The Effect of Various Plasticizer for Making Edible Coating from Canna Starch Tuber to Traditional Food (*Gelamai*)

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Abstract

Indonesia is rich with plants as a source of starch, one of the plants is the canna (Canna edulis Kerr). During this time canna plant is only used as an ornamental plant, in fact canna has tuber as the source of starch that has not been widely used. Besides that, canna also easily cultivated, so the availability was abundant. Starch is one of the edible packaging material as a replacement for plastic packaging. The advantages of using edible packaging is to protect the food product, the original appearance of the product can be maintained and can be eaten as well as safe for the environment. The purpose of this research is the detection of materials that can be used as raw material for packaging edible, edible packaging manufacture and application to semi-moist food *gelamai*, especially to its quality during storage. In this research the extraction of starch from the canna tuber is done by maceration. Starch solution obtained was made into edible packaging in a way diluted with distilled water and heated to gelatinization temperature (75-80^{o}C) is reached, after that the plasticizer is added to add plastic properties to packaging edible. Plasticizer used is glycerol, sorbitol and polyethylene glycol with various concentrations 1, 1.5 and 2%. After mixed, solution was heated for 30 minutes. Edible solution is applied to *gelamai* with variations immersion of dyeing 1 times, 2 times and 3 times, then dried in an oven at 60 °C for 1 hour. From the research that has been done obtained packaging edible coating from starch canna tuber with the addition of 1% sorbitol got the best reception from panelists based organoleptic test. Packaging edible coating give effect to the shelf life of this galamai characterized by decreasing the rate of increase in the value of Thiobarbituric acid to coated *gelamai* compared with the control. Control undergo rancidity at week 2, *gelamai* with platicizer glycerol at weeks 4 and sorbitol in week 3. Plasticizer polyethylene glycol does not give rise plasticizer, characterized by the breakdown of the surface of the product after coated and undergo rancidity in week 2.

*Keywords:*canna; edible coating; organoleptic; plasticizer

1. Introduction

Packaging of food products is a packaging process with suitable packing materials to maintain and protect food to the consumer so that quality and safety can be maintained [1]. 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 self-life of the product.

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, tearability, 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 [2].

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

Some studies that have been done in the manufacture of edible packaging with starch ingredients include the use of jackfruit seed starch as an edible coating on the quality of *dodoljenang* [5]. The use of breadfruit starch as an edible coating on the quality of *dodoljenang* [6].Corn starch as an edible coating for maintaining the quality and saving of tomatoes [7]

The source of starch in Indonesia is actually very much, of which originated from tubers. Canna which is one part of the growing source of starch in Indonesia which is currently not widely utilized [8].Canna plants are quite easy to cultivate both on fertile soil and on barren land and its growth does not require difficult requirements. Canna production is quite a lot

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in the community especially in rural areas. People still rarely use canna as food. Canna is a tuber that has carbohydrate levels 86,64-87,28% [9]. High levels of carbohydrates in canna have excellent prospects to be developed into edible packaging.

Several studies that have been done using these canna tubers include the manufacture of biodegradable plastic [9] and the manufacture of edible film for packaging *gelamai* [10]. *Gelamai* which is packed with edible film from this canna tubers can last for 1 month, before overgrown with mushroom. But the edible film produced at the time packed to *gelamai* makes the shape of the *gelamai* unattractive.

2. Method

The Making Edible Coating Solution
3 g canna tuber starch is dissolved in 100 mL of aquadest then heated to gelatinating temperature (75-80^{o}C). After gelatinization temperature was achieved, plasticizers were added with various concentrations (0%, 1.0%, 1.5% and 2.0%). After mixing then the solution is heated for approximately 30 minutes.

Application to Gelamai
The edible solution from canna tubers with the 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.

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*.

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, measure a water content test with gravimetric method and rancidity (ThiobarbituricAcid number) was performed using AOCS cd 19-90 (1990) method from *gelamai* to determine its quality

3. Results and Discussion

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, aroma, 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,

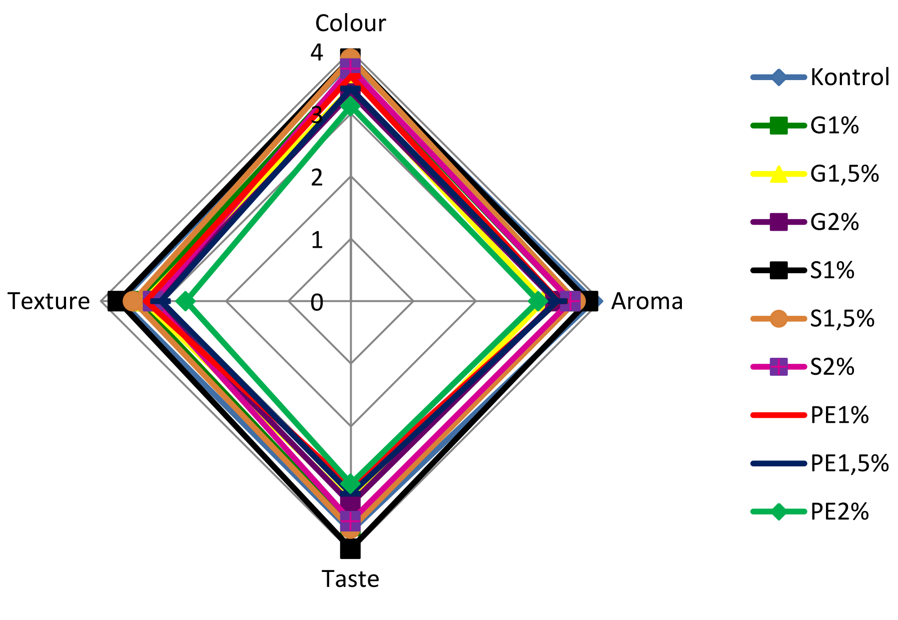
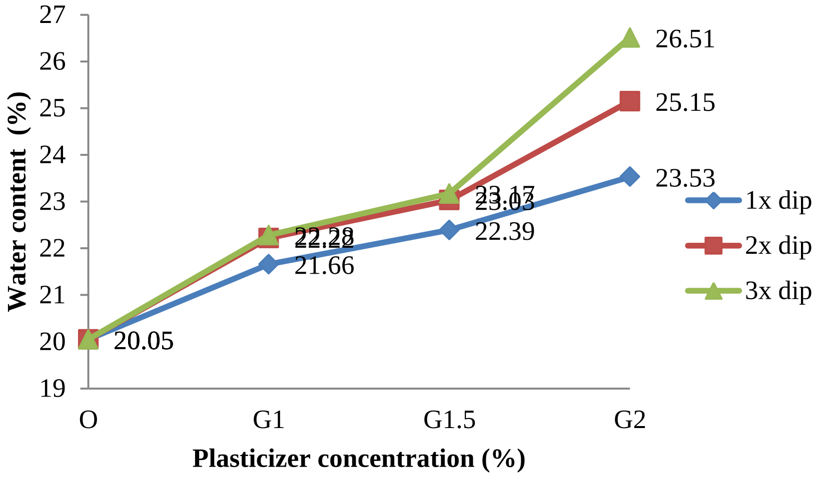


Figure 1. Panelist reception to *gelamai* with edible coating with various plasticizers
(S = Sorbitol, G = glycerol, PE = polyethylene glycol)

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. The result test of water content from *gelamai* which have been dicoating can be seen in Picture 2.



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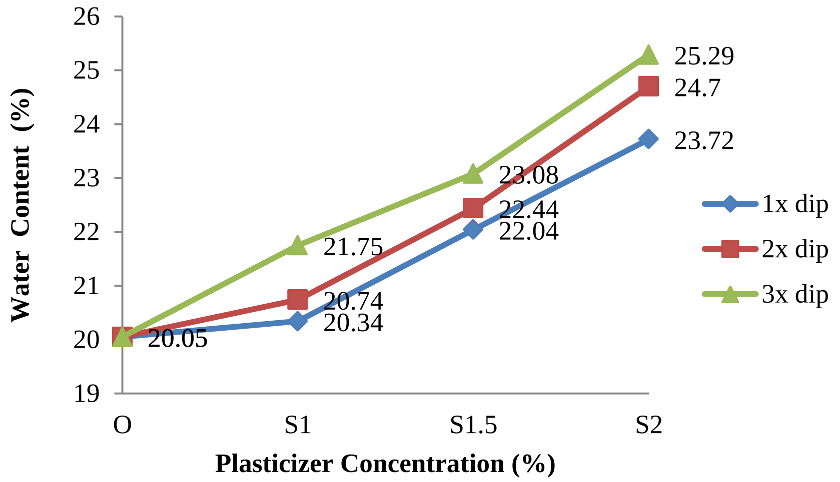

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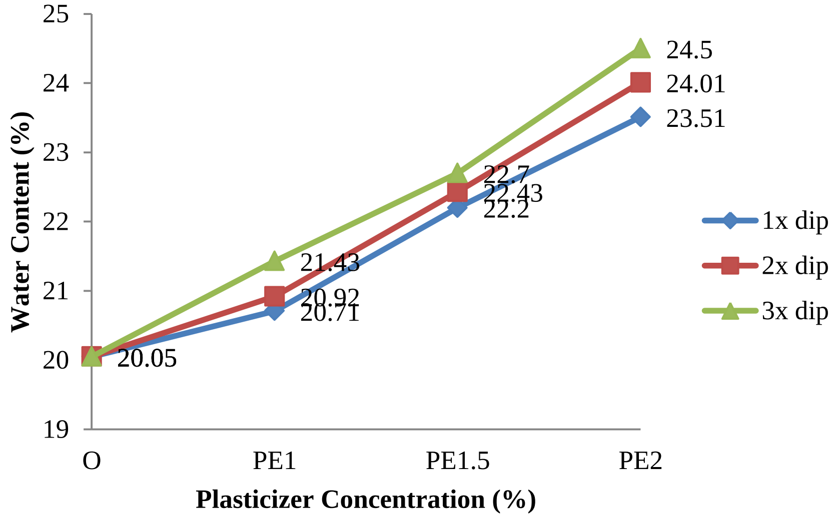

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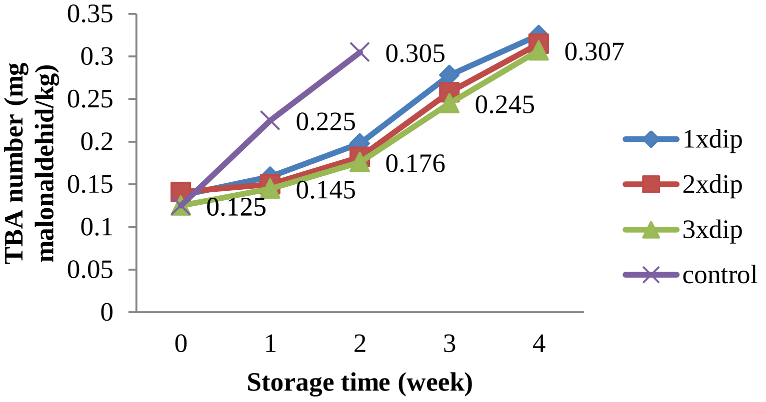
Figure 2. Graph of Water Content of *Gelamai* (a) coating with edible plasticizer glycerol. (b) Coating with edible plasticizer sorbitol and (c) coating with edible plasticizer polyethylene glycol

Figure 2 shows that the water content of the *gelamai* increases after coating with edible solution. This increase in water content depends on the thickness of the edible solution after the addition of plasticizer and the amount of coating. The thicker the edible solution, the higher the water content of the *gelamai*, as well as the more coating the higher the moisture content.

Glycerol Plasticizer

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



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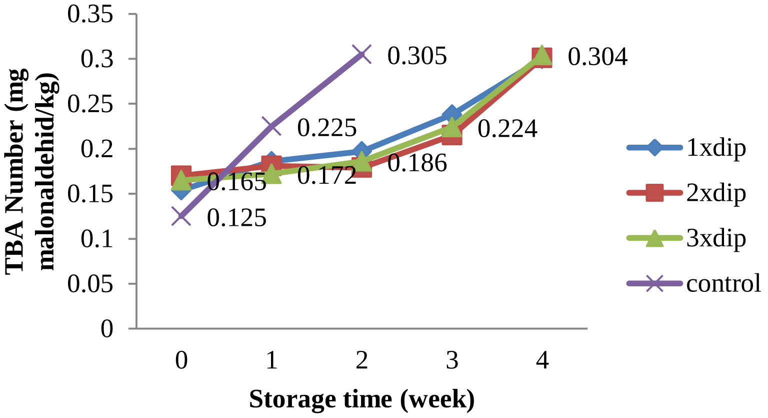

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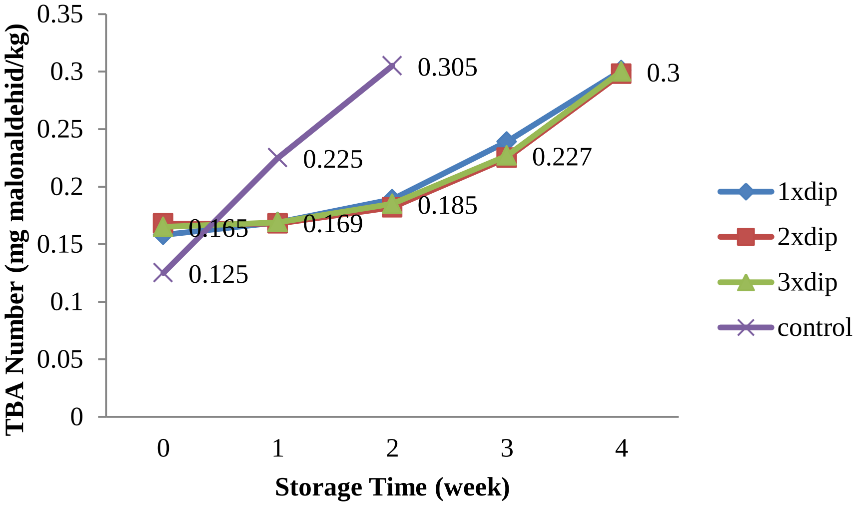

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Figure 3. Graph of Thiobarbituric Acid Content with Edible Coating Glycerol (a) 1% (b) 1.5% and (c) 2%

From Figure 3 it can be seen that the level of TBA from *gelamai* increases during storage, but the increase rate of TBA is slower when compared to the control that has shown rancidity at week 2. From the figure it is also seen that the number of dip did not significantly affect the number of TBA obtained, the plasticizer concentration has an effect on the number of the TBA from *gelamai* as shown in Figure 4.

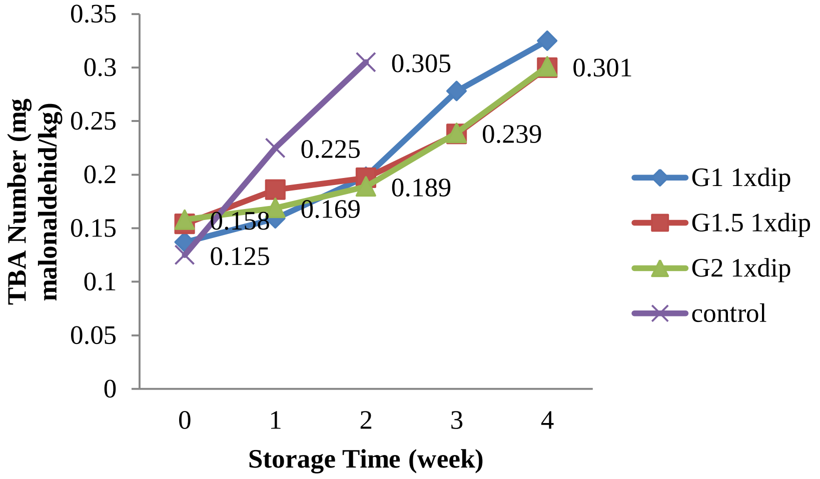
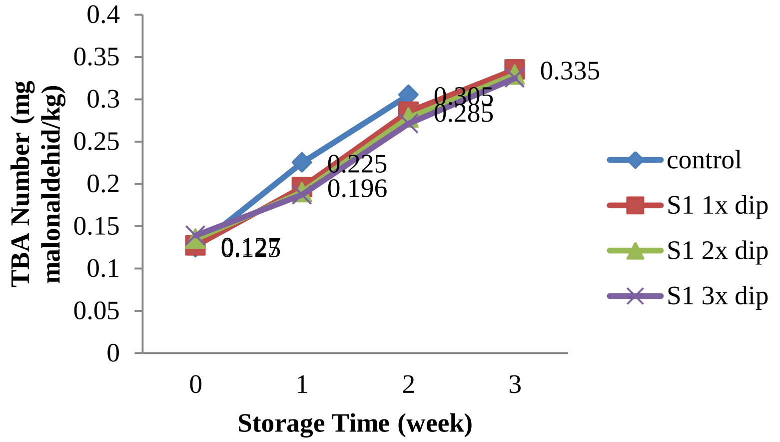


Figure 4. Graph of Thiobarbituric Acid Content of *Gelamai* with various concentrations of Glycerol

Sorbitol Plasticizer

When compared between edible coating and glycerol plasticizer, the value of rancidity with sorbitol plasticizer occurs at week 3 after coating, as shown in Figure 5. This is due to the sorbitol permeability properties of water vapor and oxygen [11] thus accelerating the hydrolysis and oxidation of oils in the *gelamai* to free fatty acids and peroxidecompounds.



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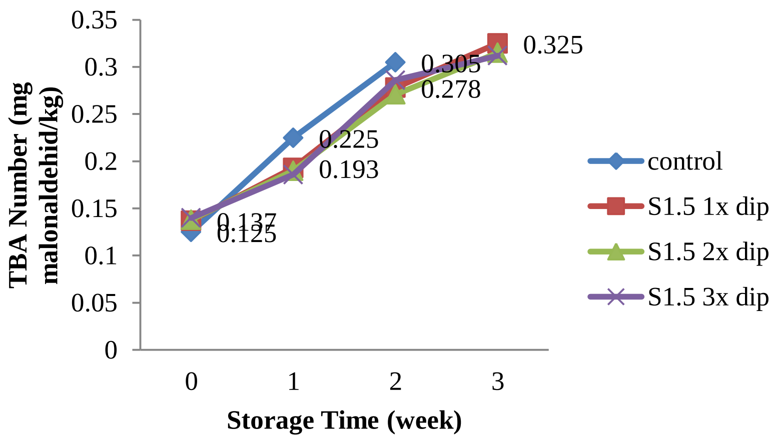

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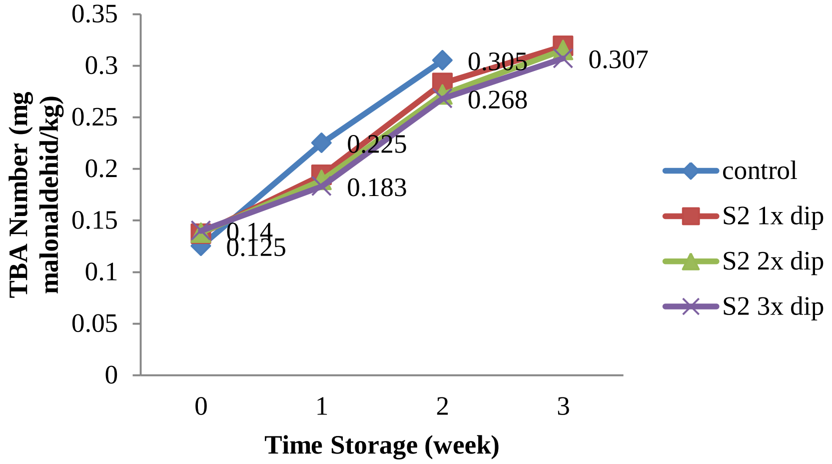

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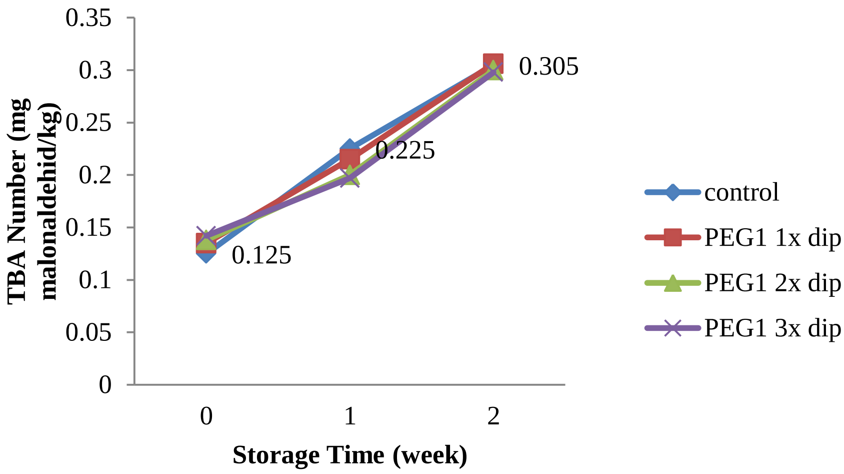
Figure 5. Graph of Thiobarbituric Acid Content with Edible Coating Sorbitol (a) 1% (b) 1.5% and (c) 2%

Polyethylene Glycol Plasticizer

Edible coating with polyethylene glycol plasticizer, does not provide plasticity addition to the edible coating. This can be seen from the emergence of cracks or cracked on the surface of the *gelamai* coating with this plasticizer. So the selflife of this *gelamai*same with *gelamai*notcoating is about 2 weeks.



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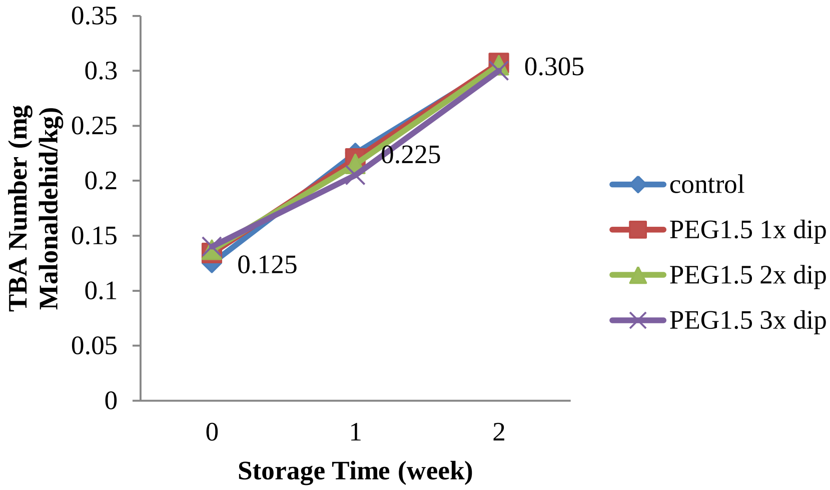

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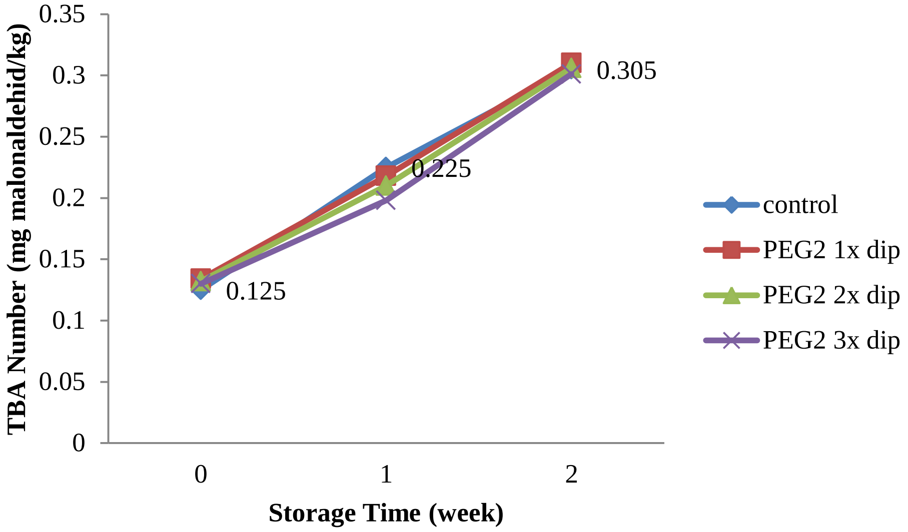

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Figure 6. Graph of Thiobarbituric Acid Content with Edible Coating of Polyethylene Glycol (a) 1% (b) 1.5% and (c) 2%

4. Conclusions

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

1. Plasticizer gives effect to the viscosity of the resulting edible coating solution.
2. Types of plasticizers and the amount of immersion provide a decrease in the level of panelist preferences in organoleptic tests. Where *gelamai* with edible solution with 1% sorbitol plasticizer get the best reception from panelist.
3. The water content of the *gelamai* is increased based on the type of plasticizer and the amount of coating.
4. Edible coating packaging gives effect to the shelf life of this galamai is marked by decreasing rate of increase of TBA value on the coating *gelamai* compared with control. The control was rancid at 2 weeks, *gelamai* with plasticizer glycerol at week 4 and sorbitol at week 3.
5. Plasticizer polyethylene glycol does not provide an increase in plasticizer, characterized by surface cracking of the product after coated. And rancidity occurs at week 2.

References

[1] Kusumawati, Dyah Hayu dan Widya Dwi Rukmi Putri, 2013, Karakteristik Fisik dan Kimia Edible Film Pati Jagung yang Diinkorporasi dengan Perasan Temu Hitam, *Jurnal Pangan dan Agroindustri*, No. 3, Vol.1, Halaman 90-100.

[2] Julianti, Elisa dan Mimi Nurmimah, 2006, *Teknologi Pengemasan*, Universitas Sumatera Utara, Medan.

[4] Dhanapal, et all.,2012, *Edible Film from Polysaccharides*, Food Science and Quality Management, ISSN 2224-6088 (Paper) ISSN 2225-0557 (Online), Vol 3, 2012

[5] 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

[6] Triwarsita, Wisnu S.A., 2013, *Pengaruh PenggunaanEdible 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

[7] 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.

[8] Kuswandari, Maila Yesti, Olivia Anastria dan Dyah Hesti Wardhani, 2013, Karakteristik Fisik Pati Canna (Canna edulis kerr) Termodifikasi Secara Hidrotermal, *Jurnal Teknologi Kimia dan Industri*. No. 4, Vol. 2, Halaman 132 – 136, http://ejournal-s1.undip.ac.id/index.php/jtki

[9] Anas, Argo Khoirul, Atika Salma, Firman Nogroho, Yulia Linguistika dan Winny Filinoristi, 2012, *Pengaruh Variasi Massa Umbi Canna (Canna edulis) pada Pembuatan dan Karakteristik Plastik Biodegradable Ramah Lingkungan Berbahan Dasar Umbi Canna*, Universitas Negeri Yogyakarta, Yogyakarta.

[10] 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

[11] Pokatong, W. Donal R, Carolina Lestari, Titri S. Mastuti, Pemanfaatan Pati Gembili (*Dioscorea Esculenta Lour. Burkill*) Dengan Penambahan Plasticizer Sebagai Edible Coating Pada Stroberi (*Fragaria Ananassa*). Prosiding SNST Ke-5 ISBN 978-602-99334-3-7. Fakultas Teknik Universitas Wahid Hasyim Semarang. 2014