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Edible Film Making of Starch Canna Tuber (Canna Edulis Kerr) and Aplication to Packaging Galamai

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***Abstract*— Canna (Canna edulis Kerr) was a tuber that had a high carbohydrate content so canna had excellent prospects to develop into edible film. The purpose of this study was to make edible film of canna starch, knowing storability galamai was packed with edible film and determine the level of preference panelists through organoleptic tests. In this research, manufacture of edible films with various concentrations of canna starch 2%, 3%, 4% and the use of plasticizer (glycerol) 1%, 2% and 3% with 100 ml of water as a solven and then applied to galamai as a packaging. Of research on edible film get the best that was produced with the use of starch canna tuber 3% with the addition of 1% glycerol, wherein the edible film produced slightly thick and easily opened from the mold. Of organoleptic test showed that galamai packed with edible films of canna tuber starch 3% was the highest scores of the panelists with categories like. From the Friedman test showed that all three variations of the edible film packaging galamai, provide diversity to the test variable organoleptic (color, aroma, texture and flavor). Galamai was packed with edible film could be stored for 1 month.**

***Keywords*— edible film, canna, galamai.**

I. INTRODUCTION

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Packaging of food products was a packaging process with appropriate packaging materials to preserve and protect the food up into the hands of consumers so that quality and safety could be maintained. So that product quality could be maintained, good and appropriate packing and storage was needed. Packaging and storage are two things that can not be separated in the food industry. In addition, good packaging and storage will extend the life of the product [1].

One of the commonly used packing material was a polymer derived from petrochemicals or better known as plastics, packaging materials were most widely used. This was caused due to various advantages such as flexible plastic, malleable, transparent, not easily broken, and the price was relatively cheap. However it turns out, the plastic polymeral had several weaknesses, which it was not heat resistant, easily torn, and the most important was that it could lead to contamination through the transmission of material that was packed to the monomer. Another disadvantage of plastic was that not destroyed naturally (non-biodegradable), waste used plastic not be destroyed even though it has stock piled decades, resulting in a build up of plastic waste that cause pollution and damage to the environment [2]

Along with man's consciousness of this issue, so it was developing the type of packaging of organic matter, and derived from renewable materials (renewable) and economical. One type of packaging that environmentally friendly was edible packaging. The advantage of edible packaging was to protect food products, the original appearance of the product could be maintained, and could be eaten as well as safe for the environment. Edible packaging grouped into two parts: a serves as coatings (edible coating) and the form of sheets (edible film) [3]. Edible packaging could made from several polimer, such as: polysaccharide (selulose, starch and pectin), protein and lipid [4]. In this case the author makes the packaging in the form of sheet, known as edible films made from starch canna tuber.

Sources of starch in Indonesia was many, of which derived from the tubers. Canna which was one part of the starch sources that grew in Indonesia, which had not been widely used [5]. Canna plants was easily cultivated either on land or on the fertile land barren and growth did not require difficult requirements. Production canna was quite alot in the community, especially in rural areas. People were still rarely utilize canna as food. Canna were tubers that have carbohydrate levels from 86.64 to 87.28% [6]. High levels of carbohydrates in the canna had excellent prospects to develop into edible film. Starch with high amylose content

produced edible film was flexible and strong , because the structure of amylase allowed the formation of hydrogen bonds between molecules of glucose during heating constituent and capable of forming a three-dimensional network that could concurrently water to produce a strong gel [7]. But edible film made from starch was relatively easy to tear (brittle), so it need the addition of a plasticizer to make it more flexible [8] for that in this study the authors use glycerol as a plasticizer.

II. METHODOLOGY

A. Preparation of Canna Starch

Canna tuber starch obtained from wild populations growing around agricultural land in the area Alahan Panjang, Solok regency of West Sumatra Province. Canna tubers harvested and cleaned of tendon fibers tubers, washed to clean soils attached, then peeled away soaked with water and shredded. Results grater shaped pulp slurry soaked in the ratio 1: 2 water and filtered with filters that separate the pulp and starch-containing water, then allowed to stand for ± 1 hour. After settling the water is removed and the starch dried in the sun to dry and then sieved with a fine goal starch evenly.An easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it

B. Optimum conditions mMaking of Canna Starch Edible Films

1) *Variations of Starch Canna Tuber*: Canna starch with a variation of 1%, 2%, 3%, 4%, and 5% was added 100 mL water as solvent , stirred for 20 minutes, heated to a temperature of gelatin formed 75-80º C, 1% glycerol was added, filtered (if required), poured into a baking dish, dried for 24 h ±, edible film obtained opens on a baking sheet.

2) Variation of Glycerol: Canna starch 3% was added 100 mL water as solvent , stirred for 20 minutes, heated to a temperature of gelatin formed 75-80º C, glycerol was added to the variation of 2%, 3% and 4%, filtered (if necessary), poured into a baking dish, dried for 24 h ±, edible film obtained opens on a baking sheet

3) *Application Edible Films on Galamai*: Edible films from canna starch was applied by wrapping galamai with edible film

4) *OrganolepticTest and Time Storage*: Tests was conducted to determine the effect of edible film packaging on the overall appearance of flavor, aroma and texture galamai that has been stored for a week and then observations was made until the change in product

III. RESULT

A. Preparation of Canna Starch

Canna tuber starch was obtained 35%. Starch obtained was not white as normal starch. This was caused by fornation of 5 Hydroxy Methyl Furfural from D-glucose during tuber shredded [9].

B. Optimum conditions Making of Canna Starch Edible Films

1) Variations of Starch Canna Tuber: To get good edible film, variation of starch was conducted and the result was obtained in Tabel 1.

TABLE I
EFFECT OF VARIATION IN THE MAKING CANNA TUBER STARCH EDIBLE FILM

No	Canna Strech (%)	Glycerol (%)	Result
1	1	1	Could not be opened from the mold, the texture was very thin
2	2	1	Difficult opening of the mold, thin texture
3	3	1	Easily opened from the mold, slightly thick texture
4	4	1	Easily opened from the mold, thick texture
5	5	1	Easily opened from the mold, the thicker texture

It can be seen from table 1. That the use of canna tuber starch 3% with the addition of 1% glycerol can produce good edible film. Where these condition produced edible film has a slightly thicker texture so easily opened from the mold. On the use of canna tuber 1-2% starch on gelatinization process, which formed a very dilute liquid so thin edible film produced and difficult to open from the mold. Hile the use of canna tuber starch 4-5% gelatine produced thick so edible film formed thicker and easier to release from the mold.

2) Variation of Glycerol: Glycerol added in the manufacture of edible film as an addition to the plastic properties of the resulting film.

TABLE III
EFFECT OF ADDITION GLYCEROL TO MAKING EDIBLE FILM

No	Canna Strech (%)	Glycerol (%)	Result
1	3	1	Easily opened from the mold
2	3	2	Could not be opened from the mold
3	3	3	Could not be opened from the mold
4	3	4	Could not be opened from the mold

It can be seen from Table 2. that edible film obtained from granting 3% canna tuber starch and glycerol 2, 3 and 4% could not be opened from the mold. This occurs because the addition of glycerol as plasticizer will reduce the density and interaction between the substrate molecules (starch) with glycerol, so that a thin layer that forms a more flexible and smooth. The addition of excess glycerol will cause the thin layer becomes soft and sticky so difficult remove from the mold due to binding of glycerol over water and dissolve the surface. Instead deficiency causes a thin layer of glycerol will be coarse and brittle [10]. Thus, the concentration of glycerol could be used only 1%

3) Application Edible Films on Galamai: From the preliminary studies that have been done then conducted further research with canna tubers starch concentration 2%, 3% and 4% and glycerol as plasticizer was used 1%.

TABLE IIIII
EDIBLE FILM MAKING

No	Canna Strech (%)	Glycerol (%)	Result		
			Viscosity	Fillning	Packaging on Galamai
1	2	1	Dilute	Difficult	Difficult
2	3	1	Condensed	Easy	Easy
3	4	1	Very Thigh	Very Easy	Very Easy but difficult to folded

When starch was heated, canna tubers formed gelatin, which gelatinization temperature ranges during the process of heating 75-80 ºC in each experiment. Canna starch concentration of different makes viscosity of each concentration was also different. The higher concentration of the more viscous canna starch gelatine produced and also the shorter heating time in which the concentration of 2% for the heating takes 8 minutes, 3% takes 6 minutes and 4% only takes 5 minutes to become gelatinous. Increasing concentrations of the materials used will cause an increase in the film thickness. The increase in thickness occurs due to differences in the concentration of the film-makers, while the volume of the solution was poured at each mold was equal. This resulted in the total solids in the films after drying increases and polymers that make up the matrix of the film was also increase [11].

Drying time was long enough ±24 hours. After it was taken from the mold by means of exfoliation. Canna starch at a concentration of 2% rather difficult to open, the concentration of 3% can be opened and for a concentration of 4% is more easily opened. This happens because the higher the concentration of the edible canna tubers produced films also getting thicker so easily opened from the mold. At the time of galamai packaging, edible films with canna tuber starch concentration of 2% a little difficult in doing packaging galamai because the texture of soft edible film so irregular with good packaging, the packaging is marked with a little sticky hands. Edible films with canna tuber starch concentration 3% galamai easy to do because the texture of edible packaging films that are a little bit thick and not sticky hands so the regular packaging. Edible starch films with a concentration of 4% canna tuber are very easy to do because the packaging galamai already slightly rough texture but a little difficult to fold packaging.

C. OrganolepticTest and Time Storage

1) Organoleptic *Test*: Organoleptic tests were conducted on galamai which were packed with edible packaging films using the hedonic test and hedonic quality test. The following results obtained:

TABLE IVV
HEDONIC TEST VALUE OF THE PACKAGING EDIBLE FILM GELAMAI

Parameter	Canna Starch Levels					
	2%		3%		4%	
	Average	*Category*	Average	*Category*	Average	*Category*
Color	3,93	Like	4,13	Like	4,00	Like
Aroma	3,87	Like	4,00	Like	3,96	Like
Texture	3,33	Quite Like	3,73	Like	3,67	Like
Taste	3,87	Like	4,03	Like	3,90	Like

From Table 4, it can be concluded that the edible film canna tuber starch 3% of galamai was most preferred products panelists. This was because the resulting edible film is thick enough so that the resulting packaging galamai was more neat, attractive and blend with galamai.

As for the 2% starch content gayong edible film produced little sticky hands so galamai packaged produce less attractive and wrinkled. In galamai with canna starch 4% packaging galamai produced less good because of the edible film thickness used so difficult folded.

TABLE V
QUALITY TEST OF VALUE HEDONIC GELAMAI PACKAGING WITH EDIBLE FILMS

Parameter	CANNA STARCH LEVELS					
	2%		3%		4%	
	Average	*Category*	Average	*Category*	Average	*Category*
Color	3,77	Brown	3,8	Brown	3,83	Brown
Aroma	4,17	Galamai Scented	3,93	Galamai Scented	3,93	Galamai Scented
Texture	3,87	Edible Film Texture Tasted	3,63	Edible Film Texture Tasted	4,13	Edible Film Texture Tasted
Taste	3,13	Edible Film quite influential	3,17	Edible Film quite influential	3,3	Edible Film quite influential

Tabel 5. showed that edible film packed to galamai was not affect to color and aroma from galamai, marked by color and scent of galamai was still same from the beginning made. But gave quite affect to texture and taste from galamai. Texture of galamai being little hard and edible film quite influential

2) Time Storage: From observation it appeared that the shelf life of packaged galamai with edible film could be stored for 1 month, marked by the growth of mold on day 30th. When compared with galamai were packed with plastic, mold growth found at day 29 th. By this could be concluded that the edible film packaging and plastic packaging was the same function in terms of inhibiting the growth of mold.

IV. CONCLUSIONS

From the research that has been done can be concluded that: Packaging canna starch edible film of 3% gives the best results for galamai packaging. Based on organoleptic test, the panelists generally liked gelamai that was packed with edible packaging. Packaging edible film was not influence on storability galamai that was characterized by durability galamai stored using edible film packaging is the same function using plastic containers, marked by the growth of mold that is almost the same for both.

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