JPBIO (Jurnal Pendidikan Biologi)
Vol. 7, No. 2, November 2022, 192 – 199 //e-ISSN 2540-802X
http://jurnal.stkippersada.ac.id/jurnal/index.php/JBIO/index

Analysis of escherichia coli dan salmonella sp. in shrimp fermentation products

Sukmawati [1*], Melda Yunita [2], Sipriyadi [3], Erin D Noya[1], Henok Siboka Onim[1]

[1]Department of Fishery Product Processing, Universitas Muhammadiyah Sorong, Indonesia.
[2]Department of Medical Education, Faculty of Medicine, Universits Pattimura, Indonesia
[3]Department of Biology, Faculty of Mathematics and Natural Science, Universitas Bengkulu, Indonesia
[3]Master's Study Program in Biology, Universitas Bengkulu, Indonesia

Corresponding author: sukmawatinurdin8@gmail.com

Article Info

Article History:
Received 30 June 2022
Revised 28 September 2022
Accepted 19 October 2022
Published 30 November 2022

Keywords:
E. coli
Salmonella sp.
Shrimp
Fermentation
Sorong

ABSTRACT

South Sorong, West Papua, is one of the areas that produce rebon shrimp. Rebon shrimp can be made into fermented products such as rebon shrimp paste (*terasi*) or acidic rebon shrimp paste (*cincalok*). *Terasi* is a food additive that functions as a seasoning or flavoring, while *cincalok* is a fermented food added with salt and rice. The objective of this study was to determine the contamination of *E. coli* and *Salmonella* in fermented rebon shrimp products. This study was a descriptive study by describing the presence or absence of contamination by *E. coli* and *Salmonella* sp. on rebon shrimp paste (*terasi*) and acidic rebon shrimp paste (*cincalok*). The study concluded that the samples of rebon shrimp paste (*terasi*) and acidic rebon shrimp paste (*cincalok*) in South Sorong were safe from contamination by *Escherichia coli* and *Salmonella* sp. According to the Indonesian National Standards Agency, fermented fish products with or without salt, good and suitable products for consumption are those that are negative for *Salmonella, V. cholera, Escherichia coli* with a limit of <3 MPN/g and *Staphylococcus aureus* should be <1 x10^3 colonies/g.

Citation: Sukmawati, Yunita, M., Sipriyadi, Noya, E.D., & Onim, H.S. (2022). Analysis of escherichia coli dan salmonella sp. in shrimp fermentation products. *JPBIO (Jurnal Pendidikan Biologi), 7*(2), 192-199. DOI: https://doi.org/10.31932/jpbio.v7i2.1785

INTRODUCTION

Sorong south of West Papua is one of the areas that produce rebon shrimp (Suruan, et. al., 2020). Rebon shrimp can be made into fermented products such as rebon shrimp paste (*terasi*) or acidic rebon shrimp paste (*cincalok*) (Irianto, 2012). Shrimp paste is a food additive that functions as a spice or flavoring (Murti, et. al., 2021). Shrimp paste is well known in Indonesia. The shrimp paste is generally in the form of a paste and the processing is done by adding salt and fermenting it at a certain temperature for several days.

Shrimp paste products have a distinctive aroma and taste. During fermentation, proteins are hydrolyzed into amino acids and peptides, fats are broken down into fatty acids and glycerol, and

carbohydrates are fermented into lactic acid (Nari, 2022). The fermentation process in shrimp paste allows the product to be durable and avoid some pathogenic bacteria. A study conducted by Arityan, et. al., (2014) stated that the shrimp paste sample had a coliform value of <3 MPN/g and the presence of *E.coli* was declared negative. Meanwhile, according to research by Rosida & Faridayanti (2015), rebon shrimp paste in the sub-district market in the East Surabaya area contained *E. coli* and *S. aereus* contamination. Furthermore, the shrimp paste samples in the coastal areas of Bulukumba district and Jeneponto district, South Sulawesi were safe from *E. coli* contamination (Amir, 2019).

In addition to *E. coli* contamination, sometimes there are also other pathogenic bacteria in shrimp paste products, including *Salmonella sp. Rebon shrimp* paste located in the Daya market area, Makassar, was declared negative for *Salmonella Linda, et. al., 2017). Likewise,* the rebon shrimp paste in the Medan Belawan sub-district, North Sumatra, was declared negative for *E. coli* and *Salmonella (Aisyah, 2021).* Besides rebon shrimp paste, another fermented product is acidic rebon shrimp paste (*cincalok*). *Cincalok* is a typical food of West Kalimantan, made through a fermentation process, where rebon shrimp added with salt and rice then fermented for 1-2 weeks until the shrimp are red and have a distinctive smell (Novelia, 2019).

Studies of microbial contamination in acidic rebon shrimp paste (*cincalok*) have not been reported to date. In general, the microbes that grow on fermentation products are either Gram positive or Gram negative bacteria, and are generally beneficial. Meanwhile, contamination of pathogenic bacteria in fermented products is caused by poor handling (Hardianti & Aziz, 2019; Sukmawati, 2022) and the addition of relatively small amounts of salt. Pathogenic bacteria that can contaminate rebon shrimp fermentation products include coliform which consists of three sub namely fecal-coliform, non-fecal coliform and *E. coli.* Another bacterial contamination is *Salmonella* sp.

According to the Indonesian National Standards Agency, fermented fish products with or without salt, good and suitable products for consumption are those that are negative for *Salmonella, V. cholera, Escherichia coli* with a limit of <3 MPN/g and *Staphylococcus aureus* should be <1 x10^3 colonies/g. The objective of this study was to determine the contamination of *E. coli* and *Salmonella* in rebon shrimp fermentation products consisting of rebon shrimp paste (*terasi)* and acidic rebon shrimp paste (*cincalok*) in South Sorong, West Papua.

RESEARCH METHODS

Research Design

This study is a descriptive study by describing the presence or absence of contamination by *E.coli* and *Salmonella* sp. on rebon shrim paste. The presence of *E. coli* and *Salmonella* sp. is very important to be detected in food or other food ingredients. These bacteria are pathogenic bacteria that contaminate food. It has been widely reported that *E. coli* can cause diarrhea while *Salmonella* sp. can cause typhoid.

Population and Samples

The samples used in this study were rebon shrimp paste which was coded TRS and acidic rebon shrimp paste (cincalok) which was coded BSH. The research was conducted in January–March 2022 in the laboratory of the Faculty of Fisheries, Universitas Muhammadiyah Sorong.

Instruments

The tools used in this research were; autoclave, petri dish, pipette, test tube, measuring cup, Erlenmeyer, beaker, incubator, and hot plate. While the materials used were; LB media, eosin methylene blue agar (EMBA), *Salmonella* Shiegella Sgar (SSA), aquades, plastic wrap, aluminum foil, and 70% alcohol.

Procedures

Analysis of Coliform

Preparation of Lactose Broth (LB). A total of 3.9 g of Lactose Broth was weighed and dissolved with 300 ml of water in an Erlenmeyer flask and heated on a Hot Plate Stirer until homogeneous. The LB solution was pipetted into each test tube containing an inverted Durham tube. Tubes containing media were covered with sterile cotton and aluminum foil and then sterilized in an autoclave at 121^{0}C for 30 minutes.

Presumptive test. A total of 0.1 ml, 0.01 ml and 0.001 ml of samples for each tested sample TRS P1, TRS P2, TRS P3, TRS P4, BSH T1, BSH T2, BSH T3, were put in a test tube containing 9 ml of LB media, then incubated in an incubator for ± 24 hours at 36^{0}C. A positive result is indicated by the presence of gas in the durham tube.

Confirmative test. This test is performed to confirm the positive result of the presumptive test. From each tube that showed positive results in the presumptive test, it was shaken and 1 mL was taken and then inoculated in a petri dish containing eosin methylene blue agar (EMBA) media. Subsequently, it was incubated for 24 hours at 36 ^{0}C. If the colony is metallic green, it is declared positive for *E. coli.*

Analysis of *Salmonella*

Preparation of *Salmonella* Shigella Agar (SSA) media. A total of 18.75 g was dissolved in 300 ml of water in an Erlenmeyer flask containing a magnetic stirrer then heated on a hot plate. The solution was then sterilized in an autoclave for 30 minutes at 121 ^{0}C, then ± 15 ml of AAS media was poured into a sterile petri dish and allowed to solidify. The sample was poured using the spread plate method. Furthermore, it was incubated at room temperature for 24 hours. If the colony grows on the media and the bottom of the media turns yellow, it is declared positive for *Salmonella*..

Data Analysis

Data analysis of *E. coli* was done descriptively qualitatively. Presumptive test for the detection of E. coli bacteria is carried out by counting the gas bubbles formed in the Durham tube. Furthermore, the number of gas bubbles in the tube was converted into an MPN table for three series of tubes (Sukmawati, et. al., 2021. Furthermore, confirmed test for *E. coli* was carried out by observing the metallic green color formed around the bacterial colony. While the presence of *Salmonella* sp. was analyzed by observing the growth of *Salmonella* sp. colonies on selective media.

RESULT

MPN coliform test is a test to determine the number of coliform bacteria. Total coliform consisted of faecal coliform, non-fecal coliform, and *E. coli*. The results of coliform and *E. coli* testing on rebon shrimp fermented products samples for the seven samples are shown in Table 1.

Table 1. Coliform and E.coli test results on fermented rebon shrimp products in southern Sorong

Sample	Presumptive Test (Total coliform MPN/g)	Confirmative Test (Analysis of *E. coli*)
TRS P1	4	Negative
TRS P2	4	Negative
TRS P3	<3	Negative
TRS P4	4	Negative
BSH T1	11	Negative
BSH T2	3	Negative
BSH T3	11	Negative

Notes. TRS: Rebon shrimp paste; and BSH: acidic rebon shrimp paste (*cincalok*)

The results of the analysis of *Salmonella* sp. on rebon shrimp fermentation products using SSA (*Salmonella*-Shigella Agar) selective media showed negative results (Table 2; Figure 1). According to (Kartika, et. al., 2014), if the food contaminated by *Salmonella* sp. is grown on SSA media, it will show bacterial colonies in round shape, convex elevation with flat margin, changes in the color of the growing media, namely yellow color at the base of the media. The color change in the media occurred due to the glucose fermentation process by *Salmonella* sp.

Table. 2 Number of colonies of *Salmonella* sp. on samples of rebon shrimp paste (*terasi*) and acidic rebon shrimp paste (*cincalok*) in south Sorong

No.	Sampele	Total bacterial colonies CFU/g
1	TRS P1	0
2	TRS P2	0
3	TRS P3	0
4	TRS P4	0
5	BSH T1	0
6	BSH T2	0
7	BSH T3	0

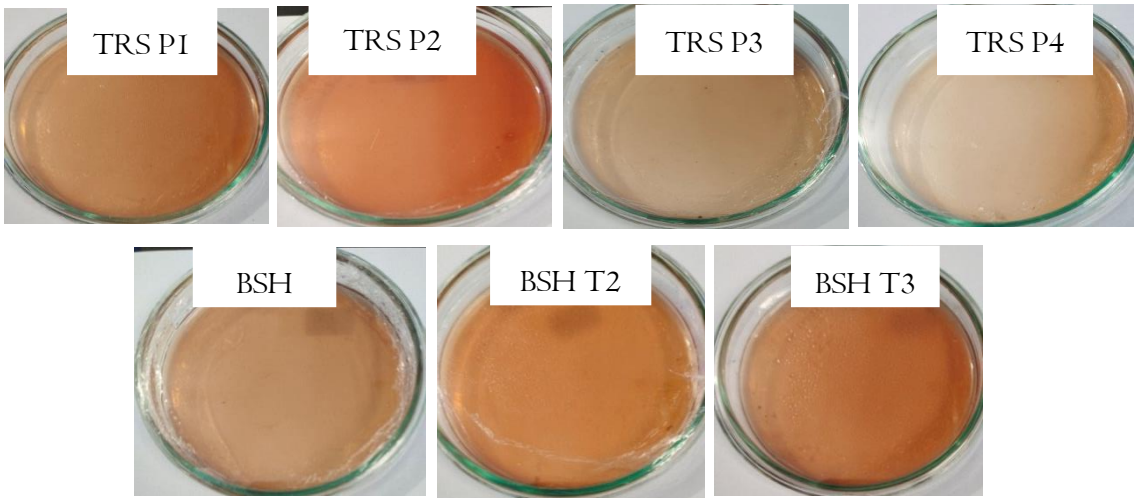

Figure 1. SSA media not covered by *Salmonella* sp. on samples of rebon shrimp paste and acidic rebon shrimp paste (cincalok) in south Sorong.

DISCUSSION

There is a difference in the results of the presumptive test for total coliform (MPN/g) in the tested rebon shrimp samples. The highest coliform bacterial contamination was found in the BSH T1 sample and the BSH T3 sample of 11 MPN/g for each sample, while the lowest coliform bacterial contamination was found in the TRS P3 sample with a total number of coliforms <3 MPN/g. However, the confirmative test results showed that all samples did not contain *E.coli* (negative) so that it could be stated that the fermented rebon shrimp product was safe from E.coli contamination because it did not cross the Indonesian national standard. The Indonesian national standard regarding fermented fishery products with or without salt is products with an MPN value <3/g (BSNI, 2009).

Presumptive test showed that six samples showed total coliform values had a value range of 3-11 MPN/g, the bacteria that grew on the presumptive test were probably fermentative bacteria capable of forming gas or bubbles when grown on media containing lactose. This is presumably

because the fermentative bacteria in the sample are the products of fermentation. In addition, it is possible that these bacteria belong to the non-fecal-coliform group.

The basic difference between coliform and fecal coliform is that, fecal coliform comes from fecal coliforms, grows at high temperatures and is generally found in the feces of warm-blooded animals. An example of faecal coliform is *Escherichia coli* which is pathogenic, the colonies grow dark in color with a green metallic luster on the surface when they are grown on EMBA media (Sukmawati, et. al., 2021). Meanwhile, non-fecal coliforms are generally considered harmless because they are not pathogenic (Kustyawati, 2010).

Table 3. Differences between fecal and non-fecal coliform bacteria

Difference	(Non-fecal) Coliform	Fecal Coliform
	Coliforms have three main subdivisions: total coliforms, fecal coliforms, and Escherichia coli	Fecal coliforms are included in the sub-category of total coliforms
Patogenicity	Not harmful	Has the ability to cause many deadly diseases
Lactose Fermentation	Lactose fermentation in the temperature range of 35 ^{0}C to 37 ^{0}C	Lactose fermentation is carried out at 44 ^{0}C
Temperature tolerance	Survive at relatively lower temperatures compared to fecal coliforms	Has the ability to grow in a high temperature range
Test Results on Eosin Methylene Blue Agar Plate	Appears in thick mucoid colonies	Appears in dark colored colonies with a soft green metallic luster on the surface

Source: (Dept of Health, 2017; Oram, 2017).

Some acid-fast bacteria and halophilic bacteria are able to grow on fermented shrimp products, both Gram positive and Gram negative. There have been no reports of previous research results regarding acidic rebon shrimp paste (*cincalok*), so this result is the first report and no comparative studies have been found from the previous literatures. As for rebon shrimp paste (*terasi)*, Yamani (2006) reported that from 15 samples of unpackaged shrimp paste on the market, 12 samples (80%) of shrimp paste showed the MPN index of *E. coli* exceeded the maximum limit of microbial contamination. Other research reports showed that *ankak* administration as a natural dye as well as a preservative showed no *E. coli* contamination in rebon shrimp paste (Indriati & Andayani, 2012).

Fermented fishery products that are safe for consumption are those that are not contaminated with pathogenic bacteria such as *E. coli* (Junianto, 2011). Bacterial contamination of shrimp paste is usually caused by the use of minimal salt. It is known that salt acts as a selector for organisms needed in the fermentation process (Aristyan, et. al., 2014). *Escherichia coli* is one of the Coliform bacteria belonging to the Enterobacteriaceae family. *Escherichia coli* is also an indicator of water quality because its presence in water can indicate that the water is contaminated with feces. Enteropathogenic *Escherichia coli* (EPEC) is a cause of diarrhea. These bacteria can cause diarrhea and even death if dehydration occurs (Rahayu et. al., 2018).

Negative result for analysis of *Salmonella* sp. in all samples of rebon shrimp paste (*terasi*) and acidic rebon shrimp paste (cincalok) (Table 3; Figure 1) showed that the samples were safe from contamination by *Salmonella* sp.

Salmonella sp. is an indicator of whether or not a food commodity and its processed products are safe (Fatiqin, et. al., 2019). Some examples of *Salmonella* strains that are very dangerous pathogens such as *Salmonella typhii, S. paratyphii* type A, and *S. paratyphi* type B

(Rahayu & Nurwitri, 2019). *Salmonella* sp. that contaminates shrimp paste can grow rapidly due to hot and humid environmental conditions (Nakamura, et. al., 2022).

According to the Indonesian National Standardization Agency (2009), the quality requirements of fermented fishery products including rebon shrimp paste should not contain *Salmonella* contamination. Basically, *Salmonella* sp. cannot grow on processed products that are salted <9% (Mulyani, et. al., 2021). This is in line with the samples tested, where samples of rebon shrimp paste (*terasi*) and acidic rebon shrimp paste (*cincalok*) samples in South Sorong were added with a minimum of >10% salt. However, a research conducted by Aristyan, et. al., (2014) stated that the effect of different salt levels (2%, 8.5%, and 15%) showed negative test results for *E. coli*, *Salmonella*, *V. cholera*). The presence of pathogenic microorganisms in food additives is caused by contamination that has occurred since the processing of raw materials, equipment, product manufacturing processes, water used, packaging, and type of container (Sukmawati & Mutmainnah, 2021).

CONCLUSION

Based on the research results that have been obtained, the conclusion of this study is that rebon shrimp paste samples coded with TRS P1 , TRS P2, and TRS P4 showed the confirmed test value of total coliform of 4 MPN/g, while sample TRS P3 was <3 MPN/g. Furthermore, the samples of acidic rebon shrimp paste (cincalok) coded with BSH T1 and BSH T3 showed presumptive test value of 11 MPN/g, while BSH T2 was 3 MPN/g. However, the confirmed test of *E. coli* for all samples showed negative value. Meanwhile, *Salmonella* sp. was not detected in rebon shrimp paste and acidic shrimp paste (cincalok) which is marked by the absence of colony growth in the selective media. It can be concluded that the samples of rebon shrimp paste and acidic rebon shrimp paste (*cincalok*) in South Sorong are safe from contamination by *Escherichia coli* and *Salmonella* sp.

ACKNOWLEDGMENT

This study is a research funded by the the Directorate General of Higher Education, Research and Technology, Ministry of Education, Culture, Research and Technology (KEMENDIKBUD-DIKTI), and the Education Fund Management Institute, Ministry of Finance (LPDP-KEMENKEU) through the lecturer independent research-scientific research grant of funding program in 245/E4.1/AK.04.RA/2021.

REFERENCES

Aisyah, N. S. (2021). Analisis mutu dan keamanan produk terasi udang rebon (*Acetes indicus*) asal kecamatan Medan Belawan provinsi Sumatera Utara. Skripsi. Manajemen Sumber Daya Perairan. Fakultas Pertanian. Universitas Sumatera Utara. Retrieved from https://repositori.usu.ac.id/handle/123456789/38748

Amir, N. (2019). Mutu dan keamanan pangan produk perikanan tradisional di pantai selatan Sulawesi Selatan. *Prosiding Seminakel*, 40-46. Retrieved from https://prosidingseminakel.hangtuah.ac.id/index.php/jurnal/article/view/57

Aristyan, I., Ibrahim, R., & Rianingsih, L. (2014). Pengaruh perbedaan kadar garam terhadap mutu organoleptik dan mikrobiologis terasi rebon (Acetes sp.). *Jurnal Pengolahan dan Bioteknologi Hasil Perikanan*, *3*(2), 60-66. Retrieved from https://ejournal3.undip.ac.id/index.php/jpbhp/article/view/5018

BSN (2009). Batas maksimum cemaran mikroba dalam pangan. SNI, 7388, 2009. Retrieved from https://www.academia.edu/download/36106935/SNI_7388-2009__-_Batasan_Maksimum_Cemaran_Mikroba_dalam_Pangan.pdf

Depkes. (2017). Bakteri Coliform dalam air minum. Departemen Kesehatan.

Fatiqin, A., Novita, R., & Apriani, I. (2019). Pengujian *Salmonella* dengan menggunakan media SSA dan *E. coli* menggunakan media EMBA pada bahan pangan. *Indobiosains*, 1(1). Retrieved from https://jurnal.univpgri-palembang.ac.id/index.php/biosains/article/view/2206

Hardianti, F., & Aziz, I. R. (2019). Identification of Pathogenic Bacteria on the Salted Fish Lutjanus Vivanus in Sorong City of West Papua. *Malaysian Journal of Microbiology*, 15(3), 237-244. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3425614

Indriati, N., & Andayani, F. (2012). Pemanfaatan angkak sebagai pewarna alami pada terasi udang. *Jurnal Pascapanen dan Bioteknologi Kelautan dan Perikanan*, 7(1), 11-20. Retrieved from http://www.bbp4b.litbang.kkp.go.id/jurnal-jpbkp/index.php/jpbkp/article/view/65

Irianto, I. H. E. (2012). *Produk Fermentasi Ikan*. Penebar Swadaya Grup. Retrieved from https://play.google.com/books/reader?id=d-P6CQAAQBAJ&pg=GBS.PP1&hl=id&lr=&printsec=frontcover

Junianto. (2011). Studi karakteristik pengolahan terasi Cirebon dalam upaya mendapatkan perlindungan indikasi geografis. *Jurnal aquatika*, Staf Pengajar Fakultas Perikanan dan Ilmu Kelautan, Universitas Pajajaran, Bandung. Retrieved from https://www.neliti.com/publications/244944/studi-karakterisasi-pengolahan-terasi-cirebon-dalam-upaya-mendapatkan-perlindung

Kartika, E., Khotimah, S., & Yanti, A. H. (2014). Deteksi bakteri indikator keamanan pangan pada sosis daging ayam di pasar Flamboyan Pontianak. *Jurnal Protobiont*, 3(2). Retrieved from https://jurnal.untan.ac.id/index.php/jprb/article/view/5518

Kustyawati, M. E., Maria, E (2020). Mikrobiologi hasil pertanian. Pusaka Media. Bandar Lampung. ISBN: 978-623-7560-96-8. Retrieved from http://repository.lppm.unila.ac.id/24864/

Linda, L., Gani, A., & Darwis, I. (2017). Identifikasi *Salmonella* sp. pada terasi yang diperjualbelikan di pasar Daya kota Makassar. *Jurnal Media Laboran*, 7(2), 38-45. Retrieved from https://uit.e-journal.id/MedLAb/article/view/514

Mulyani, S., Vestiyati, P. M., Alamsyah, H. K., & Simanjuntak, S. W. (2021). Effect of differences in salt concentration on the quality of rebon shrimp paste (acetes Sp) in Tegal district. In *IOP Conference Series: Earth and Environmental Science* (Vol. 755, No. 1, p. 012051). IOP Publishing. Retrieved from https://iopscience.iop.org/article/10.1088/1755-1315/755/1/012051/meta

Murti, R. W., Sumardianto, S., & Purnamayati, L. (2021). Pengaruh perbedaan konsentrasi garam terhadap asam glutamat terasi udang rebon (Acetes sp.). *Jurnal Pengolahan Hasil Perikanan Indonesia*, *24*(1), 50-59. Retrieved from https://jurnal.ipb.ac.id/index.php/jphpi/article/view/33201

Nakamura, A., Kondo, A., Takahashi, H., Keeratipibul, S., Kuda, T., & Kimura, B. (2022). Microbiological safety and microbiota of Kapi, Thai traditional fermented shrimp paste, from different sources. *LWT: Food Science and Technology*, *154*, (2020) 112763. Retrieved from https://www.sciencedirect.com/science/article/pii/S0023643821019162

Nari, C. A. R. (2022). Terasi udang di desa Kaukau kecamatan Bontaharu kabupaten Kepulauan Selayar. Doctoral dissertation, Universitas Hasanuddin. Retrieved from http://repository.unhas.ac.id/id/eprint/16715/

Novelia, K. (2019). Kualitas dan aktivitas antibakteri cincalok terhadap bakteri patogen selama waktu fermentasi (Doctoral dissertation, UAJY). Retrieved from http://jos.unsoed.ac.id/index.php/jgps/article/view/2986

Oram PG, Brian. (2017). Air menguji feses bakteri patogen organisme air. Washington.

Rahayu, W. P., & Nurwitri, C. C. (2019). *Mikrobiologi pangan*. PT Penerbit IPB Press. Retrieved from https://books.google.com/books?hl=id&lr=&id=Ho8SEAAAQBAJ&oi=fnd&pg=PP1&dq=Rahayu,+W.+P.,+%26+Nurwitri,+C.+C.+(2019).+Mikrobiologi+pangan.+PT+Penerbit+IPB+Press.&ots=GrYf9lFilB&sig=DWNmlbHjBXl_tg_6B7GtB69Nerc

Rahayu, W. P., Siti, N., & Ema, K. (2018). *Escherichia coli* patogenitas analisis dan kajian risiko. Bogor: Ipb Press. Retrieved from https://books.google.co.id/books?hl=id&lr=&id=jNcrEAAAQBAJ&oi=fnd&pg=PP1&dq=Rahayu,+W.+P.,+Siti,+N.,+%26+Ema,+K.+(2018).+Escherichia+coli+patogenitas+analisis+dan+kajian+risiko.+Bogor:+Ipb+Press.%09&ots=7GBPyVhs8Y&sig=35YA4_hszvGqRfVIS3u12laXKcI&redir_esc=y#v=onepage&q&f=false

Rosida, & Faridayanti A. (2015). Microbial Contamination on the shrimp paste distributed in the traditional market of East Surabaya. *Jurnal Teknologi Pangan*, 7(1). Retrieved from http://www.ejournal.upnjatim.ac.id/index.php/teknologi-pangan/article/view/485

Sukmawati S, Mutmainnah. (2021). Pengaruh lama penyimpanan produk ikan cakalang (*Katsuwonus pelamis*) asap terhadap nilai mutu organoleptik dan nilai mutu mikrobiologi di pasar Remu kota Sorong. *JB&P : Jurnal Biologi dan Pembelajarannya*, 8 (2), 102-112. Retrieved from https://scholar.archive.org/work/ia5kumtr6nbs3mwblimvxb6uee/access/wayback/https://ojs.unpkediri.ac.id/index.php/biologi/article/download/16824/2302

Sukmawati, S. (2022). Analysis of hemolysis activity of pathogenic bacteria on salted *Lutjanus vivanus* at Remu traditional market, Sorong city. *Bioscience*, 6(1), 64-73. Retrieved from http://ejournal.unp.ac.id/index.php/bioscience/article/view/114211

Sukmawati, S., Badaruddin, I., Dewi, N. K., Situmorang, N., Mahfut, M., & Mustapa, F. (2021). Analysis of organoleptic and coliform value in fresh mackerel (Rastrelliger sp.) fish In TPI Sorong city. In *Journal of Physics: Conference Series*, 1764(1), p. 012035. IOP Publishing. Retrieved from https://iopscience.iop.org/article/10.1088/1742-6596/1764/1/012035/meta

Suruan, S., Kondjol, S., Toha, M., & Boli, P. (2020). Identifikasi hasil tangkapan nelayan udang di kampung Bakoi kabupaten Sorong Selatan provinsi Papua Barat. *Jurnal Riset Perikanan dan Kelautan*, *2*(2), 212-224. Retrieved from http://ejournal.um-sorong.ac.id/index.php/jrpk/article/view/1030

Yamani. (2006). Pemeriksaan MPN coliform pada terasi tanpa kemasan di pasar Karang menjangan kelurahan Mojo Surabaya. Analis Kesehatan Trpunk, Surabaya.