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Effect of Formulation of Edible Coating Solution on Weight Loss of Kaempferia Galanga Peeled Tubers

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Abstract

Kaemferia galanga L. (Kencur) is a spice plant used for household purposes and traditional medicine. It contains phytochemical compounds. It has high water content; it caused the shelf life of peeled K. galanga at room temperature to be relatively short. There are no studies that report the effect of glycerol concentration and immersion time in edible coating based on mocaf flour on the quality of peeled K. galanga. This research aimed to study the effect of immersion time of peeled K. galanga tubers in edible coating solution with different glycerol concentrations and storage time on weight loss and sensory characteristics of K. galanga peeled tubers. The results of the descriptive test on the sensory aspect showed that the external appearance of K. galanga changed to a very dry, very hard texture, and reduced aroma during storage. RAL test showed a significant effect on the concentration of immersion time and storage time on the weight loss of peeled galangal (Sig. < 0.05). The interaction between the variables showed a significant effect on the weight loss of peeled K. galanga. The immersion time for 2 minutes showed a significant difference. Duncan's test showed 5% glycerol concentration showed the most significant results in kept weight loss compared to other concentrations.

Keywords: K. galanga tubers, glycerol, immersion

Introduction

Kaempferia galanga L., the scientific name of Kencur (Indonesia's name), a herbaceous plant belonging to the Zingiberaceae family, is the tuber that is treated in this research. Kaemferia galanga L. tubers is a traditional crop that is widely used for traditional food and herbal medicine. It has a special quality as an antibacterial (Utami et.al, 2021), an antioxidant (Muhafidzah et.al, 2018), a wound healer (Wahyuni et.al, 2022), and good for digestion (Mariani & Wardenaar, 2019). Research on the potent medicinal activities and ingredients of K. galanga extract has been carried out (Shetu et. Al, 2018). Extraction of K. galanga requires a large number of tubers. During the storage and processing, there is a time gap that causes alteration in the quality of its ingredients and characteristics. On the other hand, research about the handling of tuber peeled during storage has not been reported. The short shelf life of K. galanga tubers peeled could decrease their quality for the duration of storage. In trading, the shriveled tuber of K. galanga will certainly cause a decrease in selling value. The shrinkage of the K. galanga tubers causes K. galanga is not fresh anymore and used as a spice for cooking.

One of the storage methods using eco-friendly packaging that could improve product quality is edible packaging such as edible films and coatings. Edible films/coatings are the most widely used for fruits and candy and vegetables. Several studies have reported the effect of edible coatings on product quality during storage (Alsuhendra & Santoso, 2011; Ridawati & Indah,

2011). Edible coatings are not equally effective for all products. Therefore, the development of alternative edible coatings which increase product quality is desirable.

Increasing the shelf life and freshness of K. galanga tubers was necessary to maintain the stability of quality. The use of edible packaging is a way that could be applied. There are four types of edible packaging, i.e., edible coating, edible film, microencapsulation, and nanoencapsulation.

The quality of food is mostly related to packaging and inducing environmental problems, but this drawback could be limited by using coatings. The edible coating is a type of thin-layer packaging technology that is eco-friendly and can be used to extend the shelf life of food products (Tambunan & Faradilla, 2019). Physical and chemical properties were reported and reflect the role of the starch type (wheat, corn, or potato) and thus that of the amylose/amylopectin ratio, which influences thickness, color, moisture, wettability, thermal, surface, and mechanical properties (Basiak et.al, 2019), (Aini et.al, 2019). In this study, we will focus on edible coating with mocaf flour as basic ingredients and glycerol as a plasticizer. In the process of edible coatings formulation, it is necessary to add plasticizers such as glycerol.

Several researchers have developed edible coatings from materials found in Indonesia and have been applied to many kinds of commodities. Edible coatings from porang starch with the addition of red galangal extract could suppress respiration rate, reduce contamination, extend the shelf life of langsat fruit (Nurlatifah & Nurcahyani, 2017). Edible coating with 2% cassava starch could inhibit quality damage and extend the shelf life of minimally processed papaya fruit (Ifmalinda et. al, 2019). Another research result is that an edible coating of carrageenan and glycerol with a ratio of 2:3% can extend avocado fruit shelf life to 10 days with a weight loss of 8.815% (Nisah, 2019).

The manufacture and development of edible coatings using existing raw materials in Indonesia need to be continued to obtain edible coating products that have superior properties according to the characteristics of the food product to be coated. One of the raw materials that can be used for the manufacture of edible coatings is mocaf flour (modified cassava flour). Mocaf is flour made from cassava through a fermentation process using microbes, such as lactic acid bacteria (LAB), which grow dominantly during fermentation (Nugraheni, 2015). Mocaf has better flour properties than tapioca, such as a whiter color, and a neutral taste and aroma.

The use of mocaf as a raw material for making edible coatings has been studied to increase the shelf life of gelamai (Hafnimardiyanti & Armin, 2017). In this case, gelamai packaged with an edible coating made of mocaf and the addition of glycerol as a plasticizer have a longer shelf life than gelamai packaged with plastic.

It is necessary to research the use of edible coatings to see the effect on the mass of K. galanga L peeled tubers during storage. The edible coating used in this study was made from mocaf flour. The use of glycerol is intended to obtain edible coating properties that can protect the product. This research aimed to study the effect of immersion time of peeled K. galanga tubers in edible coating solution with different glycerol concentrations and storage time on weight loss and sensory characteristics of K. galanga peeled tubers.

Methods

K. galanga tubers were purchased from Pasar Induk, Kramat Jati, East Jakarta, Indonesia. Mocaf flour and glycerol (food grade) were purchased from the traditional market in Rawamangun, East Jakarta. In the first step, K. galanga tubers were washed, peeled, and weighed. The formulation of the edible coating was prepared with different concentrations of glycerol.

A total of 2,5 kilograms of K. galanga tubers were used in this study. Tubers were grouped randomly into ten groups (n = 200-250 grams). One group was a control group (without immersion in the edible coating). The other groups were experimental groups with two independent variables. The first variable was the concentration of glycerol (3%, 4%, 5% w/v). The second variable was immersion time in edible coating (2 min, 4 min, 6 min). This treatment was repeated twice.

The formulation of the edible coating solution based on mocaf flour was carried out based on the method used by Aini et al. (2019) with slight modifications. A total of 1000 mL of distilled

water was put into a beaker glass, then heated on a hot plate stirrer until it reached a temperature of 70oC. Then, 0.4% CMC was added to the distilled water. After being homogeneous, 2, 4, and 6% (w/v) mocaf flour were added to the solution and kept stirring until homogeneous for 3 minutes. The mixture was stirred until homogeneous for 6 minutes. The mixture formed is ready to be used to coat fresh K. galanga tubers.

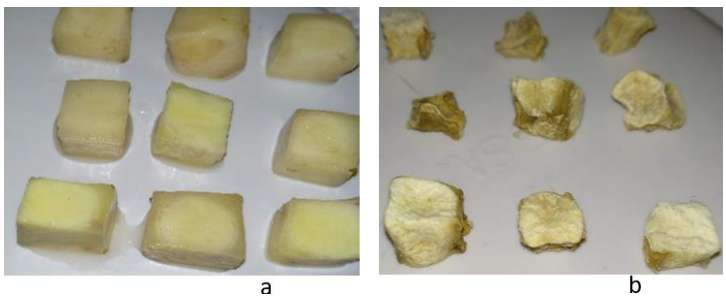
Results and Discussion

Results

K. galanga tubers used in this study are fresh tubers that are still in the ground and have not undergone a post-harvest handling process. After harvesting, the tubers are put into sacks and brought to the main market. Its tuber skin is dark brown (FIGURE 1.) and its color became light brown after washing. The processing of crops is a very important stage and needs to be done properly and correctly so that it can provide results with optimal quality, have high levels of nutritious substances, are stable, efficient, and have an attractive physical appearance.

Figure 1. Fresh, clean, and peeled K. galanga tubers.

The shelf life of fresh-cut K. galanga is limited by the change of physical and chemical during storage. The limitation of the shelf life was due to the nonexistent use of the right equipment during marketing. Changes in the physical quality of K. galanga that have been peeled and cut are very significant. The immersion of peeled K. galanga tubers into the edible coating solution is intended to increase its shelf life. The edible coating solution was made using mocaf flour as a source of hydrocolloid and glycerol as a plasticizer. The results of the peeled K. galanga research which were cut and immersed into the mocaf edible coating solution shown in FIGURE 2.



a b

Figure 2. a. Peeled K. galanga after immersion in mocaf edible coating (control) and b. after 5 days of storage.

Peeled K. galanga rhizoma drastically changed after five days of storage. Initially, the sample of peeled K. galanga rhizoma shape had a uniform shape. After 5 days, they showed different shapes. The results showed that were significantly different when viewed from the picture above. All peeled rhizoma tuber, treatment product, and control showed shrinkage. K. galanga tubers turned dry and shrunk. The texture of K. galanga tubers became very hard and their aroma was greatly reduced. The color of the tubers changed from pale yellow to brownish cream. Changes in the shape and texture of K. galanga tubers were caused by the reduced water content of K. galanga during storage.

The time of immersion of K. galanga tubers for 2 minutes into the edible coating solution of mocaf flour with glycerol concentrations of 3%, 4%, and 5% compared to the control. The results of weighing K. galanga tubers showed that there was a significant decrease in the weight of K.

galanga tubers during storage for the first 2 days. On the next day's storage, there was no significant weight loss. The weight loss of K. galanga dipped into an edible coating with 5% glycerol was less than the control and other treatments (FIGURE 3).

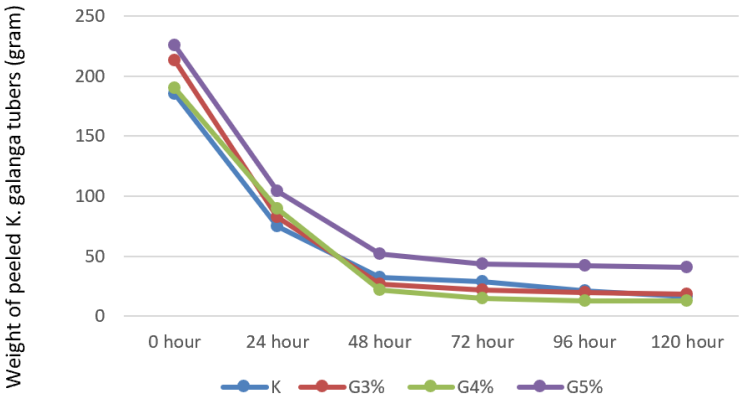


Figure 3. The weight reduction of K. galanga dipped into edible coating for 2 minutes with 3%, 4%, and 5% glycerol concentrations compared to the control.

The treatment of K. galanga immersion into edible coating solution with glycerol concentrations of 3%, 4% and 5% for 4 minutes and 6 minutes also showed that there was a significant decrease in storage for 2 days (FIGURE 4 and 5). The third to the fifth day of storage showed that there was no significant weight loss of peeled K. galanga tubers. The same pattern of weight loss was shown by all the treatments and controls.

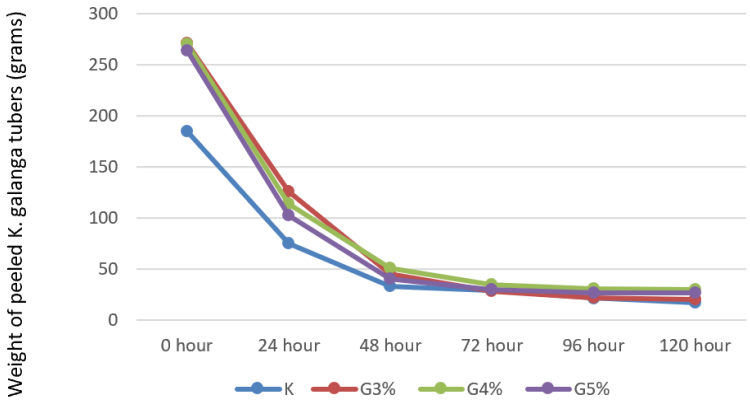


FIGURE 4. The weight reduction of K. galanga dipped into edible coating for 4 minutes with 3%, 4%, and 5% glycerol concentrations compared to the control.

The effect of glycerol concentration (3%, 4%, and 5%) with different immersion times of 2 minutes, 4 minutes, and 6 minutes compared to the control was analyzed. The results showed almost the same pattern. They showed a decrease in the weight of K galanga tubers during storage. A significant decrease occurred in storage until the second day, then the weight of K. galanga tended to be static until the fifth day of storage (120 hours) (FIGURE 6, 7, and 8). The weight loss of peeled K. galanga tubers with 4 minutes of immersion time was smaller than 2 minutes and 6 minutes of immersion time.

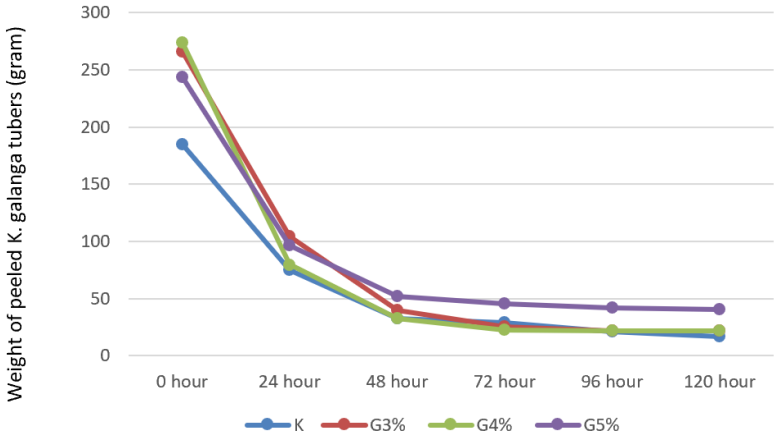


Figure 5. The weight reduction of K. galanga dipped into edible coating for 6 minutes with 3%, 4%, and 5% glycerol concentrations compared to the control.

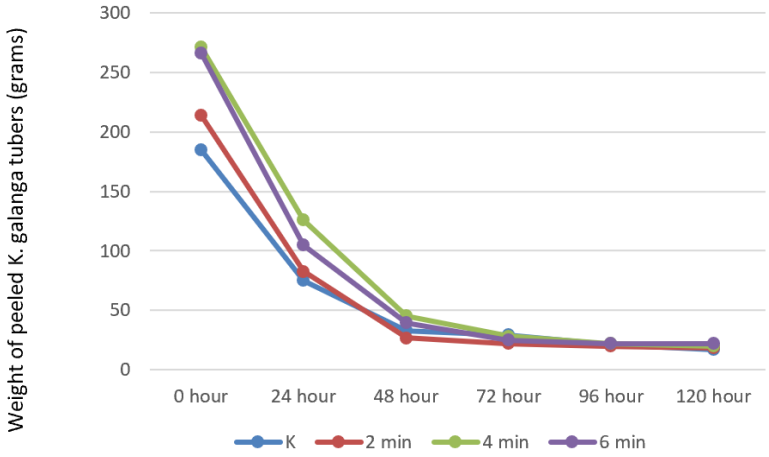


Figure 6. The weight reduction of K. galanga dipped into edible coating with 3% glycerol concentrations for 2 min, 4 min, and 6 min compared to the control.

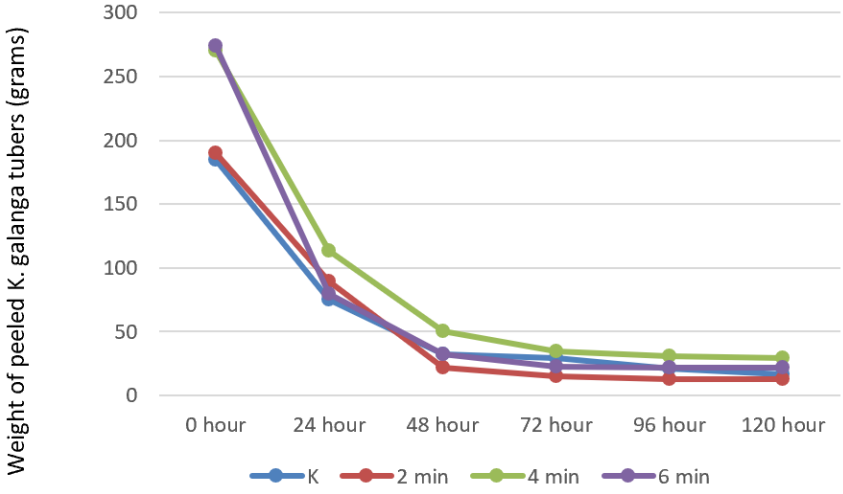


Figure 7. The weight reduction of K. galanga dipped into edible coating with 4% glycerol concentrations for 2 min, 4 min, and 6 min compared to the control.

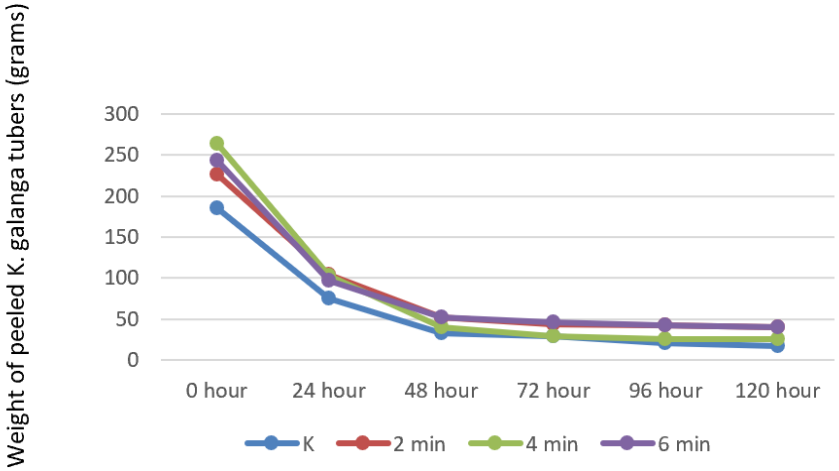


FIGURE 8. The weight reduction of K. galanga dipped into edible coating with 5% glycerol concentrations for 2 min, 4 min, and 6 min compared to the control.

Discussion

An edible coating in this study was like plastic packaging with very thickness and cover the product shape, which was formed from a combination of hydrocolloid from mocaf flour and glycerol as a plasticizer, dispersed in aqueous media. The edible coating was formed directly on the tubers.

The results of the descriptive test on the sensory aspect showed that the external appearance of K. galanga changed to a very dry, very hard texture, and reduced aroma during storage. RAL test showed a significant effect on the concentration of immersion time and storage time on the weight loss of peeled tubers (Sig. < 0.05).

The interaction between the variables showed a significant effect on the weight loss of peeled K. galanga. The immersion time for 2 minutes showed a significant difference. Duncan's test showed 5% glycerol concentration showed the most significant results in kept weight loss compared to other concentrations. The results of statistical tests using Duncan's test showed that there was a significant interaction between glycerol concentration and immersion time on weight loss of peeled K. galanga. Likewise, the interaction of glycerol concentration with storage time has a significant effect on weight loss.

The concentration of glycerol greatly affects the ability of edible coatings to protect the product against water loss. As reported that the comparison of using 3 % glycerol with carrageenan provides better protection compared to the use of 2 % glycerol (Nisah, 2019). The weight loss of Tongka Langit banana with an edible coating is relatively lower when compared with Tongka Langit banana without coating. The glycerol concentration of 3% was the best treatment due to its capability in inhibiting the decrease of hardness and weight loss (Picauly & Tetelepta, 2017). Other researchers using lower glycerol, which is less than 2 %, reported that there was no effect of using edible coating in protecting the product from weight loss. This study differs from the results reported on the use of glycerol in edible films where it was reported that increasing the concentration of glycerol had no significant effect on the value of the water vapor transmission rate of edible films (Prasetyo & Laia, 2018). The low concentration of glycerol in the edible film is not effective in inhibiting the rate of water vapor transmission from the product. Weight loss occurs due to the loss of water components and other volatiles in the process of respiration and transpiration during storage Tambunan & Faradilla (2019). Meanwhile, to improve the function of edible films in protecting products, other researchers used higher concentrations (Fatnasari et. al, 2018).

Another important factor that must be considered in the use of edible coatings is immersion time. To get optimal results, it is necessary to study the immersion time of the product in the edible coating. Differences in the type of starch and the product to be applied with edible coating were variables that must be observed.

Based on the results of the study, it is known that the edible coating of mocaf flour with the addition of glycerol as a plasticizer had not shown significantly different results compared to the control. The average weight of K. galanga before treatment (control) was 231.3 + 15.2 grams, after the treatment with edible coating it showed there was a decrease in the weight of K. galanga peeled. The higher concentration of glycerol showed the tuber shine more after storage. It was because the edible coating is more attached to the tuber.

The immersion time for 4 minutes and 6 minutes showed no significant difference. Storage until the second day showed significant results in weight loss of peeled K. galanga. Longer storage time shows the weight of K. galanga which has been stable and slightly decreased. As reported by other researchers, the best result for the immersion time of pineapple in the edible coating was 1 minute (Hasibuan et. al, 2016), while the best result for immersing chicken claw in edible coating was 3 minutes (Sompie et. al, 2020).

Conclusions

From the research, it can be concluded that: 1. Edible mocaf flour film with 5% glycerol plasticizer showed the most significant results in keeping weight loss compared to other concentrations. 2. There was a significant interaction between glycerol concentration and immersion time on weight loss of peeled K. galanga. The interaction of glycerol concentration with storage time has a significant effect on weight loss.

Acknowledgments

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