EFFECT OF EDIBLE COATING APPLICATION WITH THE ADDITION OF KECOMBRANG FLOWER (*Etlingera elatior*) POWDER ON THE QUALITY OF YELLOWFIN TUNA (*Thunnus albacares*) FILLETS

Ardhya Sekar Lintang[1], Rifda Naufalin[1]*, Rumpoko Wicaksono[1], Riviani[2], Nurul Latifasari[3], Popi Nurhopipah[1]

[1]Faculty of Agriculture, Universitas Jenderal Soedirman, Banyumas, Indonesia
[2]Faculty of Fisheries and Marine Science, Jenderal Soedirman, Banyumas, Indonesia
[3]Faculty of Telecommunication Electronics and Control Engineering, Institut Teknologi Telkom Purwokerto, Banyumas, Indonesia

*Email: rifda.naufalin@unsoed.ac.id

Abstract. Yellowfin tuna is often consumed in fillet form. Basically, fresh fish fillets decline in quality very quickly so preservation treatment is needed, one of which is edible coating. Kecombrang is a plant that has potential as a bioactive compound that can be added to edible coatings. This research aims to determine the effect of applying edible coating with the addition of various concentrations of kecombrang flower powder on the quality of yellowfin tuna fillets. This research using an experimental design, namely a Randomized Block Design (RAK) with 2 factors, namely the concentration of kecombrang flower powder (control; 0%; 0.5%; 1%; 1.5%) and long storage time (3 and 6 days). Then, quality analysis is carried out based on pH, color intensity, and sensory analysis. The results of testing the pH and color intensity were then analyzed using ANOVA and DMRT at the $\alpha = 5\%$ level. The results showed that the difference concentration on the kecombrang flower powder (K) and the long storage time (L) had a significant effect on the pH value and had no significant effect on the color intensity. Meanwhile, for sensory analysis, the results showed that the more concentration of kecombrang flower powder added, better sensory values for the parameters of discoloration, drying, odor, and texture.

Keywords: bioactive compound, edible coating, fillets, kecombrang, yellowfin tuna

A. Introduction

Fisheries are one of the sectors that play an important role in Indonesian food security. This is because 70% of Indonesian territory is water. One example of a fishery product is yellowfin tuna. Yellowfin tuna (*Thunnus albacares*) is a species of fish that has high-quality meat and a favorite food ingredient in many countries. Tuna, mackerel, and skipjack are Indonesia's second largest fishery export commodities after shrimp, reaching USD 176.63 million [1]. This makes yellowfin tuna one of Indonesia's leading export commodities [2]. Yellowfin tuna meat is often consumed as sushi or sashimi because has soft texture and savory taste, making this fish often used in fillets form.

Basically, fresh fish fillets experience a very fast decline in quality if not handled properly and quickly. That is because tuna has a high protein, fat, and water content so that bacterial and enzyme activity occurs quickly. Exposure or contamination of fish can also cause changes in color, pH, and sensory quality of fish. One of the ways to maintain the quality of tuna fillets is by using edible coating.

Edible coating is a thin layer that functions as a barrier, so that food does not lose moisture and is permeable to certain gases [3]. Edible coating can be applied to food to protect, maintain quality, extend shelf life, and improve the quality and safety of food products. This layer is usually made of materials that are safe for consumption and can dissolve naturally.

One of the plants that has the potential as a bioactive compound that can be added to edible coating is kecombrang plant. Kecombrang (*Etlingera elatior*) is a plant originating from Indonesia which is included in the *Zingiberaceae* group. This plant is often used by the community as a traditional spice for medicine or a vegetable for food ingredients. Some parts of the kecombrang plant that can be used are flowers, leaves, and stems. Kecombrang is known to contain natural bioactive compounds that have antibacterial activity so that it can help maintain the quality of food products from damage. The application of edible coating with the addition of kecombrang flowers is able to maintain the quality of gourami fish fillets such as texture, color, and pH [4]. This makes kecombrang flowers is one of the food ingredients that are good enough to be used as a natural preservative such as edible coating and applied to yellowfin tuna fillets to maintain their quality.

The purpose of this study was to determine the effect of applying edible coating with the addition of various concentrations of kecombrang flower powder on the quality of yellowfin tuna fillets.

B. Methods

The materials used were kecombrang flower, yellowfin tuna, carboxymethyl cellulose (CMC), glycerol, distilled water, acetate buffer, phosphate buffer, sterile PP plastic (0.3 mm), plastic wrap, litmus paper, aluminum foil, plastic gloves, and styrofoam plates. The tools used were chopper, cabinet dryer, hammer mill, beaker, measuring cup, 60-80 mesh sieve, sprayer, measuring pipette, stirrer, hot plate, thermometer, color reader, knife, cutting board, tray, mortar, pestle, analytical balance, pH meter, refrigerator, and sensory test form. The factors studied in this research were the concentration of kecombrang flower powder (control; 0%; 0.5%; 1%; 1.5%) and the storage time (3 and 6 days).

The research was conducted in two stages, namely preliminary research and main research. Preliminary research included the manufacture of kecombrang flower powder consisting of several stages such as sorting kecombrang flowers, cutting them into small pieces with a chopper, drying using a cabinet dryer at a temperature of 60^{o}C, grinding dry simplicia with a hammer mill, and sieving the powder with a 60-80 mesh sieve. Meanwhile, the main research included the manufacture of edible coating that had been added to kecombrang flower powder with different concentrations and analysis of physical characteristics such as color analysis with a color reader, pH with a pH meter, and sensory analysis.

The preparation of 100 ml of edible coating solution was done by adding distilled water to 0.5% (w/v) CMC and 1% (v/v) glycerol. Then the solution was transferred into a beaker to be heated on a hot plate to a temperature of 70^{o}C. After that, the edible coating solution was added with kecombrang flower powder with concentrations of 0.5%, 1%, and 1.5%. Then, the edible coating solution that had been added with kecombrang flower powder was applied to the yellowfin tuna fillet.

The application is done by weighing the yellowfin tuna fillet first with a weight of ±100 g. The edible coating solution of kecombrang flower powder which will be applied to yellowfin tuna fillets using a spray method. Edible coating solution of 100 ml was put into a sprayer container, then the solution was sprayed on the tuna fillet 3 times for 5 seconds and dried by airing for 5 minutes. After being sprayed, the tuna fillet was packed with sterile PP plastic (0.3 mm) then closed and stored in a refrigerator at a temperature of 4^{o}C for 6 days.

The analysis in this research uses experimental research methods. Data analysis uses a statistical program with a confidence level of 95%. When Analysis of Variance (ANOVA)

revealed a significant effect (at the 0.05 level), treatment means were then compared using the Duncan Multiple Range Test (DMRT) at the $\alpha = 0.05$ level.

C. Results And Discussion

1. pH Analysist

Based on the results of the analysis with the Analysis of Variance (ANOVA) statistical test, a significant level (95%) obtained a significance value of < 0.05, indicating that there is a difference in pH value in yellowfin tuna fillets. Figure 1 shows that there is a change in pH value at different concentrations of kecombrang flower powder. The graph shows that the control treatment with edible coating has the highest pH value, while the 0.5% powder treatment has the lowest pH value. Determining pH itself is an important indicator for measuring freshness in fish [5]. Yellowfin tuna fillet samples given edible coating with the addition of 0.5% and 1% powder tend to have the same pH value, which is lower than the others. The differences that occur in pH values can be caused by several factors including the physiological condition of fish, the composition of salt compounds in fish, and enzyme activity. Changes in pH value in fish can also be caused by the cold temperatures during storage. During the cooling process, enzyme and microbial activity can be inhibited so that the quality degradation process also takes place more slowly [4]. The pH value obtained is still in accordance with the fresh tuna fillet standard, which is around 5.8 to 6. In addition, the longer the storage, the higher the pH value of the fish. An increase in pH can occur due to the precipitation of acidic salts, such as potassium citrate and sodium citrate [6].

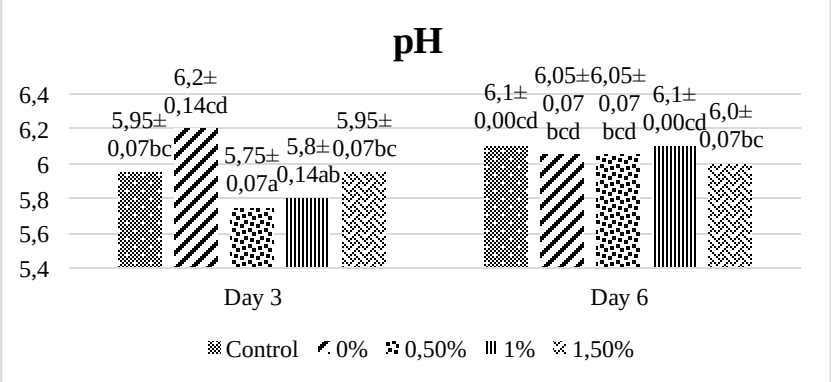

Figure 1. pH value of yellowfin tuna fillets

2. Color Instensity

Based on the results of the analysis using the Analysis of Variance (ANOVA) statistical test, a significance level (95%) was obtained with a significance value of > 0.05, thus indicating that there was no difference in the color intensity value of yellowfin tuna fillets.The color intensity value itself indicates the color density of a material. The higher the color intensity value, the more concentrated the color. Figure 2 shows that the color intensity in the 1% treatment on the 3rd day showed the highest value, while the lowest value was in 0% treatment. Color intensity itself is one of the important parameters that must be tested on fillet products because color plays an important role in the acceptance of a product by consumers because color can be used as a parameter of changes that occur both physically and chemically [7]. One of the factors causing changes in color intensity is oxidation. Color changes in fish can be seen from the color of the fish which was originally fresh red to reddish brown or grayish. The longer the storage also causes the color intensity value to increase, namely becoming reddish brown and grayish. The color change to grayish can be caused by hemoglobin and myoglobin changing into methemoglobin and metmyoglobin. Oxidation in fish meat containing fatty acids also affects the color change towards a darker direction [4].

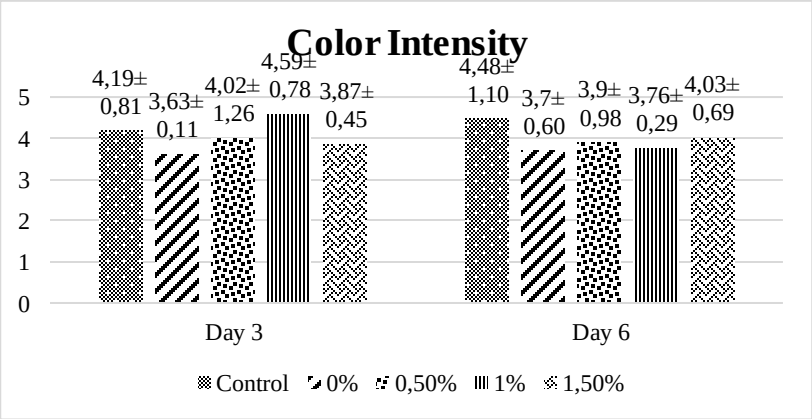

Figure 2. Color intensity value of yellowfin tuna fillets

3. Sensory Analysist

a. Discoloration

Color change or discoloration is one of the most important factors in yellowfin tuna fillets in determining their quality. In fact, the color of tuna fillets is used as the main reference in determining the quality of tuna fillets. Figure 3 shows that the highest discoloration value is in the treatment with a concentration of 1% and 1.5% kecombrang flower powder with a value of 7 on the 3rd day. A value of 7 means that the tuna fillet sample has a specification that experiences a large color change on the product surface of 20% -30%. This means that the presence of kecombrang flower powder can slightly inhibit the occurrence of color changes in yellowfin tuna fillets. This is because kecombrang flowers contain red anthocyanin pigments [8]. So, the more concentration of kecombrang flower powder added, the more anthocyanin pigments in yellowfin tuna fillets and the red color of the fish fillets can be maintained.

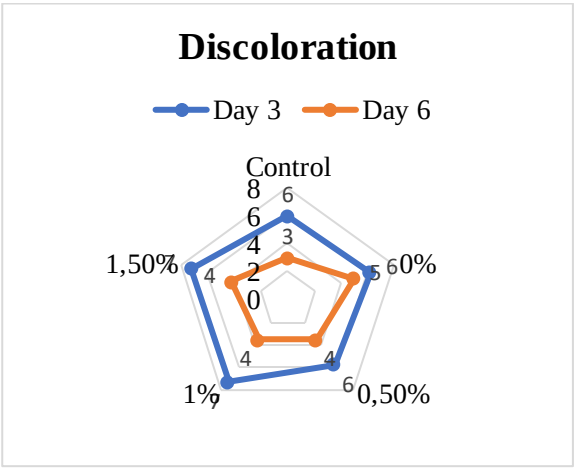

Figure 3. Discoloration value of yellowfin tuna fillets

b. Drying

Drying or dehydration is a process of losing water in fish so that the surface of the fish looks dry. The higher the sensory value of drying fish fillets, the better the product will be because there is not much dry surface of the fish. Figure 4 shows that the longer the storage time, the more the fish will lose its water content. From the graph, it can also be seen that the addition of kecombrang flower powder concentration does not greatly affect the drying value of tuna fish fillets, where the control sample and treatment sample have sensory values that are not much different, ranging from 7-8.

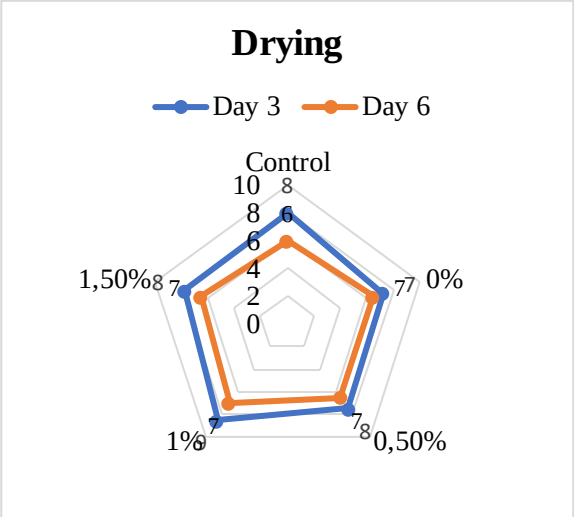

Figure 4. Drying value of yellowfin tuna fillets

c. Odor

Odor is one of the parameters in a product that often determines the quality and consumer acceptance of the product as a whole [9]. Figure 5 states that the addition of kecombrang flower powder to the edible coating for yellowfin tuna fillets can maintain the sensory value of the odor parameter. This can be seen from the sensory value of the odor parameter, where on the 3rd and 6th days the sensory results of yellowfin tuna fillets coated with edible coating of kecombrang flower powder did not experience a decrease in odor value, namely 7 with specifications almost fresh, a little additional odor. In contrast to the control treatment without edible coating which obtained a value of 4 on the 6th day with specifications that there was an additional odor, disturbing, and not rotten. This is because kecombrang flowers contain antibacterial compounds so that they can inhibit the growth of rotting bacteria that contain volatile compounds that have an unpleasant odor. This unpleasant odor is produced from the process of protein degradation and its derivatives will form volatile bases that are easily evaporated, namely ammonia and histamine, causing a foul odor [10].

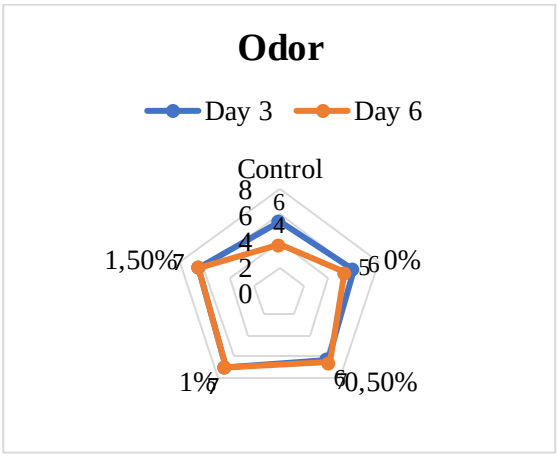

Figure 5. Odor value of yellowfin tuna fillets

d. Texture

Texture is a characteristic description of the surface of the fish body that can be an indicator of fish freshness that can be observed using the sense of touch [11]. Figure 6 states that the addition of kecombrang flower powder concentration to the edible coating solution can maintain the texture value of yellowfin tuna fillet meat on the 3rd day. However, on the 6th day, the addition of kecombrang flower powder concentration did no longer maintains the

sensory value of the texture. This is because the longer the storage time, the more the growth of rotting bacteria can damage the texture of the fish. Fish that have a non-compact texture are caused by the activity of bacteria that contaminate the fish. This is because fish is a good medium for bacterial growth because fish have a high water content [12].

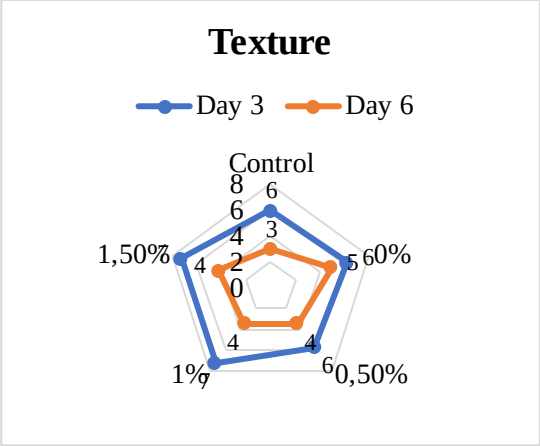

Figure 6. Texture value of yellowfin tuna fillets

D. Conclusion

According to the research results, it shows that the difference in the concentration of kecombrang flower powder added to the edible coating (K) and the length of storage time (L) and the combination of both (K × L) significantly affected the pH value and did not significantly affect the color intensity value in yellowfin tuna fillets. Meanwhile, for sensory analysis, the results showed that the more concentration of kecombrang flower powder added, the better the sensory value of the parameters of color change, drying, odor, and texture. So that yellowfin tuna fillets with the application of 1.5% kecombrang flower powder edible coating are samples with the best sensory value.

E. References

[1]. Kementerian Kelautan dan Perikanan RI. (2020) 'Triwulan I 2020, Nilai Ekspor Perikanan Capai USD1,24 Milyar', https://kkp.go.id/artikel/18769- triwulan-i-2020-nilai-ekspor-perikanan accessed on 10th December 2023.

[2]. Hartanto, T. R., Suharno, S., & Burhanuddin, B. (2021) 'Daya Saing Ekspor Ikan Tuna-Cakalang-Tongkol Indonesia di Pasar Amerika Serikat', *Jurnal Pengolahan Hasil Perikanan Indonesia*, vol. 24, no. 2, pp. 227-235.

[3]. Susilowati, P. E., Fitri, A., & Natsir, M. (2017) 'Penggunaan Pektin Kulit Buah Kakao Sebagai Edible Coating Pada Kualitas Buah Tomat dan Masa Simpan' *Jurnal Aplikasi Teknologi Pangan*. 6(2): 1-4.

[4]. Naufalin, R., Wicaksono, R., & Triyulianingrum, E. (2019) 'Edible Coating Application with Addition of Kecombrang Flower Concentrates to Maintain Quality Fillets of Gurami Fish During Storage', *AIP Conference Proceedings*, vol. 2094, no. 1, AIP Publishing.

[5]. Hidayati, F., Darmanto, Y. S., & Romadhon. (2017) 'Pengaruh Perbedaan Konsentrasi Ekstrak Sargassum sp. dan Lama Penyimpanan Terhadap Oksidasi Lemak Pada Fillet Ikan Patin (Pangasius sp.)', *Jurnal Ilmu Lingkungan*, vol. 15, no. 1, pp. 64-73.

[6]. Azzahra, F. A., Utami, R., & E. Nurhatadi. (2013), 'Pengaruh Penambahan Minyak Atsiri Lengkuas Merah (*Alpina purpurata*) Pada Edible Coating terhadap Stabilitas pH dan Warna Fillet Ikan Patin Selama Penyimpanan Suhu Beku', *Jurnal Teknosains Pangan*, vol. 2, no. 4, pp. 32-38.

[7]. Zega, O., Baehaki, A., & Herpandi. (2017). 'Pengaruh Ekstrak Apu-Apu (Pistia stratiotes) terhadap Daya Simpan Fillet Ikan Patin (Pangasius sp.) yang Disimpan Pada Suhu Dingin', *Jurnal Teknologi Hasil Perikanan*, vol. 5, no. 1, pp. 69-79.

[8]. Novitriani, K., H. N. Hasanah, & A. M. Z. Ulfa. (2017) 'Ekstrak Bunga Kecombrang (Etlingera elatior) sebagai Indikator Alternative pada Media Gula-gula', *Jurnal Kesehatan Bakti Tunas Husada*, vol. 17, no. 1, pp. 81-86.

[9]. Santika, M. A., & Batubara, S. C. (2024) 'Potensi Bubuk Bunga Kecombrang sebagai Pengawet Alami pada Siomay Ikan Tenggiri', *Seminar Nasional Pariwisata dan Kewirausahaan (SNPK)*, vol. 3, pp. 735-747.

[10]. Suhesti, T.S., Fudholi, A., Martien, R. and Martono, S., 2017, Pharmaceutical nanoparticle technologies: An approach to improve drug solubility and dissolution rate of Piroxicam, *Research J. Pharm. and Tech.*, **10**(4), 7 p. https://doi.org/ 10.5958/0974-360X.2017.00176.7

[11]. Al Fatich, M. F. N., Setyastuti, A. I., Kresnasari, D., & Sarmin, S. (2023) 'Identifikasi Tingkat Kesegaran Ikan Tongkol (Euthynnus sp.) di Pasar Bumiayu, Kabupaten Brebes', *Journal of Marine Research*, vol. 12, no. 3, pp. 511-518.

[12]. Wati, M. & Sari, H. (2023) 'Analisis Mutu Ikan Kurisi dan Swanggi Hasil Tangkapan Nelayan di Tempat Pelelangan Ikan Mayangan, Probolinggo', *Jurnal Pengolahan Hasil Perikanan Indonesia*, vol. 26, no. 1, pp. 25-38.