, bromelin and with koji soybeans (Hariono et., al 2005).

Bacteria that play a role in the fermentation process of fish sauce

Bacteria that play a role in the fermentation process of fish sauce are lactic acid bacteria where these bacteria are classified into two groups, namely lactic acid bacteria that bind aromas in fish sauce and lactic acid bacteria that produce proteolytic enzymes (Lopetcharate 2001 in Siahaan et., al 2017). Lactic acid bacteria play an important role in the food industry where these bacteria become a starter in the fermentation stages of drinks and foods. In addition, lactic acid bacteria can also expand the shelf life of products, produce bacteriocins as a food biopreservative, control the growth of destructive microorganisms and pathogens, and are good for health because they act as prebiotics (Nurmalasari, 2008).

In one study it was found that the fermentation of fish sauce (Caranx leptolepis fish or selar fish) carried out for six months produced a salt content of 19.04% where the value had met the requirements of SNI-01-4271-1996 with a salt content of about 19-25%. While the total microorganisms were found as much as 2.8 x 106 (colony units / ml) with a total of 1.1 x103 lactic acid bacteria (colony units / miles). In the fermentation process in MRS Agar, the dominantly grown bacteria are selected, where the isolation process will be carried out until four pure isolates are obtained, namely b1, b2, b5, and b6. The four isolates will then be characterized and identified to the species level and then used as a starter for fish sauce.

The b1 isolate looks round from above, smooth from the side, has a protrusion shape embossed with a white color, and a rod-shaped cell that belongs to the gram positive bacteria of non-motile pores. Based on Bergey's Manual in Tilarsih (2008), b1 isolates belong to the Bacillus sp type. While in Bergey's Manual book quoted by Tilarsih (2008), b2 isolates included in Pediococcus sp with tetracoccus form, included in gram-positive bacteria, have a diameter of 1.0-2.0 µm, non-sporous and non-motile, facultative anaerobic, with an optimal temperature for growth of 25-40 °C. Furthermore, in the kozaki manual quoted by Tilarsih (2008), this b2 isolate is thought to belong to group VI, namely Pediococcus urinaeequi. For b5 and b6 isolates, further identification was carried out using the API Kit System where after a table reading on the API Kit System database it was found that the b5 isolate was Staphylococcus lentus bacteria with a percentage of 99.5% and the b6 isolate was declared staphylococcus epidermidis bacteria with a percentage of 77.1%.

Fish sauce Fermentation Method

The way to process fish sauce is by fermentation process using salt and enzymes. Enzymes that can be used one of them is the coarse papain enzyme that serves to hydrolyze proteins so that fish sauce has protein content that is in accordance with the standard. Salt itself is used for the purpose of bacteriostatic so that only halophilic microorganisms live at the time of fermentation and also as a producer of proteolytic enzymes that will help speed up the fermentation process. In addition, salt in the process of processing fish sauce also has a function as a preservative during the fermentation process. The steps to take when making fish sauce are:

1. Preparing tools and materials

The first thing to do when going to make fish sauce is to prepare tools and materials. For fish sauce making materials can use all types of fish, but the most commonly used to make fish sauce are lemuru fish, manyung fish, sepat fish and other fish. The spice ingredients used in the manufacture of fish sauce are brown sugar, lemongrass, laos, bay leaves, sesame, coriander, pekak and also pecans. For the tools used are cloth filters, blenders, knives, pots and stoves.

2. Fish weeded

Before processing, the fish must first be weeded. Fish should be discarded gills, offal and also scales. After that the fish that have been weeded are cleaned using clean water.

3. Milling

Fish that have been cleaned then go into the milling process to get a smoother texture of the fish. After that, the fish mill can be

weighed to determine the dose of seasoning for the next process.

4. Salt and Enzymes

After the fish mill is weighed and then the fish grind is put in a jar and then given salt with a content of 20% and can also be added enzymes that can hydrolyze proteins.

5. Fermentation

Grinds of fish meat that have been mixed with salt and also enzymes will then be fermented for 30 days, 60 days or 90 days at room temperature. The length of the fermentation process will vary depending on the desired acidity level of fish sauce.

6. Sterilization

After fish sauce is fermented and sterilization is carried out to kill organisms that are likely to damage the results of fish sauce and to maintain sterility from processed products. Sterilization can be done with an autoclave at a temperature of 121^{o}C for 10 minutes. But usually in the processing of fish sauce traditionally rarely done sterilization because the fermented results will be cooked as well as given additional spices. The fermentation process in traditional processing is also done in a shorter time.

7. Filtering

After going through the sterilization process next is the filtering process by using a cloth filter to get fish sauce without dregs.

8. Packaging

The last process is packaging and also storage of fish sauce. Fish sauce is packaged in glass bottles or plastic bottles and stored at room temperature.

Comparison Table of Fish sauce Fermentation Using Enzymes and Salts

	Fermentation of Fish sauce Using Enzymes	**Fermentation of Fish Sauce Using Salt**
Time	The manufacturing process is shorter can be done for 3 days.	The manufacturing process is quite long ranging from 4-12 months.
Protein Levels	Enzymatic hydrolysis results in higher protein levels.	The higher the salt concentration, the lower the level of protein produced.
Taste	The taste of a typical fish is slightly reduced	The taste of salty fish and better
Color	The longer the fermentation period, the more brown-black the color will be.	The longer the fermentation period, the more brown-black the color will be.
Aroma	The higher the enzyme (e.g. bromelin enzyme) the higher and stronger the aroma of fish sauce and the aroma will be strong even though the fermentation time is not long.	The aroma of fish sauce will be very strong if the fermentation is long.
Texture	The texture of fish sauce fermented using enzymes tends to be more liquid. However, this is influenced by the amount of enzymes given. The higher the enzyme levels, the thicker the texture of fish sauce.	The texture is thicker. But the texture of food (fish sauce) is influenced by the water content of the product.
Shelf Life	Because the levels of protein contained are high, contamination of rotting microbes is easy to occur so that the shelf life is not long.	Because protein levels are lower due to the higher concentration of salt, the activity of microbes is limited and the shelf life is longer.

Factors Affecting Fish sauce Fermentation

In the fermentation process, the manufacture of fish sauce involves the activity of microorganisms in the form of bacteria naturally derived from the fish's body. This is because the fermentation process will be successful if there is active microbial activity, so that the fish sauce produced has good quality. However, the success of the fermentation process in the manufacture of fish sauce is also influenced by various factors. Here are the factors that affect the fermentation process in the manufacture of fish sauce:

a) Temperature

Temperature is one of the physical factors that support the growth of dominant bacteria during the fermentation process. Microbial growth, including bacteria has a minimum, optimum, and maximum temperature range (Sanita & Soemarno 2013). The minimum temperature is the lowest temperature where bacteria can still survive, but if the fermentation process is treated below the minimum temperature then the growth of microorganisms will not occur again. Optimum temperature is the most appropriate temperature for the growth of microorganisms, optimum temperature is very likely to occur faster growth of microorganisms. The maximum temperature is a temperature that tends to be hot and becomes the limit of giving the highest temperature because more than that temperature the bacteria will not experience growth again.

b) Microbial culture

In the fermentation process, the use of microbial cultures derived from certain strains is indispensable. Cultured microbes need to know their properties first and the equipment used in the culture process must be sterile. This aims to keep microorganisms or bacteria from growing. In general, microbial cultures are divided into two, namely single and mixed cultures. In a single culture process, cultured microbes need to be given optimum temperature treatment because a single culture has a higher risk of failure. While mixed culture is a type of culture that can reduce failure and reduce the risk if other microbes are not actively fermented (Handiyanto & Azim, 2016).

c) Oxygen

The availability of oxygen greatly affects the types of microbes whose growth requires oxygen. Oxygen levels that are not in accordance with bacterial growth will cause changes in the morphological shape system and physiological work system during the fermentation process. Each microbe needs different oxygen levels to form new cells in the fermentation process.

d) Salt concentration

The concentration of salt given in the manufacture of fish sauce serves as a bacteriostatic, so it will support halophilic microorganisms that can produce enzymes and speed up the fermentation process. In addition, the addition of salt in the fermentation process of fish sauce is also known to extend the shelf life and preserve the ingredients during the fermentation process. In addition, according to Ebine (1997) in (Kurniawan, 2012) reported that the influence of salt concentration in the fermentation process of fish sauce, namely to avoid the growth of types of microbes that are not needed during the fermentation of fish sauce, create anaerobic parts in the fermentation process, prevent or eliminate bitter taste due to proteins broken down by protease enzymes, and serve as a flavor giver and preservative fish sauce can be stored longer.

e) pH

pH is a chemical factor that expresses the degree of acidity of an ingredient. pH in the fermentation process is one of the most important chemical factors because it is related to the continuity and breeding of microbes. In addition, pH also plays a role in the durability of a foodstuff.

f) Water concentration

The moisture content used in the fermentation of fish sauce affects the growth rate of bacteria. This is because a microorganism will not experience growth and breeding if there is no water as a medium of development. Water as a substrate used in the growth of microorganisms is expressed in terms of water activity (aw) or water activity, which is a comparison between the vapor pressure of the solution (P) and the pressure of pure water vapor (Po) in the same room.

Advantages of Fish Sauce

Fish sauce is one of the fermented processed food products made from fish or fish waste that has a distinctive taste and smell and long shelf life. In general, fish sauce is made from protein sources both animal and vegetable hydrolysis acid and enzymatically (Oktaviani et al., 2016). Traditionally, fish sauce is produced by mixing two or three parts of fish with salt which is then fermented for 6-12 months or more at ambient temperature.

The application of technology in the manufacture of fish sauce through the addition of enzymes has sufficient protein content or in accordance with Indonesian Industrial Standards. In addition, the fish used in the manufacture of fish sauce also has an

effect. Like sea fish that has a fairly high omega-3 content where omega-3 is beneficial such as lowering the risk of cardiovascular disease, preventing dementia, relieving arthritis.

Fermentation processes involving lactic acid bacteria can degrade proteins into peptides that produce angiostensin converting enzyme (ACE) inhibitor activity that has the potential to inhibit blood pressure (Wenno et al., 2016).

Conclusion

Fish sauce is one of the products produced by fishery processing made through the fermentation process. Bacteria that play a role in the fermentation process of fish sauce are lactic acid bacteria. The processes carried out in making fish sauce fermentation include preparing tools and materials, weededing fish, milling, giving salts and enzymes, fermentation, sterilization, filtration and finally packaging. Some factors that can affect the fermentation process of fish sauce are temperature, microbial culture, oxygen, salt concentration, pH, water concentration. The advantages of fermentation in fish sauce products are that they can form the desired texture, improve the taste of fish, control microorganisms .

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