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APPLICATION OF EDIBLE COATING KAPPA CARRAGEENAN IN THE QUALITY OF EDIBLE SPOON PRODUCTS

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ABSTRACT

Edible spoon is an edible spoon and is a biodegradable spoon. Foodstuffs that do not use preservatives will be damaged more quickly or microbes grow faster, so there needs to be a coating, Edible coating is a thin layer used to inhibit the humidity and migration of O_2 and CO_2 in handling food. Carrageenan is hydrophobic which causes low product moisture and is a polymer of linear galactant sulfate chains that have high potential as edible coating formers. The purpose of this study was to determine the effect of adding edible coating kappa karaginan to the quality of edible spoon products. This study uses an experimental method with a completely randomized design consisting of five treatments and four replications. The results of the study of the total plate count (TPC) value of the best with the lowest value at 1% treatment is 1.1 x 10^2 cfu /g. The best value of water activity and water content was obtained with the lowest Aw value at 1% treatment, namely Aw; 0.50 and the lowest water content of 3.89%. The best value texture analysis value at a concentration of 4% hardness value is 5.26% and fracturability is 5.16%. The value of melting time of the best value is 4% with a value of 13.92 minutes. Based on the appearance parameters, texture, color, flavor, and taste of the overall highest value with a concentration of 4%.

KEY WORDS : Edible Spoon, Edible Coating, Kappa Carrageenan

INTRODUCTION

The increase in the use of plastic is a result of the development of industrial technology and population numbers. The use of plastic material is increasingly widespread because it is strong and is not easily damaged by weathering. As a result of the increased use of plastic, plastic waste is added and causes environmental pollution (Proshad *et al*., 2018). The increasing use of plastic, especially as tableware or as a tablespoon, needs new innovations to replace the spoon with a more environmentally friendly one.

Edible spoon is an edible spoon and can only be used once. Previous research was conducted by Puspitasari (2018) for the manufacture of edible spoon alginate with the addition of wheat flour, sugar, salt, water, and alginate 2 gr as a substitute for eggs. The results obtained have good texture quality, but the quality of edible spoon products is unknown. Alginate functions to strengthen product texture (Abraham *et al.*, 2018).

Dry food products can be stored for a long time because the water content in the product is only a little due to the high-temperature roasting process. However, foodstuffs that do not use preservatives will break faster or microbes grow faster (Inetianbor *et al*., 2015). So that it is coating on edible spoon to improve product quality.

According to Suput *et al*. (2015) Edible coating is a thin layer made from edible ingredients and can be used as an antimicrobial, antioxidant, flavor and so on. Carrageenan is a polymer of a linear chain of some galactan sulfate which has high potential as a form of edible coating. Based on the explanation above, a study was conducted on the manufacture

of edible spoon which was given a coating from carrageenan to determine the quality of edible spoon products.

MATERIALS AND METHOD

Edible spoon made with flour, alginate flour obtained from CV. Nurajaya Surabaya, sugar, salt and water. While the materials used in the manufacture of coatings include carrageenan kappa flour obtained from CV. Nurajaya Surabaya and aquades. This study was experimental using a Completely Randomized Design (CRD) with 5 treatments and 4 replications. Edible coating treatment includes P0 without coating, P1 giving 1% coating, P2 giving 2% coating, P3 giving 3% coating, and P4 giving 4% coating.

Making Edible Spoon

The stages of the process of making edible spoon with the use of 185 gr flour formulation, 6 gr sugar, 4 gr salt, 100 mL water, and 2% alginate. All ingredients are mixed to form a mixture then printed to resemble a spoon. The product is in the oven with a temperature of 100 ! for ± 2 hours.

Making Edible Coating

The production of edible coating was carried out with a concentration of 0%, 1%, 2%, 3%, and 4%, namely by dissolving carrageenan into distilled water which was previously heated at 80 °C for ± 15 minutes. Previously prepared kappa caraginan coating solution was then applied to edible spoon products by dipping edible spoon into carrageenan solution at a temperature of 50 °C for ± 2 seconds then placing it in a tray before being in the oven with a temperature of 50 °C and storing the room temperature (28-30 °C).

Test Method

The testing phase includes a total plate count (TPC) test on the product after coating. Water content test based on the AOAC method (2007) by the oven method, Water activity test was carried out using Aw meter based on the method of Utami *et al*. (2017), Texture analysis was tested using the Texture analyzer based on the method of Feili *et al*. (2013), melting time test, and hedonic test based on SNI (2011). Data from the results of testing edible spoon products were analyzed using ANOVA (Variant Analysis) then continued with Duncan's Multiple Distance test.

RESULTS AND DISCUSSION

Total Plate Count

Food safety from microbes is an important thing that must be considered in preserving food or extending its shelf life.

Table 1. Total Plate Count Test Results

Treatment	Average TPC Value (Cfu/g)
P0	5.1×10^2
P1	1.1×10^2
P2	3.0×10^2
P3	6.5×10^2
P4	2.2×10^3

Microbiological damage to dry food products is generally caused by mold, during the roasting process a number of microorganisms are reduced in number but microorganism spores are still alive. The best TPC value of edible spoon products is the one that has the lowest bacterial growth value in the treatment of 1% as much as 1.1×10^2. However, the overall data on edible spoon products treated with coatings is said to be safe for consumption.

According to Utami *et al*. (2017) the existence of coatings in the form of edible coating makes the transfer of oxygen from the environment to the product can be inhibited so that the growth of aerobic bacteria is also inhibited. According to the Indonesian National Standardization (2011) the maximum Total Plate Number (ALT) value for biscuit products is a maximum of 1×10^4 cfu/g so that edible spoon products are still safe for consumption.

Water Activities

Activity water (Aw) or water activity is the amount of free water available and can be used for microbial growth in food.

Table 2. Results of Testing Water Activities

Treatment	Average Aw ± SD
P0	$0.51^{c} \pm 0.002$
P1	$0.50^{c} \pm 0.006$
P2	$0.57^{b} \pm 0.053$
P3	$0.58^{ab} \pm 0.054$
P4	$0.62^{a} \pm 0.008$

Storage time is influenced by water activity and water content in food. The value of water activity of

edible spoon products is increasing with the provision of more carrageenan coatings, but the overall data shows that the value of water activity of edible spoon products is low. According to Utami *et al*. (2017) Various microorganisms have a minimum Aw value in order to grow well, for example bacteria Aw: 0.90; yeast Aw: 0.80-0.90; Aw mold: 0.60-0.70.

Water Content

The value of water activity (Aw) is closely related to the water content in the food to the product storage power.

Table 3. Result of Testing Water Content

Treatment	Average Water Content (%) ± SD
P0	4.74^{b}± 0.39
P1	3.89^{c}± 0.72
P2	4.08^{bc}± 0.30
P3	4.36^{bc}± 0.29
P4	5.71^{a}± 0.48

The value of water content which has decreased with the added concentration of carrageenan, but the overall dạta is still low. This is because the application of edible carrageenan coatings can be a barrier that has resistance to O_2 and CO_2 gases so that it retains edible spoon products because air humidity does not enter the edible spoon pores which can cause bacteria to grow easily (Utami *et al*. 2017). According to the Indonesian National Standardization (2011) the maximum water content value for biscuit products is a maximum of 5%.

Texture Analysis

Water content in food products can affect the texture of the product produced. Texture analysis includes the value of Hardness and Fracturability.

Table 4. Result of Testing Texture Analysis

Treatment	Average *Hardness* (kgf)±SD	Average Fracturability (kgf)±SD
P0	4.25^{b}± 0.40	4.03^{b}± 0.11
P1	4.40^{b}±0.19	4.46^{b}± 0.07
P2	4.62^{ab}± 0.28	4.50^{b}± 0.40
P3	5.09^{a}± 0.70	5.16^{a}± 0.65
P4	5.26^{a}± 0.38	5.15^{a}± 0.72

The value of hardness and fracturability of edible spoon products increases with increasing carrageenan concentration. This is due to the use of alginate in the manufacture of edible spoon. Alginate has good water-binding properties so it can prevent hardening and fragility of dry food (Subaryono, 2010).

Hardness and fracturability of biscuits depends on water activity contained in food ingredients. In addition, the use of a thicker carrageenan coating causes the surface to become hard. The hard surface causes the pressure to become hard so the hardness value becomes high and the fracture power of the product becomes low (Mahardika *et al.* 2014).

Melting Time

Melting time is the time needed to maintain the shape of the texture and the time it melts is marked by the product starting to expand and be flexible when in hot water.

Table 5. Result of Testing Melting Time

Treatment	Average Melting Time (minute) ± SD
P0	10.05^{c}± 0.411
P1	0.74^{bc}± 0.361
P2	1.29^{b}± 0.921
P3	3.20^{a}± 0.871
P4	3.92^{a}± 0.44

The value of melting time in the treatment is increasing. The addition of alginate to the ingredients of edible spoon and carrageenan as coatings can slow down the melting time of edible spoon products. According to Mulyani *et al*. (2017) Alginate is able to regulate the balance of the emulsion with the binding and protection of colloids.

Addition of high stabilizer concentrations will cause slow melting (Mulyani *et al.*, 2017). Edible Coating from carrageenan functions as a stabilizer that can improve the texture and bind the water more so that the product does not melt quickly.

Hedonic

Hedonic value is used to measure the level of preference of panelists.

Appearance describes the overall assessment of the appearance of edible spoon products. Appearance is influenced by the product moisture content. Edible spoon has a low water content so it has a good appearance. Edible spoon which is given a coating looks shiny so that it looks nicer and cleaner. According to Juhaimi *et al*. (2012) edible coating can maintain product quality and can cover

Table 6. Result of Testing Hedonic

Treatment	Average				
	Appearance	Texture	Flavour	Color	Taste
P0	6.44[a]	6.28[a]	6.26[a]	6.47[a]	6.14[a]
P1	6.64[a]	6.56[a]	6.64[a]	6.62[a]	6.55[a]
P2	6.57[a]	6.55[a]	6.56[a]	6.51[a]	6.66[a]
P3	6.52[a]	6.71[a]	6.76[a]	6.52[a]	6.58[a]
P4	7.1[a]	6.92[a]	7.13[a]	6.74[a]	6.88[a]

the surface of the product perfectly when applied so that it can make the product surface clearer, transparent, shiny, and brighter.

The texture of edible spoon products has a texture that is not too hard and crispy when eaten. The oven process affects the texture of the product. According to Khan and Saini, (2016) roasting process helps in the formation of product texture, the longer the roasting time will cause an increase in viscosity because the water in the evaporating material increases and the total dissolved solids increase so that the viscosity will increase.

The flavor of a food is very influential on the reaction of the level of preference of panelists. The aroma of edible spoon products has a delicious aroma that comes from applying butter to the product before being in the oven. According to Ayub *et al*. (2013) the flavor of biscuits formed during the oven process. Because volatile compounds evaporate so that the flavor of the material is partly lost due to cooking. The flavor of biscuits can also be caused by various components of other ingredients in dough such as margarine, sugar, and floating ingredients. The use of coatings can maintain the aroma of food.

Color is a very important attribute because it can arouse consumer interest related to appetite and play an important role in receiving food products (Abraha *et al*. 2017). The color parameter of the edible spoon product has a brownish color. The color of the product comes from the color of the raw material used and the maillard process occurs during roasting. According to Uthumporn *et al*. (2015) the reaction between protein and carbohydrates is responsible for the brown color and physical properties of bread products. Coating can delay color changes

Taste is a sensory attribute in receiving food products. Edible spoon products tend to taste more savory, not too sweet and not too salty. The treatment of dyeing materials in edible coating solutions will not result in changing tastes compared to the coating treatment. Dyeing in edible coating causes compounds that cause the taste of the product to be retained by the edible coating (Khare et al. 2016).

CONCLUSION

The best treatment in this study was edible spoon coating with a concentration of 3%. The administration of edible coating kappa carrageenan has an effect on the value of water activity, moisture content, texture analysis, and melting time but has no effect on storability, namely the number of bacteria in total plate count value and hedonic value of edible spoon products compared to the control treatment.

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