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C. PERTANIAN DAN PERKEBUNAN

D. PETERNAKAN DAN SOSIAL EKONOMI PERTANIAN

POTENTIAL STARCH *ZINGIBERACEAE* AS RAW MATERIAL FILMS AS *GALAMAI* PACKAGING

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Abstract

The study was aimed to determine characteristics of Zingiberaceae starch as raw material films as galamai packaging. Galamai is a traditional food from West Sumatera Indonesia. Semimoist foods with high sugar content, has a short shelf life. Rhizome of the Zingiberaceae, including: Curcuma xanthorrhiza, Curcuma domestica, Zingiber officinale var. rubrum and Zingiber officinale var. amarum, used as a treatment in this study, and as a control use of Mannihot uttilisima starch. The results showed Curcuma xanthorrhiza starch is more potential to be films as galamai packaging. Where yield: 12.67%, water content: 57.39, amylosa: 46%, amylopektin: 54% and the temperature of gelatinization: 81,10C. However, antimicrobial activity against microorganisms that grow on galamai relatively low: 3.75 mm.

Key Word : Potential, Material, Packaging

INTRODUCTION

Edible films are made of materials that can be eaten, serves as a barrier to mass transfer (eg contact with oxygen, moisture and fat), and as an additive carrier and to improve food safety (Haris, 2001). Han, J.H (2014) reported edible films enhance the quality of food products, pretecting them from physical, chemical, and biological deterioration. The application of edible films and coatings can readily improve the physical strength of food products, reduce particle clustering, and improve visual and tactile features on product surfaces. It can also protect food products from moisture migration, microbial growth on the surface, light induce chemical changes, and oxidation of nutrients.

Krochta, J.M, E.A. Baldwin and M. Nisperos-Carriedo(1994), component or edible film base material is a hydrocolloid that is made of polysaccharides (cellulose, modified cellulose, starch, agar, alginate, pectin, dextrin) and protein (collagen, gelatin, egg whites). In addition, fat and composites. Han, J.H (2014) reported edible films are produced from edible biopolymers and food grade additives. Various biopolymers ca be mixed together to form a film with unique properties that combine the most desirable attributes of each component.

Each type of coating has advantages and disadvantages that must be combined with other materials. To maintain consistency in the manufacture of edible film solution, it should be added filler such as glycerol. Fennema, OR (1985) explains, glycerol is used as a plasticizer, which serves to reduce brittleness or cracks, increase the flexibility of the films, refine and narrow the results of the films. Han, J.H (2014) reported, in most cases, plasticizers are required ingredients for edible films, especially for polysaccharides and proteins. These film structures are often brittle and stiff due to extensive interactions between polymer molecules.

Edible films can carry various active agents, such as emulsifiers, antioxidants, antimicrobials, nutraceuticals, flavors, colorants, and can enhance food quality and safety, up to the level where the additives interfere with physical and mechanical properties of the films (Han, J.H, 2014). Ustunol, Z (2009), reported edible film can serve as carriers for a wide range of food additives, including antimicrobials, which can reduce microbial growth at meat and poultry surfaces to improve product safety and extend product shelf life.

Antimicrobial films means that the packaging is able to act as a coating and also able to deter and suppress the growth of microorganisms. Some natural antimicrobial compounds that are easily found are a group of essential oils, flavonoids, oleoresin and its derivatives such as phenol, kurkuminoid, alkaloids, terpenoids, tannins and so on. Such compounds contained in the *Zingiberaceae*, as dominant in *Curcuma xanthorrhiza* (*Xanthorizol*), *Curcuma domestica* (*Curcumin*) and essential oils other, *Zingiber officinale var. Amarum* (*Zingiberine*), *Zingiber officinale var. rubrum*) are also *Zingiberin*. In addition to its antimicrobial compounds the *Zingiberaceae* also contains starch respectively: 41.45% (Hayani, 2006), 40-50% (Atmaja, 2008), 44.25% and 52.9% (Winarti.C and Harnani, 2012), means the potential to be used as raw material in the manufacture of edible film. Furthermore, antimicrobial activity will be measured against microorganisms that grow on *galamai*.

Galamai is tradisional food in West Sumatera, Indonesia. It's maked from rice flour, palm sugar, and coconute milk. The materials are mixed and cooked on high temperatured until compact and elastic dough are formed. *Galamai* has a sweet taste, chewy texture and is very suitable as a snack. When packaged plastic, have a short shelf life. Damage *galamai* marked with a rancid smell and then the surface appears white. Traditional food so that it can not serve as a souvenir for turism. Thus this study aims to determine the characteristics of *Zingiberaceae* starch as raw material for edible film *galamai* packaging.

MATERIALS AND METHODS

Materials

The *Zingiberaceae* (*Curcuma xanthorriza, Curcuma domestica, Zingiber officinale* var. *rubrum* and *Zingiber officinale var. amarum*) starch and *Mannihot uttilisima* starch was produced by precipitated basic materials (2 h). Previously, *Curcuma xantorriza, Curcuma domestica, Zingiber officinale* var. *rubrum* and *Zingiber officinale var. amarum* and *Mannihot uttilisima* starch was produced by using juice extractor.

Isolation of Microorganism

Microorganism was prepared from contaminated galamai and was removed to Potato Dextrose Agar (PDA) medium. Potato Dextrose Broth (PDB) were used with growth media for antimicrobial activity analysis.

ANALYSIS

Moisture content (Gravimetri)

The sample is weighed as much as 2 g in a porcelain cup known weight. The cup is inserted into the oven at a temperature of 100 ^{0}C until 105 ^{0}C or until constant weight. The sample is introduced into the desiccator and immediately weighed after it reaches room temperature. Weight loss is calculated as the percentage of water content. (Sudarmadji, S., B. Haryono, dan Suhardi,1997)

Yield

Weigh rhizome to be taken before the shredded starch, then weigh the resulting starch. Starch obtained divided by the initial weight of 100% multiply the percent of yield.

Amylosa (Spectrofotometri)

Weigh 5 g of sample, dissolve in KOH solution and dilute with distilled water. Perform dilution with a dilution factor of 10 : 1. Add to HCl and reagent B. Measure absorbance at 589 nm wavelength.

Amylopektin

Amylopektin value obtained by different.

Gelatinization temperature (Brabender Amylograf)

Weigh starch weighing 10 g, mix in 100 ml of distilled water. Enter into the tool, press the button on the chart monitored and observed approximately 30 minutes.

Agar diffusion method

Films were cut into 6 mm diameter, which were dried and placed on the surface of the previously inoculated PDA plates. Plates were incubated for 24 h at 30 °C, following incubation plates were examined for zone of no growth indicated by halos around (clear zone) the disk. (Davidson, P.M, Sofos, J.N, Branen, A.L, 2013). The test was done in triplicate.

Statistical design

This research was designed by Complete Random Design (CRD) with 3 replications. Treatments wereA= *Manihot uttilissima* starch(control), B= *Curcuma xantorriza*starch, C =*Curcuma domestica* starch, D= *Zingiber officinale* var. *rubrum* starchand E= *Zingiber officinale var. amarum* starch.

RESULT AND DISCUSSION

Terms of a material can be used as raw material for edible film is edible and biodegradable. Krochta (2002) reported the most beneficial characteristics of edible films are their edibility and inherent biodegradability. Han, J.H (2014) reported to maintain their edibility, all film components (biopolymers, plasticizers, and other additives) should be food grade ingredients, and all process facilities and equipment should be acceptable for food processing. With regard to biodegradability, all components ahould be biodegradable and environmentally safe.

The main film forming materials are biopolymers, such as polysacharides, lipids, proteins. They can be used alone or in combination. Polysaccharides film forming materials include starch, non starch carbohydrates, gums, and fibers. The polysaccharides have simple monomers compared to proteins, which have 20 common amino acids. However, the conformation of polysaccharide structures is more complicated and unpredictable, resulting in much larger molecular weights than proteins. Most carbohydrates are neutral, while some gums are charged negatively with very exceptional cases of positive charge. (Han, J.H, 2014)

Starches derived from the rhizome of the *Zingiberaceae* are edible and biodegradable and easy to obtain, because the films that will be produced is used as a galamai packaging and to be sold. Han, J.H (2014) reported the use biodegradable materials for food packaging in the food service business is attractive because it reduces the total amount of synthetic materials and appeals to environmentally conscious consumers. However, it is obvious that the period of disintegration of edible films through biodegradation mechanisms should be longer than the expected shelf life of the packaged products. Pavlath A.E and William, O (2009) reported a product is not only safe to eat, but still has acceptable taste, texture and appearance after being removed from its natural enviroment.

Table 1. Data analysis Zingiberaceae starch as raw material for films.

No.	Starch	Yield (%)*	Moisture content (%)	Amylosa (%)	Amylopektin (%)	Gelatinization Temperatured (°C)
1	*Mannihot uttilisima*	19.56	**	**	**	68.3
2	*C. xanthoriza*	12.67	57.39	46	54	81.1
3	*C. domestica,*	1.88	83.94	29.4	70.6	79.[illegible]
4	*Z. officinale var. rubrum*	2.76	53.74	33	67	88.4
5	*Z. officinale var amarum*	2.42	49.39	28.5	71.5	87

Note: * Intake of starch done only once laundering

** Not analyzed

Use of starch for producing films has a long history. Kramer, M.E (2009) reported the early Apollo astronauts are foods coated with starch based films to prevent the crumbs from becoming airborne and floating around the weightless environment of the cabin. Starch, being one of the largest component biomasses produced on earth, is abundant and readily available for use in edible films. Starch based films are similar to plastic films in their properties, they are odorless, tasteless and colorless. They are nontoxic, biologically absorbable and semipermeable to carbon dioxide and are good berriers to oxygen. (Ustunol, Z, 2009). Starch based edible films can enhance food quality, safety and stability. They can control mass transfer between components within a product. (Garcia, M. A., Adriana, P., Miriam, N. M and Noemi, E. Z, 2009)

Furthermore, starch is meant here is the wet starch, starch so that the water levels are still too high. It aims to be contained in the antimicrobial component is not much material is lost, because of the processing that passed too little. Moreover, it is known that the antimicrobial component in *Zingiberaceae*, consisting of one or more of the active component. So that the antimicrobial activity of the extract, which is higher than that found in the material as a whole. Yasni, S. (2013) Reported antimicrobial activity of active components extracted is greater than the powder.

The use of materials containing antimicrobial compounds *galamai* aims to avoid damage caused by the activity of microorganisms, so as to extend the shelf life *galamai*. Han, J.H (2014), various food grade preservatives and natural antimicrobials that have been incorporated into edible film materials to inactivate spoilage or pathogenic microorganisms on the surface of susceptive food products effectively. Antimicrobial agents can also be incorporated into film forming solutions to achieve active packaging functions. They provide additional active functions to the edible films system to protect food products from oxidation and microbial spoilage, resulting in quality improvement and enhanced safety. Min, S.C., Harris, L.J., Han, J.H., Krochta, J.M (2005), various natural phenolic compounds have been included in edible film materials and applied to microbiologically sensitive foods to inactivate contaminated spoilage or pathogenic microorganisms.

Furthermore, the antimicrobial compound contained in Zingiberaceae generally present in the form of essential oil fraction. Neswati, W.S, Murtius, A. Prastica, (2015), Applications of edible films containing essential oils (EOs) of red ginger gave affect sensory of *galamai.*Each Zingiberaceae antimicrobial compounds will provide different inhibitory effects on the growth of microbes. Yasni, S (2013) describes the antimicrobial compound on each type of herb has a different activity for different types of microbes. Ustunol, Z (2009) reported, essential oils has also been investegated in production of antimicrobial edible films and coatings. Although antimicrobial properties of essential oils have been recognized for centuries, there has been renewed interest in their use because of consumer demand for natural ingredients and additives.

Based on the characteristics of the Zingiberaceae starch as raw material for edible film, *Curcuma xanthorrizha* starch is the best starch. Thus testing the antimicrobial *Curcuma xanthorrizha* starch against microorganisms that grow on galamai. Murtius, W. S., Ira, D. S and Neswati (2015),dominant microorganism on *galamai* are gram negative bacterium and fungi, where bacterium grew up first than fungi. And Fardiaz (1992), microorganism that commonly contaminated food with high fat content are fungi and gram negative bacteria. However, the antimicrobial activity of ginger starch obtained is low (3,75 mm).

Starch is the main polysaccharide energy storage material in the plant kingdom. It is a mixture of the predominantly linear α- (1-4) glucan or amylose, and the highly branched, high molecular weight glucan or amylopectin. Of the two polymers, amylose is more closely associated with the ability to form films due to its predominant linear nature. Starch is both abundant in nature and readily available as an inexpensive commercial product. A film can be made from any type of starch that contains amylose. Amylose and amylopectin molecules are packaged into semi crystalline aggregates and these aggregates are systematically packaged into starch granules. In these tightly packed starch granules, the starch molecules have little affinity for water and are not functional. (Kramer, M. E., 2009).

Heat can applied to native starch in the presence of sufficient water, granules begin to open up, swell and hydrate, which initiates the process of gelatinization or loss of granular and molecular order. Gelatinization occurs over a range of temperatures, and is dependent upon the type of starch and its modification. The most apparent change upon starch gelatinization is a dramatic increase in viscocity. Monitoring the viscocity through heating and gelatinization steps is used to characterize defferent starches. (Kramer, M. E., 2009). A range of temperatures, for gelatinization of starch *Zingiberaceae* are 79,7 until 88,4 ^{0}C. A range of temperatures are best for heating process preparation edible films.

CONCLUSION

Curcuma xanthorrizha starch is a starch of the *Zingiberaceae* potentially be used as a raw material edible films for *galamai* packaging, with the yield nearing *Mannihot uttilisima* starch, gelatinization temperature suitable for the manufacture of edible films and content amylosa high.

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