International Journal of Natural Science and Engineering.
Volume 6 Nomor 1 2022, pp 14-20
P-ISSN : 2615-1383 E-ISSN : 2549-6395
DOI: https://doi.org/10.23887/ijnse.v6i1.41471

The Effectiveness of Using Direct Sunlight on the Drying Process of Salted Fish Without Formalin

Adina Sabilah[1*], Alda Khairunnisa[2], Monalia[3], Sisi Sahriani[4], Widya Pratama Sri Putri[5], Yusri Amiroh Lubis[6], Eni Marta[7]

[1,2,3,4,5,6] Pendidikan Guru Sekolah Dasar, STKIP Rokania, Pasir Pengaraian, Indonesia
**Corresponding author: adinasabila08@gmail.com*

Abstrak

Ikan asin merupakan salah satu lauk makan yang banyak diminati oleh masyarakat Indonesia. Penelitian ini bertujuan untuk menganalisis efektivitas penggunaan sinar matahari langsung terhadap proses pengeringan ikan asin tanpa formalin. Metode yang digunakan dalam penelitian ini adalah metode eksperimen. Dimana pengumpulan data ini menggunakan berbagai jenis ikan untuk dijadikan ikan asin dan ada juga beberapa ikan yang tidak diberi garam. Jenis ikan yang digunakan dalam penelitian ini yaitu ikan sungai, ikan nila, ikan singkek, dan ikan laut. Proses pembuatan ikan asin ini berlangsung 3-5 hari. Tergantung jenis ikan yang digunakan dan cuaca atau sinar matahari selama proses pengeringan berlangsung. Proses pengeringan ikan asin yang diterapkan yaitu menggunakan sinar matahari langsung atau secara tradisional dan tidak menggunakan bahan kimia atau formalin. Hasil yang didapatkan selama pengeringan, ikan yang tidak menggunakan garam mudah cepat busuk dan tidak dapat bertahan lama. Aroma dari ikan yang tidak diberi garam lebih berbau dan warna ikan juga berubah. Sedangkan ikan yang diberi garam aromanya tidak berbau busuk, warna ikan juga tidak berubah.

***Kata kunci*:** *Sinar Matahari, Proses Pengeringan, Ikan*

Abstract

Salted fish is one of the side dishes that are in great demand by the people of Indonesia. This study aims to analyze the effectiveness of the use of direct sunlight on the drying process of salted fish without formalin. The method used in this research is the experimental method. Where this data collection uses various types of fish to be used as salted fish and there are also some fish that are not salted. The types of fish used in this study were river fish, tilapia, singkek fish, and marine fish. The process of making this salted fish lasts 3-5 days. It depends on the type of fish used and the weather or sunlight during the drying process. The drying process of salted fish that is applied is using direct sunlight or traditionally and does not use chemicals or formalin. The results obtained during drying, fish that do not use salt easily spoil quickly and cannot last long. The smell of unsalted fish is more pungent and the color of the fish also changes. While the fish that is given salt does not smell bad, the color of the fish also does not change.

Keywords: Sunshine, Drying Process, Fish

1. INTRODUCTION

Fish is one of the sources of animal protein that is widely consumed by the public, and fish is also widely available abundantly in Indonesian waters. Fish is a food that is very perishable because it contains very high water (Hatta et al., 2019; Ikhsan & Muhsin, 2018). The characteristic of fish with a neutral pH, soft texture, and very high nutritional content make fish good for the human body (Syani & Hastuti, 2021; Tenyang et al., 2020). Fish also contains a fairly high amount of protein, vitamin A and vitamin D. Fish is a food ingredient with great benefits because fish contains 18–30% protein. Sanga t fish protein is needed because it contains essential amino acids, it's biological value is high (90%), cheaper than other protein sources, and easy to digest (Ciptawati et al., 2021). In addition to protein content, fish also contains unsaturated fats, vitamins, minerals, and other binding tissues that are easily digested (Bau et al., 2021; Hatta et al., 2019). The protein content of fish is related to its fat and water content. On average, fish with low-fat content have high protein levels,

History:
Received : November 25, 2021
Revised : November 30, 2021
Accepted : March 20, 2022
Published : April 25, 2022

Publisher: Undiksha Press

and vice versa in fat fish have low protein levels. Lack of fish meat can also cause kwashiorkor disease, hungry edema, inhibited growth of eyes, skin, and bones, reduced children's intelligence levels, and even cause death (Taniyo et al., 2021).

The fat content in fish is high, and the types of fatty acids found in fish are more than those in land animals (Jacoeb et al., 2020). Fish meat fat contains acids-equal saturated fats with chain lengths $C_{14} – C_{22}$ and unsaturated fatty acids with a bond count of 1-6. Terrestrial animal fats contain only some types of saturated and unsaturated fatty acids. Fish meat is very easily oxidized because it contains enough unsaturated fatty acids. Therefore, rancid odors often arise in fish commodities, especially in processed and preserved products that are stored without packaging and antioxidants. It also contains carbohydrates, vitamins, and minerals (Ndahawali et al., 2019; Shahrir et al., 2016). Carbohydrates in the fish meat are polysaccharides, that is, glycogen similar to amylum. The carbohydrate content in fish meat is minimal, and the content is less than 1%. In contrast, the vitamins contained in connective meat are classified into 2, water-soluble ones such as vitamins B, B_2, B_6, B_{12}, folic acid, cyanocobalamin, carnitine, biotin, niacin, inositol, and pantothenic acid. Vitamin C contained in fish meat is only a small amount. Fat-soluble vitamins such as vitamins A, D, and E (Jacoeb et al., 2020; Ramlah et al., 2016). These vitamins are generally found more in the internal organs of the fish body than in the meat. In comparison, the mineral salts in the fish meat are in the form of phosphate salts, calcium, sodium, magnesium, sulfur, and chlorine. These mineral salts are classified as microfilaments because of their dominant amount compared to other mineral salts.

Indonesia's population is still relatively low in consuming fish, especially residents on the island of Java. According to data from the Ministry of Marine Affairs and Fisheries, fish consumption in Java is still 32 kilograms per capita per year. While in Sumatra and Kalimantan, fish consumption is between 32 to 43 kilograms per capita per year. For eastern Indonesia, the consumption is as much as 40 kilograms per year. Fish is a commodity easily subjected to a process of deterioration and decay post-capture. According to Sutrisno, S., Priyambada, F. A., et al (2021), fish management and preservation are essential parts of the fishing industry. One of the most preserved fish products in Indonesia is salted fish. Almost 65% of the fishery population is processed and preserved by salting. The Indonesian government has designated salted fish as one of the basic ingredients of the community. This shows that salted fish is not only popular with the lower class of the economic community but also with the middle and upper classes. The appeal of salted fish lies in its very characteristic taste, aroma, and texture. Salted fish is one of the side dishes in great demand by the people of Indonesia. Several types of fish can be processed into salted fish, namely, sea fish, snakehead fish, river fish, anchovies, tilapia, singkek fish, and cob fish. Although it is often considered a simple side dish, salted fish has many nutrients that are good for the body. In 100 grams of salted fish, there is 193 kcal of energy, 42 grams of protein, 0 carbohydrates, 1.5 grams of fat, 200 milligrams of calcium, 3 milligrams of iron, and 0.01 milligrams of vitamin B1. With these nutrients, salted fish that we consume in moderation can provide many health benefits. The benefits of salted fish for health are good for dental and bone health, help accelerate wound healing, prevent anemia, maintain the body's immune system, help build muscles, a source of energy for the body, and prevent heart disease.

Salt is an important commodity in the fisheries industry. The fishery product processing industry, both traditionally and modernly, uses salt as a processing material (Hatta et al., 2019; Rahayu et al., 2018). Most of the use of salt in the fish processing industry is used in traditional processing, such as making salted fish. Salting followed by drying is preservation first applied to human marriage (Bau et al., 2021; Rahayu et al., 2018). Salts used in the salting process have bacteriostatic and bacteriocidal properties, which can delay growth and kill bacteria. Salting can draw water from the fish body caused of the influence of

osmosis pressure (Susanti et al., 2015; Sutrisno et al., 2021). Quality salt will produce good salted fish and not absorb water during storage. The rough salt containing impurities will melt because it absorbs water. The fish salting process can last for 3-4 months, depending on the moisture content of the product and storage conditions. The salt used is a type of table salt (NaCl) in the form of crystals or solutions.

Fish drying is one of the ways of fish preservation, which is done by reducing the water content of fish so that microorganisms contained in fish can be reduced (Hatta et al., 2019; Sutrisno et al., 2021). Drying fish is a very easy, cheap, and oldest preservation method. Drying will be better if it is preceded by salting with the right amount of salt and serves to stop the activity of putrefactive bacteria (Chaijan et al., 2017; Pomegranate et al., 2022). Drying the direct sun traditionally is most often used by humans. Due to the water content of the raw material evaporated using the radiance of sunlight. The drying process will reduce the moisture content in fish meat. This increases the protein content in fish meat because of the water content that has been removed in the drying process (Rizal & Muhammad, 2018; Tenyang et al., 2020). Tubuh fresh fish contains 56%-80% water; fresh and dried fish must be reduced water content by 25% to stop the growth of bacteria and reduce autolysis activity that causes rancidity, while to prevent the growth of fungi, the moisture content must be lowered to 40%. The fish will change physique, texture, color, and aroma during the drying process. Fish dried using salt will undergo brownish discoloration. The size of the fish also greatly affects the length of the drying process. The smell of fish dried using salt does not have a pungent smell, while fish that are not salted has an unpleasant aroma (Aniesrani Delfiya et al., 2022; Cui et al., 2021). Researchers did not use formalin or chemicals for salted fish during the drying process. Dried fish using only salt.

Formaldehyde, better known as formalin, is a prohibited additive even though some people already know, especially manufacturers, that this substance is hazardous if it enters the human body (Burhan, 2021). However, the use of formalin is not decreasing but increasing on a cheaper basis. Formalin is not an addition to foodstuffs due to the side effects of using this formalin substance (Habibah, 2013; Susanti et al., 2015). The use of formalin in food can cause poisoning of the human body. Symptoms that arise are difficulty swallowing, acute abdominal pain accompanied by vomiting, and the appearance of nervous system depression or circulatory disorders. Taking very high doses of formalin can result in convulsions, blood urine, and vomiting blood, ending with death within 3 hours. Meanwhile, according to the Minister of Health of the Republic of Indonesia No.033 / Menkes / Per / XI / 2012, formalin is one of the additives that are prohibited for food (Astuti & Tebai, 2018; Habibah, 2013). Therefore, this study was conducted to prove the presence or absence of formalin content in dried salted fish with quality requirements that are more defined by the Indonesian National Standard, including water content, salt content, sensory properties, and total plate numbers.

The Indonesian people have the right to get good health protection from the government through the regulation, guidance, and supervision of activities or processes of food production, circulation, and trade. Therefore, business actors in the food sector must comply with the provisions related to activities in producing food or selling food. Consumers have freedom in choosing products that suit their needs and abilities. Still, consumers must also be protected from activities that may arise from consuming products produced and offered by business actors. The reality circulating in the community is that there are producers who commit business fraud, namely having sold food that contains food additives that are harmful to the health of the human body, so that these foods do not meet the quality standards of food that should be, one of these additional ingredients is formalin. This study aims to analyze the effectiveness of the use of direct sunlight against the drying process of salted fish without formalin.

2. METHODS

Experimental research methods with a qualitative approach were chosen in this study to answer research questions. In data collection, researchers used statements about the type of fish that used salt and did not use salt to find out the difference between the fish if it has been dried. This research lasted for seven days and was carried out on Jalan Mataram Blok C, Rambah Samo District, Rokan Hulu Regency, Riau Province. While making salted fish, one should always pay attention to hygiene and use safe materials for consumption. During drying, the usefulness of direct sunlight is very influential in drying salted fish. If the weather is not hot, the dried fish will undergo a long drying process and be slightly wet. Drying salted fish used only salt as an additive and did not use formalin or harmful chemicals.

3. RESULTS AND DISCUSSION

Result

Fish management and preservation were essential parts of the fishing industry. One of the most preserved fish products in Indonesia was salted fish. Almost 65% of the fishery population was processed and preserved by salting. The Indonesian government has designated salted fish as one of the basic ingredients of the community. This showed that salted fish was not only popular with the lower class of the economic community but also with the middle and upper classes. The appeal of salted fish lies in its very characteristic taste, aroma, and texture. Salted fish was one of the side dishes in great demand by the people of Indonesia. This study used fish types: river, tilapia, sea, and singkek. The complete results are shown in Table 1. The results obtained during the drying process were fish dried using salt dry faster, the color of the fish was slightly brownish, and the aroma produced was also not too spicy. As for the fish, which was not salted, it was still a bit damp, the color produced was pale, and the resulting aroma smelled unpleasant. Types of tilapia and river fish dry faster if using salt. The drying process lasts for 3-4 days. For sea-type fish and singkek longer dry, the drying process lasts for 4-5 days if using salt. The drying process was also very dependent on the heat of the sunlight. If the weather was not hot the fish will be longer to dry. In the salting process, the salt should not be added excessively so that the quality of the fish is as expected. Salting followed by drying is the preservation first applied to human civilization. Salts used in the salting process have bacteriostatic and bacteriocidal properties, which can delay growth and kill bacteria. Salting can draw water from the fish's body caused of the influence of osmosis pressure. Quality salt will produce good salted fish and not absorb water during storage. The rough salt containing impurities will melt quickly because it absorbs water.

Table 1. Effectiveness of Direct Sunlight on The Drying Process of Salted Fish Without Formalin

No	Types of Fish	Drying Time		Texture	Color	Aroma
		With Salt	Without Salt			
1.	Parrot fish	3 days	5 days	If using salt, the texture of the fish is smooth and dry. For fish that do not use salt, the texture is slightly wet.	If using salt, the resulting color is brownish. If not use salt, the color of the fish is a bit pale.	For fish that use salt, the resulting aroma is odorless. Fish that do not use salt has an unpleasant aroma.
2.	River fish	3 days	5 days			
3.	Singkek fish	5 days	7 days			
4.	Sea fish	4 days	7 days			

The results of research that has been carried out show that fish that use salt dry faster, for example, tilapia. The process of drying tilapia for 3 days if using salt, and without using salt for 5 days. For river fish, the drying process lasts for 3 days and without salt lasts for 5 days. Singkek fish, if using salt for 5 days and without salt for 7 days. For this type of marine fish, the drying process using salt lasts for 4 days and without salt for 7 days. For the texture of the dried fish, using salt was smoother and drier and also easily broken, while the fish dried without salt, the texture of the fish was bit wet and moist. The texture was closely related to the moisture content of foodstuffs. The color produced from salted fish's drying process was brownish if salt was used and without pale white salt. Fish that used salt the resulting aroma was odorless. For the fish that did not use salt had an unpleasant aroma.

The tools and materials used in the drying process of salting fish were tilapia, singkek fish, river fish, sea fish, salt, basins, knives, and fish grills. Furthermore, the steps in making salted fish using salt were first to prepare the necessary tools and materials. Second, wash until clean the fish to be used. Third, after washing it thoroughly, the fish was put in a basin and sprinkled with the prepared salt. Fourth, after sprinkling with salt, let the fish stand for a few minutes so that the salt can dissolve completely. Fifth, those who were given salt were placed on the fish grill. Sixth, it was directly dried in the sun, and during the drying process so that the fish dries quickly, it should be turned over so that the fish dry thoroughly. Seventh, salted fish drying can last for 3-5 days, depending on the sun's heat. If the weather was not too hot the fish longer their drying. Eighth, dry fish did not forget to keep the fish clean. So that the fish were safe for consumption and there were no bacteria found in salted fish. After the drying process of the salted fish is complete, transfer the fish to a clean place and the fish can already be processed into food ingredients.

Discussion

Drying of salted fish is generally done simply. The length of salting time depended on the thickness and freshness of the fish, the desired final condition of the salted fish, the type of marinated fish, the fat content contained in the fish, the amount of salt used, the smoothness and purity of the salt, and the temperature of deposition after drying salted fish. The freshness of the fish, the high-fat content, and the thick fish meat condition will hinder the salting process. As for the high salt density and purity level, the fine salt conditions and high salting temperature will speed up the salting process. Salting can draw water from the fish's body caused by the influence of osmosis pressure. Quality salt will produce good salted fish and not absorb water during storage. The rough salt containing impurities will melt quickly because it absorbs water. The fish salting process can last for 3-4 months, depending on the moisture content of the product and storage conditions. Dried salted fish products need to be kept clean during the storage process and the quality of the fish.

The public favors the existence of traditionally processed fish because of its distinctive taste. In terms of nutrition, traditional processed foods strongly contribute to meeting the body's protein needs. Drying fish is one way of preserving fish which was done by reducing the water content of fish so that the activity of microorganisms can be reduced. Preservation with this drying method aims to extend the shelf life of fish. This drying processing method has long been carried out for various types of fish (Chaijan et al., 2017; Di Giorgio et al., 2022; Tenyang et al., 2020). Pengering of fish with sunlight is done by drying the fish for 3 days of sunny weather. The fish drying process consists of heat and mass transfer processes (Chaijan et al., 2017; Nukulwar & Tungikar, 2021). The heat transfer process is a process that occurs due to the temperature difference, the heat flowed will increase the temperature of the dried material, causing the pressure of water vapor in the dried material to be higher than the pressure of water vapor in the air (Aniesrani Delfiya et al., 2022). While the mass transfer process is a process that occurs because the relative

humidity of the drying air is lower than the relative humidity of the material, the heat flowing above the surface of the material will increase the moisture pressure of the material so that the water vapor pressure will even be higher than the pressure of the drying air vapor.

4. CONCLUSION

Based on the results of research that has been carried out on the effectiveness of the use of direct sunlight against the drying process of salted fish without formalin, namely each type of fish used, the length of the drying process is different. Fish that use salt will dry faster than fish that do not use salt. During the drying process, the cleanliness of the fish must also be maintained so that the bacteria do not get into the fish. Fish that do not use formalin will be healthier and great for consumption. The fish salting process can last for 3-4 months, depending on the moisture content of the product and storage conditions. The drying process is also very dependent on the heat of the sun's rays. If the weather is not hot, the fish will be longer to dry. In the salting process, the salt should not be added excessively so that the quality of the fish is as expected.

5. REFERENCES

Aniesrani Delfiya, D. S., Sneha, R., Prashob, K., Murali, S., Alfiya, P. V, & Samuel, M. P. (2022). Hot air-assisted continuous infrared dryer for anchovy fish drying. *Journal of Food Process Engineering*, *45*(6), e13824. https://doi.org/10.1111/jfpe.13824.

Astuti, I., & Tebai, P. (2018). Analisis formalin ikan teri (Stolephorus sp) asin di pasar tradisional Kabupaten Gorntalo. *Gorontalo Fisheries Journal*, *1*(1), 43–50. https://doi.org/10.32662/.v1i1.105.

Bau, F. C., Nina, S. U., & Antuli, Z. (2021). Pengaruh Lama Pengeringan Terhadap Kualitas Kimia Dan Biologis Ikan Teri Asin Kering (Stolephorus sp.). *Jambura Journal of Food Technology*, *3*(2), 94–101. https://doi.org/10.37905/jjft.v3i2.9101.

Burhan, A. H. (2021). Efektivitas Suhu Perendaman Nanas dan Jeruk Nipis terhadap Penurunan Kadar Formalin dalam Ikan Asin Teri Nasi. *Jurnal Ilmu Kesehatan Bhakti Setya Medika*, *6*(2), 92–101.

Chaijan, M., Panpipat, W., & Nisoa, M. (2017). Chemical deterioration and discoloration of semi-dried tilapia processed by sun drying and microwave drying. *Drying Technology*, *35*(5), 642–649. https://doi.org/10.1080/07373937.2016.1199565.

Ciptawati, E., Rachman, I. B., Rusdi, H. O., & Alvionita, M. (2021). Analisis perbandingan proses pengolahan ikan lele terhadap kadar nutrisinya. *Indonesian Journal of Chemical Analysis (IJCA)*, *4*(1), 40–46. https://doi.org/10.20885/ijca.vol4.iss1.art5.

Cui, T., Chen, C., Jia, A., Li, D., Shi, Y., Zhang, M., & Liu, C. (2021). Characterization and human microfold cell assay of fish oil microcapsules: Effect of spray drying and freeze-drying using konjac glucomannan (KGM)-soybean protein isolate (SPI) as wall materials. *Journal of Functional Foods*, *83*, 104542. https://doi.org/10.1016/j.jff.2021.104542.

Delima, R., Sahira, S., Sumiroyani, S., Kamelia, K., Reskiana, R., Rahmi, K. A., & Marta, E. (2022). The Impact of Using Salt on Drying Rate of Fish. *International Journal of Natural Science and Engineering*, *5*(3), 87–95. https://doi.org/10.23887/ijnse.v5i3.41314.

Di Giorgio, L., Salgado, P. R., & Mauri, A. N. (2022). Fish oil encapsulated in soy protein particles by lyophilization. Effect of drying process. *Journal of the Science of Food and Agriculture*, *102*(1), 206–213. https://doi.org/10.1002/jsfa.11347.

Habibah, T. P. Z. (2013). Identifikasi penggunaan formalin pada ikan asin dan faktor perilaku

penjual di pasar tradisional kota Semarang. *Unnes Journal of Public Health*, *2*(3). https://doi.org/10.15294/ujph.v2i3.3031.

Hatta, M., Syuhada, A., & Fuadi, Z. (2019). Sistim pengeringan ikan dengan metode hybrid. *Jurnal Polimesin*, *17*(1), 9–18. https://doi.org/10.30811/jpl.v17i1.666.

Ikhsan, M., & Muhsin, P. (2018). Pengaruh Variasi Suhu Pengering terhadap Mutu Dendeng Ikan Lele Dumbo (Clarias gariepinus). *Jurnal Pendidikan Teknologi Pertanian*, *2*(2), 114. https://doi.org/10.26858/jptp.v2i2.5166.

Jacoeb, A. M., Hidayat, T., & Perdiansyah, R. (2020). Komposisi kimia dan profil asam lemak ikan layur segar penyimpanan suhu dingin. *Jurnal Pengolahan Hasil Perikanan Indonesia*, *23*(1), 147–157. https://doi.org/10.17844/jphpi.v23i1.31057.

Ndahawali, D. H., Ondang, H. M., Tumanduk, N., Ticoalu, F., & Rakhmayeni, D. A. (2019). Pengaruh lama waktu pengasapan dan waktu penyimpanan terhadap kandungan gizi Ikan Tandipan (Dussumieria Sp). *Frontiers: Jurnal Sains Dan Teknologi*, *1*(3). http://ejournal.unima.ac.id/index.php/efrontiers/article/view/787.

Nukulwar, M. R., & Tungikar, V. B. (2021). A review on performance evaluation of solar dryer and its material for drying agricultural products. *Materials Today: Proceedings*, *46*, 345–349. https://doi.org/10.1016/j.matpr.2020.08.354.

Rahayu, W., Herpandi, H., & Widiastuti, I. (2018). Pengaruh Penambahan Soda Kue dan Rempah-Rempah Terhadap Karakteristik Ikan Kering Rendah Garam. *Jurnal FishtecH*, *7*(1), 60–68. https://doi.org/10.36706/fishtech.v7i1.5981.

Ramlah, R., Soekendarsi, E., Hasyim, Z., & Hassan, M. S. (2016). Perbandingan kandungan gizi ikan nila Oreochromis niloticus asal danau mawang Kabupaten Gowa dan danau Universitas Hasanuddin Kota Makassar. *BIOMA: Jurnal Biologi Makassar*, *1*(1). https://doi.org/10.20956/bioma.v1i1.1098.

Rizal, T. A., & Muhammad, Z. (2018). Fabrication and testing of hybrid solar-biomass dryer for drying fish. *Case Studies in Thermal Engineering*, *12*, 489–496. https://doi.org/10.1016/j.csite.2018.06.008.

Susanti, D. Y., Nugraheni, P. S., & Hermawan, A. (2015). Penerapan pengering suryatungku termodifikasi dalam peningkatan produktivitas dan higienitas produksi ikan asin tanpa formalin nelayan pantai congot, Kulonprogo, Daerah Istimewa Yogyakarta. *Indonesian Journal of Community Engagement*, *1*(1), 109–120.

Sutrisno, S., Priyambada, F. A., Syah, A. F., Kusumawardhany, Y. P., Putri, R. A., & Wahyudi, M. A. (2021). Alat Pengeringan Ikan Otomatis Berbasis Panel Surya Untuk Pedagang Ikan di Desa Prigi Kabupaten Trenggalek. *Jurnal Graha Pengabdian*, *3*(1), 29–37. https://doi.org/10.17977/um078v3i12021p29-37.

Syahrir, S., Soekendarsi, E., & Hasyim, Z. (2016). Perbandingan kandungan zat gizi ikan mujair Oreochormis mossambica Danau Universitas Hasanuddin Makasasar dan Ikan Danau Mawang Gowa. *BIOMA: Jurnal Biologi Makassar*, *1*(1). https://doi.org/10.20956/bioma.v1i1.989.

Syani, I., & Hastuti, H. (2021). Rancang Bangun Alat Pengering Ikan Teri Mandiri Otomatis Berbasis Ardiuno Uno. *JTEIN: Jurnal Teknik Elektro Indonesia*, *2*(2), 136–141. https://doi.org/10.24036/jtein.v2i2.146.

Taniyo, W., Salimi, Y. K., & Iyabu, H. (2021). Karakteristik Dan Aktivitas Antioksidan Hidrolisat Protein Ikan Nike (Awaous melanocephalus). *Dalton: Jurnal Pendidikan Kimia Dan Ilmu Kimia*, *4*(2). https://doi.org/10.31602/dl.v4i2.5935.

Tenyang, N., Ponka, R., Tiencheu, B., Djikeng, F. T., & Womeni, H. M. (2020). Effect of Traditional Drying Methods on Proximate Composition, Fatty Acid Profile, and Oil Oxidation of Fish Species Consumed in the Far-North of Cameroon. *Global Challenges*, *4*(8), 2000007. https://doi.org/10.1002/gch2.202000007.