

# 07 Edible Film from the Pectin of Papaya Skin (The Study of Cassava Starch and Glycerol Addition)

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## Edible Film from the Pectin of Papaya Skin (The Study of Cassava Starch and Glycerol Addition)

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**Abstract.** The production of edible cooking made from the pectin of papaya skin with cassava starch and glycerol addition had been studied. The usage of pectin of papaya skin was one way to use papaya skin waste in order to raise its economic value. The aim of this study was to study the effect of cassava starch and glycerol concentration on the product qualities and to determine the best treatment in making a good quality adible film and acceptable by the consumer. This research used completely randomized design in factorial patern with two factors. The first factor was cassava starch concentration (11%, 35% and 45%) and the second factor was glycerol concentration (20 %, 15% and 10). The data were analyzed by Analysis of Variance (Anova) and Duncan's Multiple Range Test to detect the difference between the treatment. The best treatment was 25% cassava starch addition and 10% glycerol concentration which produced edible film which had moisture content of 21.16%, thickness of 0.023 mm, tensile strength of 1.900 N, elasticity of 14.223%, and vapor transmission rate of 116.963 g/m<sup>2</sup>/24 hours. So the production of edible film from papaya skin pectin was potential to be developed.

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### 1. Introduction

Edible film is a thin layer made from edible material which is used for food coating or laid between food components (film) and had function as a barrier of mass transfer such as humidity, oxygen dan light. The use of synthetic polimer as packaging material had negative effect to the environment because it is hard to be destructed naturally by biotic agent such as decaying microorganism or abiotic agent such as sunrays. An alternative of friendly environment packaging (biodegradable) is edible film.<sup>[1]</sup> The profits of edible film are: it could be eaten with its product coated, as nutrition additive supplement, as favoring agent, dying agent, antimicrobe and antioxidative agent.<sup>[2]</sup>

Edible film could be made from 3 different ingredients such as hydrocolloid, lipid, and comsite of both compound.<sup>[3]</sup> One kind of hydrocolloid that can be used as edible film ingredisnt is carbohydrate (starch, alginate, pectin, Arabic gum and modified carbohydrate). Lipid compound that can be used is wax, glycerol and fatty acid.<sup>[3]</sup>

In this research, pectin from papaya skin as basic ingredient of edible film is an effort to increase the using of papaya skin and an alternative to create friendly environment food packaging and food product. Papaya skin contained much pectin. The research of Sofiana *et al.*<sup>[4]</sup> stated that pectin compound of papaya skin could be made by extraction process using 3.45% HCl solution.

The addition of cassava starch in edible film production influenced the product properties. The product had better pulling force but had very high vapor transmission. According to Rofikah<sup>[5]</sup>, the addition of 25% cassava starch influenced pulling force value.

According to Akili<sup>[6]</sup> the glycerol addition significantly increased elongation percent and decreased tensile strength of the edible film. Edible film with 20% glycerol addition was recommended as the best treatment because it had good plasticity properties and could wrap food product. The glycerol addition



in edible film production could increase the elasticity of the product made of cassava starch addition, so that the film was not too rigid or fragile.

**2. Materials and Methods**

The material used in the research were half ripen papaya, cassava starch, glycerol, aquadest, 0.02 N HCL and 96% ethanol. The equipment needed in the experiment were *cabinet dryer*, analytical balance, sieving pan (60 and 80 mesh), oven, and glassware for chemical analysis. To make papaya skin flour, papaya skin was washed, chopped and dried (60°C for 6 hours), prior to be grinded and sieving (60 mesh). This experiment used Completely Randomized Design in factorial pattern with two factor and three repetition. Factor 1 was cassava starch addition (25%, 35%, 45% b/b pectin) and factor 2 was glycerol addition (10%, 15% and 20% b/b pectin). The data were analyzed by analysis of variance. In order to find the difference between treatments, we used Duncan's Multiple Range Test (DMRT's).

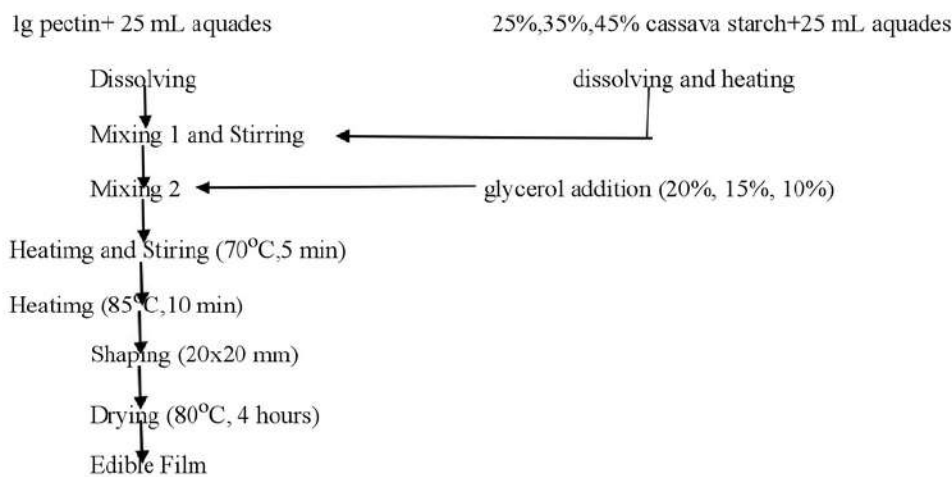


Figure 1. Flow chart of *edible film* production from papaya skin flour

**3.Results dan Discussion**

*Chemical composition of the pectin of papaya skin*

Table 1 Chemical composition of the pectin of papaya skin

Component	Content
Yield	10.75 % ± 3.862
Moisture content	31.67 % ± 0.600
Ash content	10.55 % ± 0.271
Metoxil content	2.33 % ± 0.145
Equivalent mass	633.75 mg ± 2.997

The result of the research showed that the yield of papaya skin pectin was 10.75%, moisture content 31.67%, ash content 10.55%, metoxyl content 2.33%, equivalen mass 633.75 mg. The research of Widodo *et al.*<sup>[7]</sup> showed that the yield of papaya skin was 9.

Pectin from papaya skin flour in this research was categorized as low metoxyl pectin because according to *International Pectin Association*, low metoxyl pectin had 2-7% metoxyl content and high metoxyl pectin had >7.12%.<sup>[8]</sup>

Pectin from papaya skin flour had 633.75 mg equivalent mass which was suitable with the range of quality standard of *International Pectin Association*, such as 600-800 mg. [8]

*The Characteristics of Edible Film*

*Moisture content*

The analysis of Variance showed there is no significant interaction ( $p \leq 0,05$ ) cassava starch and glycerol addition on moisture content of edible film. However, each treatment made significant difference on moisture content (Table 2 and Table 3).

**Table 2** The moisture content of edible film from papaya skin with cassava starch addition treatment

Cassava starch addition (%)	Moisture content (%)	DMRT	Notation
25	20,518	-	a
35	21,210	1,274	ab
45	21,966	1,330	b

The value with the same notation means no significant difference between the treatment ( $p \leq 0,05$ )

Table 2 showed that the higher the cassava starch content, the higher the moisture content of edible film. The more starch content in the film, it has more hydroxyl content that had more water absorption ability.

**Table 3** The moisture content of edible film from papaya skin with glycerol addition treatment

Glycerol Addition (%)	Moisture content (%)	DMRT	Notation
10	20,455	-	a
15	21,382	1,274	ab
20	21,866	1,330	b

The value with the same notation means no significant difference between the treatment ( $p \leq 0,05$ )

Table 3 showed that the more glycerol addition, the moisture of edible film was higher. Because there is an increase of hydrophilic of edible film since the raise of hydroxyl group from glycerol that increased the water content bounding.

*Thickness*

The analysis of variance showed there is significant interaction ( $p \geq 0,05$ ) cassava starch and glycerol addition on the thickness, tensile strength and vapor transmission rate of edible film.

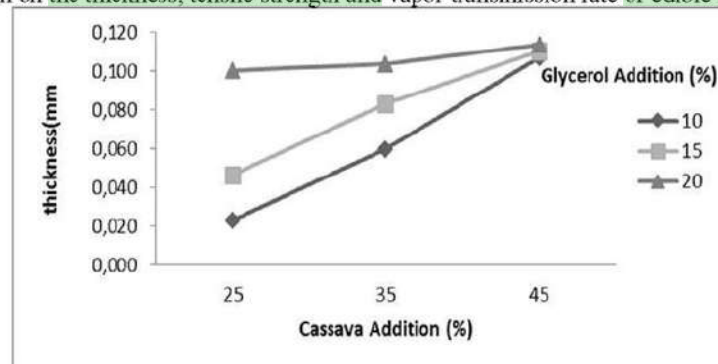


Figure 2. The effect of cassava starch and glycerol addition on the thickness of edible film

Figure 2 shows that the more cassava starch and glycerol addition, the thickness of edible film raised significantly. Because cassava starch was hydrocolloid and the cassava starch addition made the solution thicker and caused the thickness of edible film increased.

**Tensile strength**

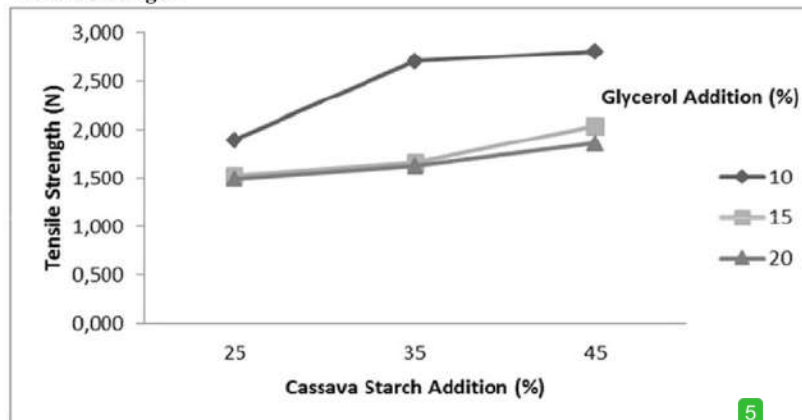


Figure 3. The interaction between cassava starch and glycerol addition on the tensile strength of edible film

Figure 3 shows that the more cassava starch addition, the higher tensile strength. However the more glycerol addition caused the lower tensile strength. Because the more soluble solid content made crosslink formation from starch polymer more intense so it needed more forces to pull edible film to break. But glycerol addition made the structure of starch polymer become fragile and the intermolecular interaction force decreased.

According to Rodrigues<sup>[9]</sup>, high concentration of glycerol as plasticizer would disturb starch cohesiveness, decrease intermolecular interaction and increase polymer mobility, so that tensile strength would be lower.

*Elasticity*

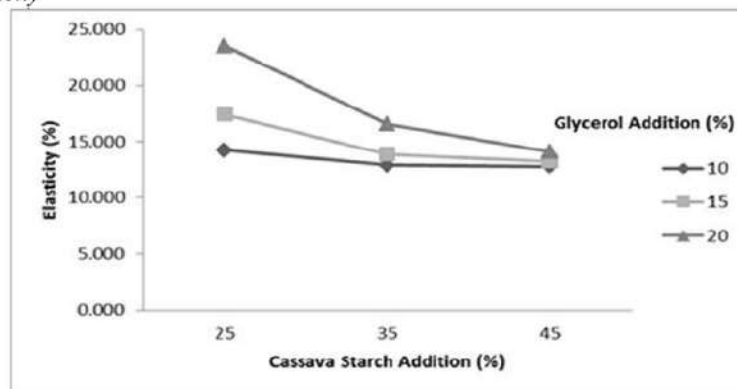


Figure 4. The interaction between cassava starch and glycerol addition on the elasticity of edible film

Figure 4 shows that the more cassava starch addition, the lower elasticity of edible film. However the more glycerol addition caused the higher edible film elasticity. It is because the plasticizer concentration is higher and could longer the quantity of polymer-plasticizer bound formation, so that the elasticity of edible film increased. Previous research showed that *edible film* made without plasticizer addition would be fragile and brittle. According to Jansen dan Moscicki [10], the addition of glycerol as *plasticizer* could increase the ability of edible film flexibility so that it increased elasticity.

#### Vapor Transmission Rate

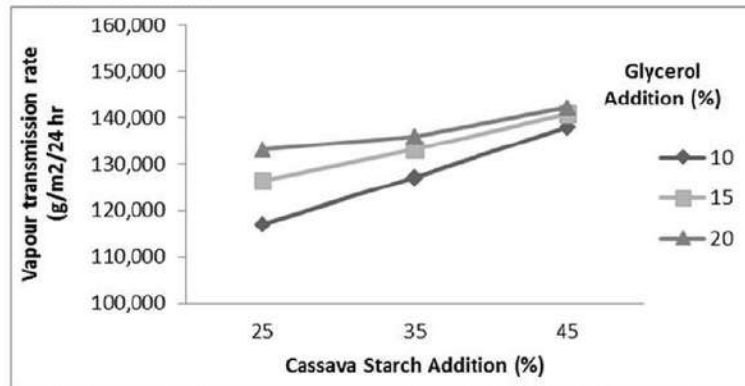


Figure 5. The interaction between cassava starch and glycerol addition on the vapor transmission rate of edible film

Figure 5 shows that the more cassava starch and glycerol addition, the higher vapor transmission rate of edible film. Because cassava starch was polysaccharide compound and had hydrophilic properties. Glycerol was plasticizer agent which had hydrophilic properties. Hydrophilic properties made edible film have high vapor transmission rate in accordance with the more cassava starch and glycerol addition. According to Irianto *et al.*[3], the material which had hydrophilic properties would increase vapor transmission rate of edible film. Plasticizer had hydrophilic properties, such as glycerol and sorbitol, could cause high vapor transmission rate in hydrocolloid-based edible film

#### 4. Conclusion

The research showed the significant interaction between cassava starch and glycerol addition on thickness, tensile strength, elasticity and vapor transmission rate of edible film from papaya skin flour. It concludes that the best treatment was 25% cassava starch addition and 10% glycerol addition. edible film which had moisture content of 21.16%, thickness of 0.023 mm, tensile strength of 1.900 N, elasticity of 14.223%, and vapor transmission rate of 116.963 g/m<sup>2</sup>/24 hours.

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