

Original Research Article

Application of Good Manufacturing Practices and Sanitation Standard Operating Procedures on Jambal Roti Salted Fish Processing at MSME MamahJambalPangandaran

ABSTRACT

This research aims to evaluate the application of the GMP and SSOP systems and determine the quality of the jambal roti salted fish produced at MamahJambal MSMEs, Pangandaran. The research was conducted from September 2021 to January 2022 using the case study method. The research procedure includes observation of processing stages, prerequisite program deviation analysis, and microbiological, chemical, and metal contamination testing. The data obtained were compared and analyzed descriptively, referring to Regulation of the Minister of Marine Affairs and Fisheries of the Republic of Indonesia No. 17 of 2019 and SNI 8376:2017. The analysis showed that there were 12 minor deviations, 9 major deviations, and 3 serious deviations in the process of processing jambal roti at MamahJambal. Based on the number of deviations applying GMP and SSOP, MamahJambal has a C predicate (enough). Quality analysis of jambal roti showed that the samples met microbiological and metal contamination standards. The test did not find the content of *Salmonella* sp. and *Escherichia coli* in the sample. The metal contamination test results found promising results, cadmium (Cd) 0.0037 mg/kg, mercury (Hg) 0.2993 mg/kg, and no lead (Pb) content. The results of chemical parameter testing showed a difference in the amount of chemical content in jambal roti salted fish with a predetermined standard, the water content of 55.58%, the salt content of 10.6%, and acid insoluble ash content of 0.09%.

Keywords : Salted Fish, Jambal Roti, UMKM, UPI Basic Feasibility, Good Manufacturing Practices, Sanitation Standard Operating Procedures, Food Safety

1. INTRODUCTION

Pangandaran is one of the coastal areas of Indonesia that has potential in the fish-based food processing sector. One of the regional specialties is jambal roti salted fish. This preparation made from catfish (*Arius thalasinus*) is traditionally processed with the addition of salt, which aims to preserve fish and extend the product's shelf life [1].

The jambal roti salted fish processing in Pangandaran Regency is generally still traditionally done [2]. This can be seen from the processing process obtained from generation to generation with limited knowledge of food safety and quality management [3]. The lack of knowledge about food safety and quality management resulted in the processing process being still far from the application of sanitation and hygiene and has the potential to cause food insecurity.

Deviations often found in jambal roti salted fish is the presence of chemicals that are not safe for consumption, such as pesticides, formalin, heavy metal contamination, and microbiological contamination [4][5]. Deviations found in jambal roti salted fish are a source of food insecurity that can cause health problems (food borne disease) [5][6].

These problems have caused the Indonesian Ministry of Maritime Affairs and Fisheries to make regulations that aim for each fish processing unit to implement an integrated quality management program with two basic prerequisites, namely Good Manufacturing Practices (GMP) and Sanitation Standard Operating Procedures (SSOP) [7][8]. Traditional jambal roti salted fish processing is still constrained in applying GMP and SSOP. Constraints experienced in applying GMP and SSOP by the salted fish processing industry are caused by the lack of awareness and understanding of business actors regarding the implementation of quality management systems [9].

A good application of GMP and SSOP in all aspects of production is expected to improve the quality and food safety of jambal roti salted fish. An increase in food quality and safety will encourage the development of production and marketing of jambal roti salted fish. One of them is in MSME MamahJambal, one of the largest jambal roti salted fish producers in Pangandaran.

The application of GMP and SSOP can improve food quality and safety, which has an impact on increasing consumers buying jambal roti salted fish products. Therefore, this study aims to analyze the application of GMP and SSOP in the manufacture of Jambal Roti salted fish at MamahJambalPangandaran SMEs, starting from receiving raw materials, processing, and testing the quality of Jambal Roti salted fish, as well as employee aspects of improving quality, quality, and the safety of jambal roti salted fish products. This study aims to evaluate the application of the GMP and SSOP systems during the Jambal Roti salted fish processing in MamahJambal MSMEs, Pangandaran, and determine the quality of Jambal Roti salted fish produced at MamahJambal SMEs, Pangandaran.

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2. MATERIALS and methods

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2. METHODOLOGY

This research was carried out at the MamahJambal Fish Processing Unit, Pangandaran, from October to December 2021. The method used in this study was a case study and observation with a comparative descriptive analysis of the applicable regulations. The case study method aims to find information related to detailed field facts from existing symptoms, get justification related to ongoing problems through activities, and find out problem solving by a team that is the research target.

Data were collected by observing the jambal roti processing process, employee interviews, and the results of microbiological, chemical, and metal pollution tests. The data obtained were then analyzed using a comparative descriptive method against SNI 8376:2017 [10] and the Minister of Marine Affairs and Fisheries of Republic Indonesia Regulation Number 17 of 2019 concerning Requirements and Procedures for Issuing a Processing Feasibility Certificate [11]. Assessment regarding the implementation of GMP and SSOP refers to Table 1.

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Table 1. Processing Feasibility Rating

Rate	Number of Deviations			
	Minor	Major	Serious	Critical
A = Very Good	6	0-5	0	0
B* = OK	≥ 7	6-10	1-2	0
C = Enough	NA	≥11	3-4	0
D = Fail	NA	NA	≥5	0

* The number of Major and Minor deviations is not more than 10

3. RESULTS AND DISCUSSION

3.1 PRODUCT DESCRIPTION

Jambal Roti is processed salted fish derived from thick-fleshed fish such as kadukang fish (*Arius thalassinus*) and catfish (*Pangasius hypothalamus*) [2] [12]. As the name implies, jambal roti salted fish has a texture that quickly resembles bread crumbs when it is fried [13] [14]. In Pangandaran Regency, two types of salted jambal roti are distinguished by their quality: Jambal Roti ordinary and Jambal Roti super.

Generally, the process of making jambal roti salted fish is still done traditionally. The two main stages that must be carried out in the processing of jambal roti anchovies are salting and drying [12]. The Indonesian National Standardization Agency through SNI 8376:2017 concerning jambal roti salted fish that the processing stages of salted jambal roti consist of weeding, aging, fermentation, and drying. Jambal Roti salted fish processing methods differ in each region and depend on the type of product to be produced [15].

3.2 EVALUASI PENERAPAN GMP DAN SSOP

Evaluation of the implementation of GMP and SSOP in the salted fish jambal roti processing at MamahJambal SMEs is based on the Minister of Marine Affairs and Fisheries Regulation Number 17 of 2019. Aspects of GMP and SSOP are assessed based on four categories of deviations: minor, major, serious, and critical.

3.2.1 Minor Deviation

Analysis of the results of observations made on the processing of salted fish jambal bread at MamahJambalPangandaran SMEs found eleven small deviations. Minor deviations that occur include facilities, application of sanitation, and hygiene at UPI (Table 2).

Table 2. Minor Deviations in MamahJambalMSMEs

Minor Deviation Aspect	Conditions at MSME Mamah Jambal	Regulation (Permen KP No. 17 of 2019)	Repair Recommendations
Management Commitment	Quality documents are incomplete.	Have a solid commitment to implement basic requirements, and have documents and a unified team.	Complete quality information documents.
Door	Made of smooth wood but not impermeable to	It is made of soft and waterproof material.	Do a coating on the bottom of the door so that it is

Minor Deviation Aspect	Conditions at MSME Mamah Jambal	Regulation (Permen KP No. 17 of 2019)	Repair Recommendations
Wall	water. The walls are waterproof, not easy to peel and challenging to clean. Some grooves are difficult to clean.	Waterproof, not easy to peel, flat, without cracks, not mouldy, and easy to clean.	waterproof and not brittle. Uneven walls can be smoothed or coated with different paint and are easy to clean. Alternatively, the walls can be coated with ceramic for easy cleaning and not mould [16].
Lighting	The lighting from the lamp is bright enough, but the lamp is not equipped with a protector.	The condition of the room is bright enough, and the lamp is equipped with a safe protector.	If possible, the lamp section is protected.
Tool Arrangement and Placement	Equipment is only hung and does not have particular storage space.	Prevent cross-contamination, and ensure the smooth process of processing and sanitizing tools.	It is necessary to pay attention to the storage area for tools to keep them sanitary and prevent cross-contamination.
Equipment Marks and Use	There are no markings indicating the work area on the equipment.	Equipment is marked for each different work area and separated between use for raw materials and products.	It was marking on tools adapted to use in the processing process.
Laundry Design and Facilities	It does not have special washing facilities. Washing is carried out in the processing area.	They were designed to prevent contamination and maintain and keep clean.	There must be a barrier between the equipment washing facility and the processing area to avoid cross-contamination.
Foot Sinks	It does not have a foot sink to enter the processing area.	available for products that, according to the type of processing, are not suitable for using the foot sink, they can be replaced with footwear specifically used in the processing room.	Foot sinks can be added at the entrance to the processing area by making a small tub filled with clean water.
Employee Changing Room	The changing room is attached to the toilet, and there are no lockers.	It is outside the processing area and is equipped with lockers.	Adding lockers for employees can store their luggage.
Warning on How to Do Processing	There are no warning signs whatsoever.	Existing and adequate, such as no smoking, no spitting, no littering, etc.	The addition of simple warning signs is needed to remind employees about hygiene and sanitation during processing.
Label on Packaging	The product is packaged using newsprint, so it does not have a product description. The product brand is found on the tertiary packaging, namely on the plastic wrap.	Product packaging is labelled or a description that shows a summary or description of the product: type of product, year, month, and date of production.	The date and month of production can be added simply by attaching a label to the secondary (plastic) packaging.
Training Program	Does not have a training program for employees.	There is a program to increase the ability/skills of employees.	It is necessary to hold a training program, especially regarding implementing GMP and SSOP in the

Minor Deviation Aspect	Conditions at MSME Mamah Jambal	Regulation (Permen KP No. 17 of 2019)	Repair Recommendations
			processing process.

3.2.2 Major Deviation

Major deviations in jambal roti salted fish processing at MamahJambal MSMEs returned nine deviations. These deviations are found in aspects of UPI's building and construction, product reception and handling, employee facilities, and employee hygiene (Table 3).

Table 3. Major Deviations in MamahJambal MSMEs

Major Deviation Aspect	Conditions at MSME MamahJambal	(Permen KP No. 17 of 2019)	Repair Recommendations
UPI Location and Area	It is located in the middle of a residential area with a dusty area. Allows for contamination during processing.	The location of the UPI area is sanitary and hygienic, does not become a source of contaminants and is separated from the place of residence.	Locations that are not possible to change can be circumvented by improving the construction of UPI to prevent contamination from the environment around UPI.
Floor	It has an uneven surface, and there are still puddles of water on some sides.	Smooth surface, no cracks, no puddles	It is necessary to repair some parts that have puddles during the processing.
Receiving Raw Materials	Done quickly, but not sanitary and not documented.	Fast, sanitary, protected and prevent contamination; documented and monitored.	Raw materials should not be stored on the floor. There needs to be a special place, so the raw materials do not come into direct contact with the floor. Documentation of activities and recording raw materials entry also needs to be done.
Fresh, Raw and Cooked Product Handling Temperature	Receipt of raw materials is not carried out with the cold chain, so it can affect the product's characteristics.	Have a temperature and storage area following product characteristics	he raw material received should be given ice so that its quality is maintained and its characteristics do not change.
UPI Construction	The UPI design can only minimize the entry of sources of contamination but cannot prevent the entry of nuisance animals and the accumulation of dirt.	Able to prevent the entry of sources of contamination, nuisance animals, and accumulation of dirt	Improvements and adjustments to several UPI design to prevent the entry of nuisance animals and the accumulation of feces during and after production.
Room and Equipment Conditions	The room had some dirty sides (walls) and could not be cleaned.	Well-maintained, clean and sanitary.	Need to do maintenance on dirty walls. In addition, the cleanliness of the walls must always be maintained and cleaned after the processing is complete.
Hand washing facilities	There is no hand washing area (sink).	Adequate hand washing facilities are	Provide a sink with the amount of 1 for every 10 employees.

Major Deviation Aspect	Conditions at MSME MamahJambal	(Permen KP No. 17 of 2019)	Repair Recommendations
Work Clothes and Employee Hygiene	Employees do not have unique work clothes for processing. Employees use clothes that have been used since their respective homes.	available. Work clothes are available, and the cleanliness of employees is well maintained.	Work clothes must be separated from clothes used outside the processing. UPI can provide an apron, gloves, and headgear that are kept clean.
Pest Control Facility	Does not have pest control facilities.	There are pest control facilities available.	Must have pest control facilities equipped with monitoring and control procedures.

3.2.3 Serious Deviation

Observations on the processing of salted fish found three serious deviations. If no corrective action is taken, this deviation will affect the safety and quality of food. The three aspects that are classified as serious deviations are the aspects of UPI ventilation, packaging materials, packaging, and labels on products, as well as the health condition of employees (Table 4).

Table 4. Serious Deviations in MamahJambal MSMEs

Serious Deviation Aspect	Conditions at MSME MamahJambal	(Permen KP No. 17 of 2019)	Repair Recommendations
Ventilation	Air circulation is obtained through a wide open door and is not protected by a bulkhead and ventilation holes above it so that it cannot prevent the entry of dust or contaminants.	Sufficient air circulation to prevent condensation, humidity and contaminants from entering the process chamber and easy to maintain and clean	the air inlet is too large and does not have a barrier. It is necessary to install a plastic curtain so that air from outside does not enter directly. UPI can also use a blower to support good circulation.
Packaging, Wrapping and Labeling Materials	Packaging materials that box directly with the product are newsprint and have the potential to contaminate the product.	Food grade protects the product, is hygienic and does not contaminate the product.	Primary packaging should be replaced with other materials that do not have the potential to contaminate the product.
Employee Health	Employees with mild illnesses are still allowed to enter and carry out the processing.	Employees who are sick and potentially transmit diseases are not allowed to come to work.	If there are employees who are sick and have the potential to transmit the disease, management should advise not to process jambal roti.

3.2.4 Critical Deviation

The observation activity on applying for the pre-requisite program at MamahJambal's fish processing unit did not find any critical deviations. Critical deviations are deviations that affect food safety if no corrective action is taken following the deviations that occur immediately. The absence of critical deviations indicates that MamahJambal's UMKM has gradually tried to implement the basic eligibility requirements system.

3.3 ANALYSIS OF THE APPLICATION OF GMP AND SSOP IN MSMEs MAMAH JAMBAL

Observations on the implementation of GMP and SSOP that have been carried out at UPI owned by MSME MamahJambal found several irregularities. The deviations found were divided into minor, major, and severe categories (Table 6). The number of deviations in MSME MamahJambal is calculated and compared with Table 1. Based on the number of deviations, MSME MamahJambalPangandaran has a processing feasibility level with a predicate of C (sufficiently).

Table 5. Number of Deviations in MSME MamahJambal

	Deviation Category			
	Minor	Major	Serious	Critical
Number of Deviations	12	9	3	0

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3.4 MICROBIOLOGICAL TEST

The results of the microbiological contamination test can be seen in Table 6. Based on the tests, no microbial contamination in the form of *Salmonella* and *E. coli* was found in the test sample. This is possible due to the salting process in fish which inhibits the activity of these microorganisms [17]. The undetected microbiological contamination in this test can also be caused by the storage of jambal roti salted fish below the freezing point. In addition, high salt content in jambal roti salted fish is one of the inhibiting factors for the growth of microorganisms in the product because salt is antimicrobial [18]. *Salmonella* cannot survive in an environment with salt levels above 9% [19]. Meanwhile, *E. coli* will also be resistant if the domain has a high salt content.

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Research on *Salmonella* levels in talang-talang salted fish also mentions that other factors can affect microbiological contamination, namely product storage [19]. Salted fish that are not stored properly and are not placed at low temperatures have the potential to be contaminated by microbes. *E. coli* can only grow at a temperature of 10-40 °C with an optimum temperature of 37 °C, while *Salmonella* can only grow at a temperature of 5-47 °C with an optimum temperature of 35-37 °C [20]. Product storage carried out at MamahJambal SMEs is an important aspect that is carried out in controlling microbiological contamination.

Table 6. Quality Test Results of Jambal Roti Salted Fish Production of MSME MamahJambal

Observation Parameter	Unit	Observation Parameter Content	
		Analysis Standard (SNI 8376:2017)	Laboratory Test Results
Microbiological Test			
<i>Salmonella</i> sp.	mg/kg	≤ 0,1	Negatif
<i>Escherichia coli</i>	mg/kg	≤ 0,5	0
Chemical Test			
Water content	%	≤ 50	55,58
Salinity	%	15 – 20	10,6
Ash content is not soluble in acid	%	≤ 0,3	0,09
Metal Grade Test			

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Cadmium (Cd)	mg/kg	≤ 0,1	0,0037
Mercury (Hg)	mg/kg	≤ 0,5	0,2993
Lead (Tb)	mg/kg	≤ 0,3	0

3.5 CHEMICAL TEST

The results of testing the chemical parameters in Jambal Roti salted fish can be seen in Table 6. This test found water and salt content mismatches in Jambal Roti salted fish produced by MamahJambal SMEs with applicable standards. The water content of Jambal Roti salted fish produced by MamahJambal SMEs is 55.58% and is above the average determined by BSN in SNI 8376:2017, which is a maximum of 50%. Meanwhile, the salt content of 10.6% is below the predetermined standard of 15-20%. The ash content that is insoluble in acid is in accordance with the applicable quality standards.

The mismatch of water and salt content is caused by the low concentration of salt used because the water content will decrease with increasing salt content [21]. Maulid and Abrian's research (2020) states that jambal roti salted fish products in Pangandaran generally have a water content above a predetermined standard. The water content of Jambal Roti salted fish in Pangandaran varies between 51.55-62.46%. The same study also explains that jambal roti salted fish products in Pangandaran, on average, have a low salt content. The average salt content in Jambal Roti salted fish products produced in Pangandaran is 4.75-13.17%. The difference in water and salt content in Jambal Roti salted fish products in Pangandaran occurs due to the low concentration of salt used in the salting process.

The salting process will also affect the content of acid insoluble ash content. Research on the quality of dry salted African catfish revealed that using the dry salting method would produce a higher acid insoluble ash content than the wet salting method [22]. The acid insoluble ash content in the Jambal Roti salted fish produced by MSME MamahJambal followed the existing provisions of 0.09% of the quality standard set at ≤0.3%.

3.6 METAL POLLUTION TEST

Testing samples of salted fish jambal roti produced by MSME MamahJambal found that the product contained heavy metal contamination in the form of Cadmium (Cd) of 0.0037 mg/kg and Mercury (Hg) of 0.2993 mg/kg (Table 6). The content of this heavy metal is still below the applicable quality threshold. Detection of Cd and Hg content in jambal roti salted fish can be caused by contamination in fish habitat waters [4].

The content of Cd and Hg detected in jambalroti salted fish product MamahJambal was indicated to come from several sources. The use of salt in the fermentation process allows it to be a source of heavy metal contaminants. The metal content in salt comes from marine pollution where salt is made, which can contaminate jambal roti salted fish products [23]. Moreover, the salt used came from the North Coast of Java which was detected to be contaminated with metals from industrial waste. However, the amount was still below the specified threshold [24] [25].

4. CONCLUSION

Based on the research that has been done, the processing of jambal roti in MSME MamahJambal has followed the provisions regarding GMP and SSOP with sufficient status. There are several deviations consisting of 12 minor deviations, 9 major deviations, and 3 serious deviations in the whole processing stage. The quality of the salted jambal roti

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How many samples did you test ?
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produced has met the majority of applicable quality standards, although there are still discrepancies in the aspects of water content and salt content. The detected water content is still above the predetermined standard, which is a maximum of 50%. Meanwhile, the salt content is still below the standard for the use of jambal roti salted fish, which is 15-20%.

REFERENCES

1. Rostini I, Pratama RI, Liviawaty E. Development of fishery product processing technology in Pangandaran district. *Journal of Community Service*. 2018;2(4):386-389. Indonesia
2. Maulid DY, Abrian S. Salt content and proximate composition of salted fish jambal roti (*Arius thalassinus*) from Pangandaran. *Marine and Fisheries Science Technology Journal*. 2020;1(1):1-6. Indonesia.
3. Nurpajri Y, Wiryati G, Sunaryo A. Identification of fishery potential in Parigi District, Pangandaran Regency, West Java Province. *Journal of Fisheries and Marine Extension*. 2019;13(1):29-41. Indonesia.
4. Nuraini V, Suhartatik N. Counseling on foods of animal origin free of borax, formalin and heavy metals in 5 sub-districts of Solo Raya. *Proceedings of the Community Service Seminar (Senadimas)*. 2018. Indonesia.
5. Purnomo IMH, Lestari SD, Baehaki A. Analysis of the content of formaldehyde, pesticides, and fungi in several types of salted fish. *Journal of Fishery Products Technology*. 2017;6(1):47-55. Indonesia.
6. Nurcahyani EA, Karyantina M, Suhartatik N. Utilization of activated carbon to reduce formalin contamination in jambal roti salted fish. *UNISRI Scientific Journal of Food Technology and Industry*. 2020;5(1):90-99. Indonesia.
7. Bimantara AP, Triastuti RJ. Application of good manufacturing practice (GMP) at the squid (*Loligo vulgaris*) freezing factory at PT. StarfoodLamongan, East Java. *Journal of Marine and Coastal Science*. 2018; 7(3). Indonesia.
8. Suharna C, Sya'rani L, Agustini TW. Study of quality management system on the processing of "jambal roti fish" in Pangandaran. *Dissertation. Postgraduate Program, Diponegoro University*. 2006. Indonesia.
9. Sumarno T, Agustini TW, Bambang, AN. Strategy for developing the quality of jambal roti salted fish (catfish) in Karangsong, Indramayu Regency. *Journal of Indonesian Fishery Products processing*. 2020; 23(2): 196-205. Indonesia
10. Indonesian National Standardization Agency. *Indonesian national standard for jambal roti salted fish*. Jakarta: BSN; 2017.
11. Indonesian Ministry of Marine Affairs and Fisheries. *Regulation of the Minister of Fisheries and Marine Affairs Number 17 of 2019 concerning Requirements and Procedures for Issuing Processing Feasibility Certificates*. Jakarta: KKP; 2019.
12. Christie TF, Ma'ruf WF, Susanto E. Reducing oxidation of catfish (*Arius thalassinus*) jambal roti with edible film implications during storage at room temperature. *Journal of Fishery Products Processing and Biotechnology*. 2016;5(1):94-100. Indonesia
13. Karyantina M, Anggarahini S, Utami T, Rahayu ES. Moderate halophilic lactic acid bacteria from jambal roti: a traditional fermented fish of Central Java, Indonesia. *Journal of Aquatic Food Product Technology*. 2020;29(10):990-1000.
14. Niken T, Nurcahya DE, Winarni AT. Sustainability analysis of jambal roti business as superior product from Indramayu, West Java of Indonesia. *Eurasia: Economics & Business*. 2019;8(26):52-62.
15. Huda N. *Indonesian fermented fish products. handbook of animal-based fermented food and beverage technology*. Boca Raton: CRC Press; 2012.

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16. Hidayat T, Najah Z, Putri NA, Zulmaner. The evaluation of good manufacturing practices (GMP) in fish processing SME center case study of Balikpapan City. *Food Science Journal*. 2019; 1(1):45-53.
17. Choirunissa V, Karyantina M, Suhartatik N. Safety assessment of jambal roti salted fish in Solo City. *Proceeding ICTESS (International Conference on Technology, Education and Social Sciences)*; 2018.
18. Akbar MY, Diansyah G. Detection of *Salmonella* sp. on anchovy (*Stolephorus* spp.) fishery products in breech waters, Banyuasin Regency, South Sumatra. *Maspari Journal: Marine Science Research*. 2016; 8(1): 25-30. Indonesia.
19. Melawati B, Fakhurrrazi, Abrar M. Detection of *Salmonella* sp. on talang-talang salted fish (*Scomberoidestala*) in Leupung District, Aceh Besar District. *Veterinary Student Scientific Journal*. 2019; 3(3): 175-180. Indonesia.
20. Susianawati R. Study of the application of GMP and SSOP on dried salted fish products in an effort to improve food safety in Kendal district. Thesis. Postgraduate Program, Diponegoro University; 2006. Indonesia.
21. Rochima E. Effect of salt fermentation on the characteristics of jambal roti. fishery product technology bulletin. 2005; 8(2): 46-56. Indonesia.
22. Muhtadi Z, Pancapalaga W, Wachid M. Quality of dry salted African catfish (*Clariasgariepinus*) using dry salting and wet salting methods with different concentrations of NaCl. *Food Technology and Halal Science Journal*. 2019; 2(2): 239-255. Indonesia.
23. Yuyun Y. Analysis of lead and cadmium heavy metal content in salted fish processing in Banggai Islands Regency. *Journal of Health Bakti Tunas Husada: Journal of Nursing, Health Analysts and Pharmacy*. 2018; 17(2): 331-338. Indonesia.
24. Samsiyah N, Moelyaningrum AD, Ningrum PT. Quality Indonesian salt: study of the heavy metal content of lead (pb) in salt. *Scientific Journal of Fisheries and Marine Affairs*. 2019; 11(1): 43-48. Indonesia.
25. Suyanto A, Kusmiyati S, Retnaningsih C. Heavy metal residue fish from polluted waters off the north coast of Central Java. *Journal of Food and Nutrition*. 2010; 1(2). Indonesia.