Utilization of Edible Coating and Film from Mocaf Flour to Extend Shelf Life of Gelamai

Hafnimardiyanti[a*], M. Ikhlas Armin[a]

[a]*Departemen of Analytical Chemistry, Polytechnic of ATI Padang,Jl. Bungo Pasang, Tabing, Padang25171, Indonesia*

Abstract

Plastic is the most widely used for packaging material, but plastic polymers have weaknesses such as heat-resistant, tear-free and contamination by monomer transmission to packaged materials and non-biodegradable properties. Then developed the type of packaging from organic materials and derived from renewable materials, economical and edible packaging. Mocaf (Modified Cassava Flour) has become one of the potential sources of starch for edible packaging. Mocaf is a derivative product from cassava flour made with the principle of modification of cassava cells in fermentation with lactic acid bacteria. The purpose of this research is to observe the effect of mocaf edible packaging (film and coating) on the storability of the gelamai packaged with this edible packaging. In this study, gelamai is packed with edible packaging in the form of edible film with 1% glycerol plasticizer, edible coating with glycerol and sorbitol plasticizer with concentration of 1, 1.5 and 2%. Then performed organoleptic test to see panelist reception to gelamai which is packed with this edible packing, then the determination of water content and tiobarbiturat acid level to see the effect of edible packing during storage of gelamai. From the research that has been done obtained that based on organoleptic test, the increase of plasticizer concentration decrease panelist's preference level to gelamai. This edible packaging has an effect on the shelf life of the galamai, wherein gelamai with edible coating plasticizer glycerol 1% provides longer shelf time compared to other packing types, marked by the growth of fungus at week 4, although rancidity has begun to appear at week 3. The other packers such as plastic, edible film glycerol 1% and sorbitol, rancidity have arisen at week 2 and fungus grows at week 3.

Keywords: mocaf, edible coating, edible film, organoleptic, plasticizer

1. Introduction

Indonesia is a country rich in various types of processed foods, one of this types is the gelamai. This traditional food is a snack from West Sumatra made from glutinous rice flour mixed with coconut milk and brown sugar or palm sugar. Almost every area in Indonesia has this type of traditional food known as dodol or jenang. Galamai is the same as dodol, has a dark brown and shiny, if taste tasted chewy and tender tongue.

Gelamai is semi-wet food, contains water content ranges from 15-50% and water activity less 0.6-0.9. Damage that occurs in this gelamai because of the aroma of rancid caused by the oxidation of fat, especially in coconut milk that produces aldehyde and peroxide compounds. The oxidation process produces odors and flavors that can degrade the quality of food [1]. The damage causes the gelamai to have a relatively short shelf life.

Foodstuffs are generally very sensitive and susceptible to quality degradation due to environmental, chemical, biochemical and microbiological factors. One of method to prevent or slow the phenomenon is with proper packaging. Packaging of food products is a packaging process with suitable packing materials to maintain and protect food to the consumers so that quality and safety can be maintained. In order for product quality to be maintained, packing and storage is necessary and appropriate. Packaging and storage are two things that cannot be separated in the food industry. In addition, good packaging and storage will extend the life of the product [2].

One of the most commonly used packaging materials of packaging material derived from petrochemical polymers or better known as plastics, is the most widely used packaging material. This is due to various plastic advantages such as flexible, easily formed, transparent, not easily broken, and the price is relatively cheap. However, plastic polymers also have many disadvantages, namely its non-heat resistance, tear ability, and most importantly contamination through its monomer transmission to packed material. Another disadvantage of plastic is its non-biodegradable nature, used plastic waste will not be destroyed even if it has been dumped for decades, as a result of the buildup of plastic waste can cause pollution and damage to the environment [3].

Along with the human consciousness of this problem, it developed a type of packaging from organic materials, and derived from renewable and economical materials [4]. One type of packaging that is environmentally friendly is edible packaging. The advantage of edible packaging is that it can protect food products, the original appearance of products can be maintained, and can be directly eaten and safe for the environment. Edible packaging is grouped into two parts, which

* Corresponding author. Tel.: +62751 7055053; fax: +62751 41152.
*E-mail address:*hafni_cien@yahoo.com

serves as an edible coating and an edible film [5]. Edible film and coating packaging is potentially applied to food to extend the life of food stores [6].

Edible packaging can be made from several polymers, namely: hydrocolloids (in the form of polysaccharides: cellulose, starch, pectin, etc. and proteins: collagen and gelatin), lipids (fatty and fatty acids) and composites [7].

Some research that has been done in packing semi-wet food with edible packaging is edible coating tapioca to pack the lempok durian [8], edible film palm fruit with antioxidant to pack the lempok durian [9], edible coating breadfruit starch for jenang dodol packaging [10], edible coating starch Seeds jackfruit for jenang dodol packaging [11], edible film starch canna tuber to package gelamai [12], edible film sodium alginate to pack seaweed dodol [13], edible coating pectin durian for packing gelamai [14].

Polysaccharide is one of the edible packaging materials [15]. Indonesia as an agricultural country has enormous potential to produce polysaccharides, both from agricultural products and from agricultural waste. One of the Indonesian agricultural products is cassava, from this cassava can produce some derivative products such as mocaf. Mocaf flour is made by fermentation with lactic acid bacteria by modifying cassava starch cells [16].

Hafnimardiyanti [17] has done research making edible film of mocaf flour with various plasticizer. The best edible film was produced by the addition of a 1.5% glycerol plasticizer with a tensile strength of 60.2 MPa and a maximum strain of 5.3%. In this study edible mocaf film produced is applied to pack semi-wet food gelamai, beside that the packaging will also be done in coating.

2. Method

2.1. Edible Film Making

The making of edible film is based on Hafnimardiyanti's research (2016). Where 4 g of mocaf flour was dissolved in 100 mL of aquades then heated with hot plate with constant stirring of 700 rpm, until it reached gelatinating temperature (80-90oC). After the gelatinization temperature was reached, a glycerol plasticizer was added with a concentration of 1.5%. After mixing then the solution is heated for approximately 30 minutes. Strain with whatman paper, then mold into a 40x60 cm baking sheet of 250 mL and dried in an oven at 85 ° C for 3 hours, open the film from the plastic mold and store in the desiccator before being used to package the gelamai.

2.2. Edible Coating Solution Making

4 g of mocaf flour is dissolved in 100 mL of aquades and then heated with hot plate with constant stirring of 700 rpm, until gelatinating temperature (80-90oC) .. After gelatinization temperature is achieved, plasticizer added with various concentration variations (0%, 1.0% ; 1.5% and 2.0%). After mixing then the solution is heated for approximately 30 minutes and strain with whatman paper

2.3. Application at Gelamai

The resulting edible film was applied to pack the gelamai.

The edible solution of mocaf flour with plasticizer variation was applied to the gelamai by immersion into an edible solution (with variations of 1x, 2x and 3x dipping) then dried in an oven at 60 ° C for 1 hour.

2.4. Organoleptic Test

The test is conducted to determine the effect of coating and film on the appearance of the overall taste, aroma and texture of the stored gelamai.

2.5. Storage Gelamai

Coated and enclosed edible films are inserted into the container and stored for 30 days at room temperature. On days 7, 14, 21, 30, a water content test with gravimetric method and fat loss (TBA number) was performed using AOCS cd 19-90 (1990) method from gelamai to determine its quality.

3. Results and Discussion

3.1. Organoleptic Test

The organoleptic test is performed to determine the level of panelist acceptance of the resulting gelamai. The organoleptic test was performed by 30 untrained panelists with parameters including color, flavor, taste and texture.

From organoleptic test that has been done to gelamai which have been packed with various edible coating got the most accepted product of panelist is gelamai with edible coating sorbitol 1% as seen in Figure 1 below.

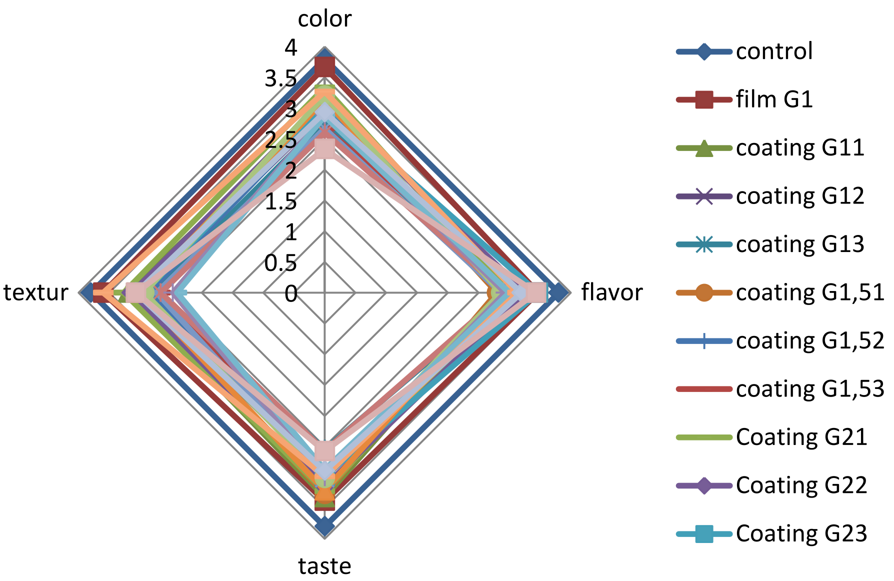

Figure 1. Panelist reception of gelamai with edible coating with several plasticizers

3.2. Water Content

The influence of moisture is very important in the formation of durability of food, because water can affect physical properties or chemical changes [1]. The result of test of water content of gelamai which have been dicoating can be seen in following picture 2.

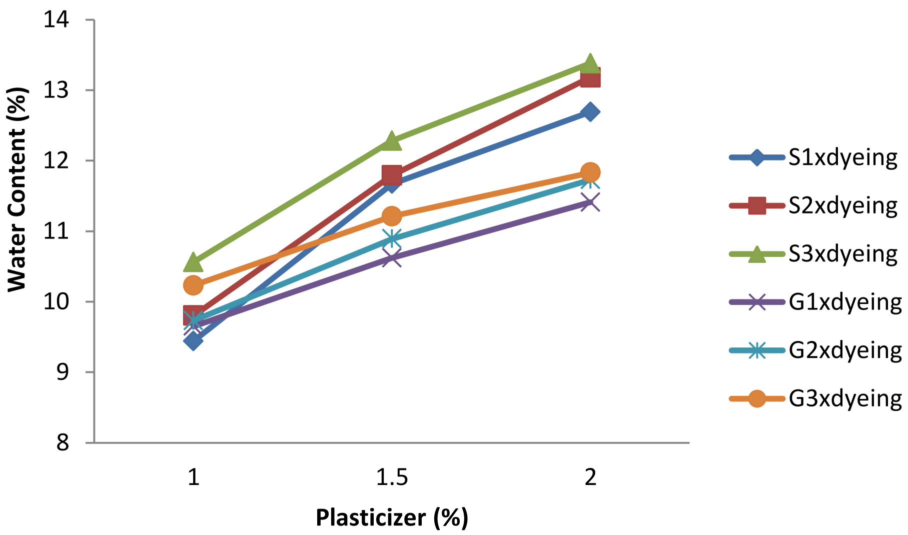

Figure 2. Graph of Moisture Water Content coated with edible plasticizer glycerol and sorbitol

From Figure 2. it can be seen that the water content of the gelamai increases after coating with edible solution. Increased moisture content is strongly influenced by the type and concentration of plasticizer and the amount of dyeing. This is due to the increase of hydrophilic properties of the edible coating solution with the increasing of OH group of plasticizer so that it will increase the amount of water tied up and make the solution becomes more viscous.

3.3. Tiobarbituric Acid Number

Changes in nutritional value such as fat during the precipitation can form rancidity in foodstuffs. Rancidity is caused by the formation of peroxide numbers that occur during storage [18]. Measurement of Tiobarbiturate (TBA) number is used to determine the level of oil rancidity and according to Sudarmadji [19] a minimal TBA number indicating that a rancid product is 0.300 mg malonaldehyde / kg.

Glycerol Plasticizer

Determination of TBA to gelamai during storage can be seen in Figure 3.

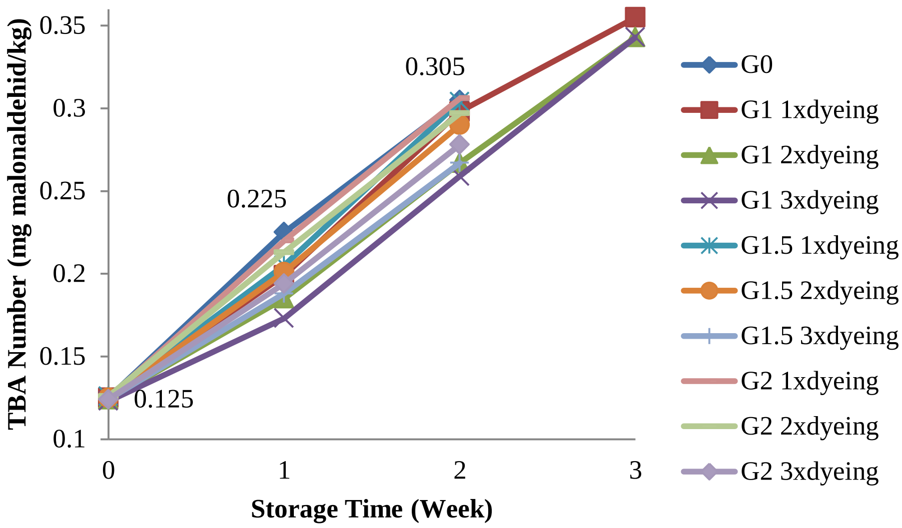

Figure 3. Graph of TioBarbituric Acid Number of Gelamai with Edible Coating Glycerol

From Figure 3 it was seen that the level of TBA from the gelamai increased during storage, but the rate of TBA number increase was slower when compared to the controls that had shown rancidity at week 2. From the figure it was also shown that 1% glycerol gave longer shelf life time compared to glycerol 1.5 and 2%, this is due to the higher concentration of plasticizer the higher moisture content of the product thus accelerating rancidity and growing its fungus.

Sorbitol Plasticizer

When compared between edible coatings with glycerol plasticizer, the value of rancidity with sorbitol plasticizer occurs at 2 weeks after coating, as shown in Figure 4. This is due to the good sorbitol permeability properties of water vapor and oxygen (Sobral, et al in Pokatong, 2014) thus accelerating the hydrolysis and oxidation of oils in the gelamai into free fatty acids and peroxide compounds.

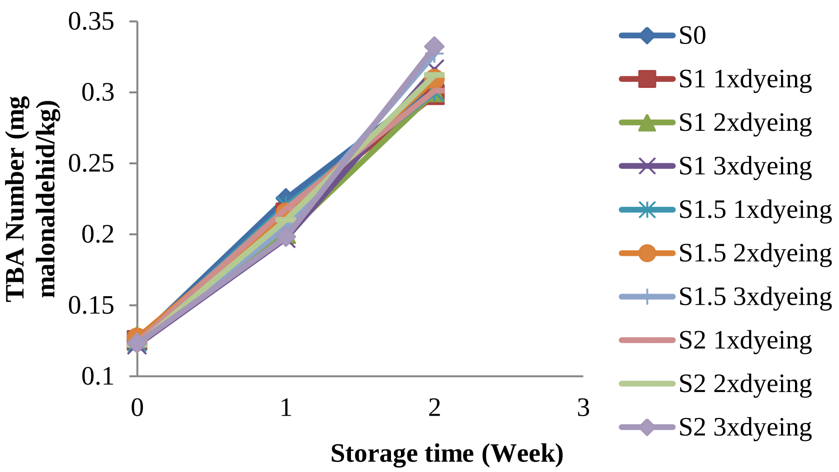

Figure 4. Graph of TioBarbiturate Acid Number with Edible Coating Sorbitol

Type of packaging of TBA Number

To see the effect of storage time to the type of packaging, then comparisons of the number of TBA that have been packed with various types of packaging, as in figure 5 below.

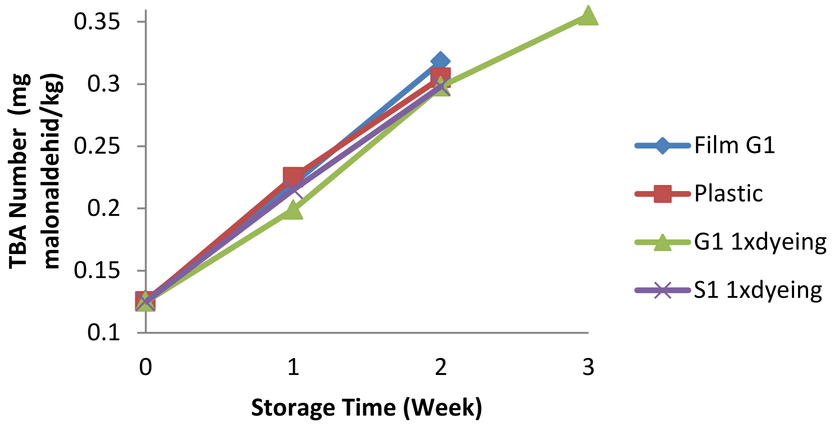

Figure 5. Graph of TBA Number of gelamai with various types of packaging

From Figure 5 it can be seen that edible coating with 1% glycerol plasticizer gives longer self life time compared to other packing type, marked by the growth of fungus at 4th week although rancidity has started to appear 3 weeks. Other packing types such as plastic, edible 1% glycerol film and sorbitol rancidity have arisen at 2 weeks and the fungus grows at week 3.

4. Conclusion

From the research that has been done can be concluded that:

1. Edible mocaf flour film with 1% glycerol plasticizer had the same self life time with plastic which is 2 weeks.
2. Edible coating with 1% glycerol plasticizer able to preserve the gelamai for 3 weeks, while plasticizer sorbitol 2 weeks.
3. Edible coating with glycerol plasticizer gives best storage result compared edible film glycerol 1% and edible coating sorbitol

References

[1] Winarno, F.G.,2002, *Kimia Pangan dan Gizi*, Gramedia Pustaka Utama, Jakarta.
[2] Hui Yui H., 2006, *Hanbook of Food Science, Technology and Engineering*, CRC Press. ISBN 0849398479,9780849398476
[3] Julianti, Elisa dan Mimi Nurmimah, 2006, *Teknologi Pengemasan*, Universitas Sumatera Utara, Medan.
[4] Lin, S.Y., Zhao, Y. (2007). Innovations in development and application of edible coatings for fresh and minimally processed fruits and vegetables. Comprehensive Reviews in Food Science and Food Safety, 6 (1),60 - 75.
[5] Park H.J., etc., 2014, *Processes and Applications for Edible Coating and Film Materials from Agropolymers*. Innovation in Food Packaging, Elsevier Ltd, DOI: http://dx.doi.org/10.1016/B978-0-394601-0.00010-2.
[6] Pashova S., and Zhivkova V., 2016, *Edible Film and Coating Used For Prolonging The Term of Storage of Food*. http.://www.researchgate.net/publication. Diunduh 4 November 2016 jam 13.00 WIB
[7] Dhanapal, et all.,2012, *Edible Film from Polysaccharides*, Food Science and Quality Management, ISSN 2224-6088 (Paper) ISSN 2225-0557 (Online), Vol 3, 2012
[8] Santoso B., Saputra D., Pambayun R., 2004, *Kajian Teknologi Edible Coating dari Pati dan Aplikasinya Untuk Pengemas Primer Lempok Durian*, Jurnal Teknol.dan Industri Pangan, Vol.XV, No.3.
[9] Santoso B., Priyanto G., Purnomo H.D., 2007, *Sifat Fisik dan Kimia Edible Film Berantioksidan dan Aplikasinya Sebagai Pengemas Primer Lempok Durian*, Jurnal Agribisnis dan industri Pertanian Vol.6 No.1.
[10]Triwarsita, Wisnu S.A., 2013, *Pengaruh Penggunaan Edible Coating Pati Sukun (Artocarpus altilis) Dengan Berbagai Variasi Gliserol Sebagai Plasticizer Terhadap Kualitas Jenang Dodol Selama Penyimpanan.* Jurnal Teknosains Pangan, Vol 2, No 1, Januari 2013
[11]Sari, D.K., dkk., 2013, *Pengaruh Penggunaan Edible Coating Pati Biji Nangka (Artocarpus heterophylluss) Dengan Berbagai Variasi Gliserol Sebagai Plasticizer Terhadap Kualitas Jenang Dodol Selama Penyimpanan*. Jurnal Teknosains Pangan, Vol 2, No 2, April 2013
[12]Hafnimardiyanti, M. I. Armin, Martalius. 2014. *Edible Film Making of Starch Canna Tuber (Canna Edulis Kerr) and Aplication to Packaging Galamai*. International Journal on advanced Science Engineering Information Technology, Vol.4(2014) No.3
[13]Nasyiah, Darmanto Y.S., Wijayanti I., 2014, *Aplikasi Edible Coating Natrium Alginat Dalam Menghambat Kemunduran Mutu Dodol Rumput Laut*, urnal Pengolahan dan Bioteknologi Hasil Perikanan, Vol.3, No.4.
[14]Hafnimardiyanti, M.I. Armin, Martalius, 2015, *Utilization of Pectin From Durian Seed For Making Edible Coating Packaging and Application to Traditional Food*, International Conference on Sustainable of Agriculture and Energy (SAFE), *Abstracted.*
[15]Poli, etc., 2011, *Polysaccharides from wastes of vegetable Industrial Processing: New Opportunities for Their Eco-Friendly Re-Use*, Biotechnology of Biopolymers, In Tech Publisher, ISBN 978-953-307-179-4.
[16]Subagio, A., 2007, *Industrialisasi Modified Cassava Flour (MOCAL) Sebagai Bahan Baku Industri Pangan Untuk Menunjang Diversifikasi Pangan Pokok Nasional*, Fakultas Teknologi Pertanian, Universitas Jember, Jember.
[17]Hafnimardiyanti, *Armin M.I., 2016, Effect of Plasticizer on Physical and Mechanical Characteristics of Edible Film from Mocaf Flour*, Der Pharmacia Lettre. 2016, 8 (19):301-308
[18] *Ketaren, S. 2005*. *Pengantar Teknologi Minyak dan Lemak Pangan*, ed 1. Jakarta: UI-Press
[19] Sudarmadji. S., Haryono, B., Suhardi, 1996, *Analisa Bahan Makanan dan Pertanian*, Liberty Yogyakarta, Yogyakarta