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Changes In Organoleptic Characteristics of Nori From *Gracilaria* Sp. During Storage With Different Types of Packaging

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Abstract

This research was conducted at the Laboratory of Fisheries Products Processing, Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran, Jatinangor. The purpose of this research is to test the quality of *Gracilaria* sp. packed with various types of packaging during the 25ºC dan 35ºC temperature storage period. The method used in this research is an experimental method with 2 treatments, namely (1) packaging type factors, namely polyethylene (PE), polypropylene (PP), and aluminum foil packaging and (2) storage time factors, namely 1, 7, 14, 21, 28, and 35 days. The test carried out in each treatment is the organoleptic test using the scoring test by standard panelists. The results of the organoleptic research were analyzed using the average data of the appearance, aroma, texture and taste scoring test to see the differences between treatments. The scoring test results show that the treatment of aluminum foil packaging can maintain the appearance, aroma, texture and taste parameters until the 35th day when compared with other packaging treatments.

Keywords: Aluminum foil, *Gracilaria* sp., nori, organoleptic, polyethylene, polypropylene

1. Introduction

Japanese food has become a lifestyle for several people in Indonesia. One of the favorite Japanese foods is sushi. Sushi is a food filling consisting of rice, watercress, seafood, kyuri and then rolled coated using dried seaweed sheets or what we usually know as nori. Nori is the main ingredient in sushi making. Nori is the name in Japanese for food in the form of dried seaweed sheets (Abduh, Maulana, Tinggi & Trisakti, 2018).

Seaweed is one of the marine plants belonging to the benthic macroalgae that lives attached to the bottom of the waters (McHugh, 2003). According to the Indonesian Seaweed Association (ARLI), of the 555 types of seaweed found in Indonesia, only 3 types can only be cultivated, including *Gracilaria*, Eucheuma Cotonii, and Eucheuma Spinosum. One of the seaweed species. important economic value in Indonesia, namely *Gracilaria* sp. from the Rhodophyceae class, this seaweed is widely used as raw material for making agar (Supriyantini, Santosa & Alamanda, 2018).

Nori products circulating in Indonesia have mostly imported products from foreign companies. A large number of imported nori causes the need for innovation in the manufacture of nori with many raw materials in Indonesia. This innovation was made by observing the similarity in the physical characteristics of imported nori, especially in terms of its shape in the form of a sheet (Seftiono & Puspitasari, 2019). Utilization of other types of grass is one effort that can be made to innovate nori making. One of the seaweeds is *Gracilaria* sp. (Ramadhan, Afrianto, Dhahiyat & Liviawaty 2019).

Research on nori *Gracilaria* sp. has been done before by Ramadhan et al. (2019). The raw materials used in the nori manufacturing process will affect the physical and chemical characteristics of the nori produced and will affect the quality of the nori. Color of nori *Gracilaria* sp. those with good quality are reddish brown, while nori *Gracilaria* sp. which has decreased quality is dull brown (Ramadhan, Afrianto, Dhahiyat & Liviawaty, 2019). The aroma of nori is identical to the aroma of the raw material for making nori, namely seaweed, besides that there is also the aroma of spices and flavorings if the nori is still of good quality (Lalopua, 2018). The texture of nori as a coating or wrapper for sushi is dominant in a crunchy texture and does not break easily if the nori is still of good quality. Nori *Gracilaria* sp. Those with good quality generally have a distinctive taste of the seaweed raw material they use, there is a sense of fiber in the after-taste and the flavor of the spices and flavorings used (Ramadhan, Afrianto, Dhahiyat & Liviawaty, 2019).

Dry sheet products such as nori will easily become damp and increase in moisture content if left unpackaged so that their shelf life is relatively short (Teddy, 2009). So it is necessary to do proper packaging to extend the shelf life of these products. Plastic packaging such as high density PE (HDPE) and PP as well as aluminum foil has good water and gas molecular migration barrier properties (Hendrasty, 2013), making them suitable for packaging nori which has dry characteristics and easily becomes moist so that its quality is maintained.

Polyethylene is classified into two types, namely Low Density Polyethylene (LDPE) and High Density Polyethylene (HDPE). LDPE is a cheap plastic with strong enough tensile power, flexible but not clear, can provide protection against moisture but is easily penetrated by oxygen and can affect the smell or smell of the food in it. Meanwhile, HDPE is a plastic that is strong, thicker, less flexible, more resistant to water and resistant to chemical compounds than LDPE (Hendrasty, 2013).

HDPE plastic is better than LDPE in terms of protection against air or oxygen, so HDPE plastic is more suitable for packaging nori which is dry and easily becomes damp (Teddy, 2009). Polypropylene (PP) is shiny and clear plastic with good optical properties and tensile resistance, making it easy to handle and distribute (Syarief, 1989). Aluminum foil packaging has good water and gas molecular migration barrier properties (Hendrasty, 2013), making it suitable for packaging nori which has dry characteristics and easily becomes moist so that its quality is maintained. Aluminum foil packaging is composed of hermetic, flexible, and opaque metal so that it has high protective properties against water vapor, light, grease and gas (Aprida, 2017). The purpose of this research is to test the quality of *Gracilaria* sp. packed with various types of packaging during the room temperature storage period.

2. Materials and Methods (TN Roman 12pt)

2.1. Tools and Material

The tools used in this research are a basin, blender, baking sheet (15 x 20 cm), scale, oven, measuring cup, spoon, pan, label, HDPE, PP dan aluminum foil (0.6 mm thickness), incubator and sealer. The materials used in this research are dried seaweed (*Gracilaria* sp.), rice water, clean water, salt, sugar and ground pepper, flavorings, sesame oil, olive oil and fish sauce.

2.2. Method

This research uses experimental methods using nori products made from *Gracilaria* sp. packed into HDPE, PP and aluminum foil packaging. The packaged products are stored at room temperature or at 25ºC. Observations were made on days 1, 7, 14, 21, 28 and 35. The parameters tested were the organoleptic characteristics of nori *Gracilaria* sp. with quality attributes in the form of appearance, aroma, texture, and taste. Organoleptic testing is often referred to as objective testing with the help of the five human senses, to assess the acceptability of a material, to assess quality characteristics, and to determine the taste properties of a material (Yahya, Naiu & Yusuf, 2015). The form of organoleptic testing used in this research is the scoring test. The scoring test is a test using a scale of number one as the lowest value and number nine as the highest value (Soekarto, 1981). The organoleptic test was carried out by 7 people trained or standardized. The results of the scoring test were then analyzed by looking for the average value of each quality attribute on each package and the length of the storage period

3. Results and Discussion

3.1. Appearance

Appearance assessment aims to determine the panelists' acceptance as assessed from the surface appearance and nori color made from *Gracilaria* sp. Product appearance is the most important attribute in a product. In choosing a product, consumers will consider the appearance of the product first and ignore other sensory attributes (Tarwendah, 2017). The level of acceptance of food products from appearance can be influenced by color changes, this is because color changes can indicate changes in nutritional value, so that color changes are used as indicators of quality degradation (Hasany, Afrianto & Pratama, 2017).

Table 1: Average Value of Appearance Parameters of Nori *Gracilaria* sp. in HDPE, PP and Aluminum Foil Packaging at 25ºC Storage Temperature

Packaging	Temp	Average of appearance *Gracilaria* sp. Nori Days to-					
		1	7	14	21	28	35
HDPE	25ºC	8.43	7.00	6.71	5.29	4.71	4.43
	35ºC	8.43	6.43	5.57	4.71	4.43	4.14
PP	25ºC	8.43	7.86	7.57	6.71	5.57	5.29
	35ºC	8.43	7.29	6.43	5.29	5.00	4.71
Aluminum Foil	25ºC	8.43	8.14	7.86	7.57	6.71	6.43

	35ºC	8.43	8.14	7.57	7.29	6.43	6.14

Based on the average appearance value of Nori form *Gracilaria* sp. (Table 1) in HDPE, PP and aluminum foil packaging, it shows a decrease in the appearance value along with the length of the storage period. The highest average appearance value on the 35th day was on aluminum foil packaging at 25ºC storage, which was 6.43 which resulted in *Gracilaria* sp. nori pseudo reddish brown and slightly bright. While the lowest average appearance value of *Gracilaria* sp nori is in HDPE packaging with a storage temperature of 35oC, which is 4.14 which produces *Gracilaria* sp. nori with a pseudo reddish brown appearance, not bright and slightly translucent.

There is a difference in the appearance value of each type of packaging because the packaging has different translucency (Susilawati & Dewi, 2011). In addition, according to Winarno (1997), changes in appearance can also be caused by reactions that occur between organic compounds in products and air. The average appearance value on aluminum foil packaging is higher than that of PP and HDPE packaging. Aluminum foil packaging is composed of hermetic, flexible, and opaque metal so that it has high protective properties against light and gas (Aprida 2017). As for the type of plastic packaging is a poor light reflector, this is due to the slow movement of electrons in the polymer material which is easier to absorb light (Sucipta, Suriasih, and Kenacana, 2017). Although it is almost the same as the type of polyethylene, polypropylene has a more complex molecular structure, this causes polypropylene to have better anti-gas or air migration ability when compared to polyethylene type plastics (Hendrasty, 2013).

Nori *Gracilaria* sp. with good quality is reddish brown, while *Gracilaria* sp nori which has decreased in quality is dull brown (Ramadhan, Afrianto, Dhahiyat & Liviawaty, 2019). The high and low average appearance values are influenced by several factors including pigments, caramelization reactions, Maillard reactions (reactions between amino groups with reducing sugar groups), reactions of organic compounds with air and the addition of dyes (Winarno, 1997).

3.2. Aroma

Aroma or odor can be produced due to the presence of volatile compounds (volatile) in food and will be carried by air and enter the nasal cavity (DeMan, 1997). Aromatic compounds are volatile, so they easily reach the olfactory system at the top of the nose, and need sufficient concentration to interact with one or more olfactory receptors (Tarwendah, 2017). The aroma parameter determines consumer acceptance because aroma or odor stimuli become impulses that will go to the olfactory nerve and describe the characteristics of a product (Hasany, Afrianto & Pratama, 2017).

Table 2: Average Value of Aroma Parameters of Nori *Gracilaria* sp. in HDPE, PP and Aluminum Foil Packaging at 25ºC Storage Temperature

Packaging	Temp	Average of Aroma *Gracilaria* sp. Nori Days to-					
		1	7	14	21	28	35
HDPE	25ºC	8.14	7.29	6.71	5.86	4.71	4.43
	35ºC	8.14	6.71	6.14	5.00	4.43	4.14
PP	25ºC	8.14	7.57	7.00	6.14	5.00	4.71
	35ºC	8.14	7.00	6.14	5.57	4.71	4.43
Aluminum Foil	25ºC	8.14	8.14	7.57	7.29	6.43	5.86
	35ºC	8.14	7.57	7.00	6.71	5.86	5.00

Based on the average value of *Gracilaria* sp. nori aroma (Table 2) in HDPE, PP and aluminum foil packaging, it shows that the aroma value decreases with the length of the storage period. The highest average aroma value on the 35th day is on aluminum foil packaging at 25ºC, which is 5.86 which produces a distinctive aroma of *Gracilaria* sp. and the aroma of spices is somewhat lost. Meanwhile, the lowest average value of *Gracilaria* sp nori aroma is in HDPE packaging with a storage temperature of 35oC, which is 4.14 which results in a slightly lost and slightly rancid aroma of *Gracilaria* sp. According to Lalopua (2018), the aroma of nori is identical to the aroma of the raw material for making nori, namely seaweed or the distinctive aroma of seaweed used.

The average aroma value on aluminum foil packaging is higher than that in PP and HDPE packaging. This is because aluminum foil packaging has high protective properties against water vapor and is hygienic or cannot be passed by gas, so it is difficult for the evaporation process to occur in aluminum foil packaging (Aprida, 2017). Meanwhile, plastic packaging such as HDPE and PP has higher permeability or absorption properties, especially in HDPE packaging, because HDPE packaging has a simple molecular structure compared to PP packaging (Hendrasty, 2013), so that gas and moisture will more easily enter the packaging material. This causes a higher evaporation process when compared to aluminum foil packaging.

The deterioration in aroma quality is caused by the evaporation process of volatile compounds in nori made from *Gracilaria* sp. A decrease in the quality of the aroma will occur with the length of the storage period and the higher the storage temperature (Hasany et al. 2017). The longer the storage time and temperature, the greater the evaporation rate of volatile compounds in the product (Majid, Agustini & Rianingsih, 2014).

3.3. Texture

The acceptance rate of food products from the nori texture made from *Gracilaria* sp. is influenced by the moisture content of a product. The texture is a characteristic of a material as a result of a combination of several physical properties including size, shape, quantity and the elements forming the material that can be felt by the sense of touch and taste, including the sense of mouth and sight (Hasany, Afrianto & Pratama, 2017).

Table 3: Average Value of Texture Parameters of Nori *Gracilaria* sp. in HDPE, PP and Aluminum Foil Packaging at 25ºC Storage Temperature

Packaging	Temp	Average of Texture *Gracilaria* sp. Nori Days to-					
		1	7	14	21	28	35
HDPE	25ºC	8.14	7.00	6.71	6.14	5.57	4.71
	35ºC	8.14	6.71	6.14	5.57	4.71	4.14
PP	25ºC	8.14	7.29	6.71	6.43	6.14	5.00
	35ºC	8.14	7.00	6.43	6.14	5.57	4.71
Aluminum Foil	25ºC	8.14	7.57	7.00	6.71	6.43	5.86
	35ºC	8.14	7.29	6.71	6.43	5.86	5.29

Based on the average texture value of *Gracilaria* sp. nori (Table 3) in HDPE, PP and aluminum foil packaging, it shows a decrease in the texture value along with the length of the storage period. The average value of nori texture made from *Gracilaria* sp. (Table 4) in HDPE, PP and aluminum foil packaging shows a decrease in texture quality as the length of storage period and temperature increases. The highest average texture value on the 35th day was on aluminum foil packaging at 25ºC storage, which was 5.86 which resulted in *Gracilaria* sp. nori which was rather dry, flexible and not crunchy. Meanwhile, the lowest average texture value of *Gracilaria* sp. nori is in HDPE packaging with a storage temperature of 35oC, which is 4.14 which results in *Gracilaria* sp. nori which is moist, flexible, not crunchy and easy to tear. The texture of nori as a coating or wrapper for sushi is dominant in a crunchy texture and does not break easily if the nori is still of good quality (Ramadhan, Afrianto, Dhahiyat & Liviawaty 2019).

Indirectly, changes in texture are influenced by storage time and storage temperature (Hasany, Afrianto & Pratama, 2017). In addition, changes in texture also occur due to the transfer of water vapor through the polymer packaging material (Eskin & Robinson, 2000). Water vapor transfer can occur due to differences in water vapor pressure between the packaging and the system (conditions outside the packaging), this can result in the transfer of water vapor in the product (Aprida, 2017). According to Johnrencius, Netty & Vonny (2017), the higher the amount of water vapor that is diffused into the product causes a reduction in the texture of *Gracilaria* sp. nori, which is initially dry, rather flexible and slightly crunchy, becoming slightly moist, supple and not crunchy.

The textural average value of aluminum foil packaging is higher than that of PP and HDPE packaging. This is because the aluminum foil packaging is composed of hermetic metal, so it has high protection properties against water vapor (Aprida, 2017). Polypropylene packaging has better water and gas permeability properties than polyethylene packaging, so HDPE packaging absorbs oxygen gas and water vapor greater than PP packaging (Hendrasty, 2013).

3.4. Taste

Taste is an important factor of food products in addition to the texture, appearance and consistency of ingredients that will affect the taste caused by these food ingredients. The taste of an ingredient can come from the nature of the food itself or because of the presence of other substances added to the processing process (Kartika, Hastuti, & Supartono, 1988).

Table 4: Average Value of Taste Parameters of Nori *Gracilaria* sp. in HDPE, PP and Aluminum Foil Packaging at 25ºC Storage Temperature

Packaging	Temp	Average of Texture *Gracilaria* sp. Nori Days to-					
		1	7	14	21	28	35
HDPE	25ºC	8.14	7.00	6.14	5.00	4.71	4.43
	35ºC	8.14	6.71	5.86	4.71	4.43	4.14
PP	25ºC	8.14	7.29	6.43	5.86	5.29	4.71
	35ºC	8.14	6.71	6.14	5.57	4.71	4.43
Aluminum Foil	25ºC	8.14	7.86	7.29	6.14	5.86	5.57
	35ºC	8.14	7.29	7.00	5.86	5.57	5.00

Based on the average value of *Gracilaria* sp. nori taste (Table 4) in HDPE, PP and aluminum foil packaging, it shows that the taste value decreases with the length of the storage period. The highest average taste value on the 35th day is on aluminum foil packaging at 25ºC storage, which is 5.57 which results in the taste of *Gracilaria* sp. nori which is rather savory, slightly chewy, has a fiber taste, after-taste is somewhat bitter and the taste of the spices is rather clear. While the lowest average value of *Gracilaria* sp. nori taste is in HDPE packaging with a storage temperature of 35oC,

which is 4.14 which results in the taste of *Gracilaria* sp. nori which is not savory, not chewy, has a fiber taste, bitter after-taste and the taste of spices is lost. According to Ramadhan, Afrianto, Dhahiyat & Liviawaty, (2019), good quality *Gracilaria* sp. nori generally has a distinctive taste of the seaweed raw material it uses, there is a sense of fiber in the after taste as well as the taste of the spices and flavorings used.

Changes in the taste of the product can be caused by the transfer of organic compounds in the product. This is following the statements of Sucipta, Suriasih, and Kenacana, (2017), that the permeability of gas and water vapor can cause the movement of gas molecules from outside the package (air) or vice versa from food to the outside through the packaging layer. The transfer of gas and water vapor can cause various organoleptic deviations, both taste and smell (Sucipta, Suriasih, and Kenacana, 2017).

Aluminum foil packaging has the highest average taste parameter value when compared to PP and HDPE packaging. This is because aluminum foil packaging has excellent permeability to gas and water vapor so that it has high protective properties against water vapor and gas (Aprida 2017). Meanwhile, plastic packaging such as PP and HDPE can absorb gas and water vapor greater than aluminum foil packaging (Johnrencius, Netty & Vonny 2017), so it is easier to experience changes in the taste of the product.

4. Conclusion

The treatment of aluminum foil packaging can maintain the appearance, aroma, texture and taste parameters of nori up to 35 days compared to other packages. In general, aluminum foil packaging treatment is better for packing *Gracilaria* sp. nori during the storage period.

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