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# THE USE OF JACKFRUIT SEEDS IN MAKING EDIBLE FILM WITH THE ADDITION OF CHITOSAN

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**Abstract :** Edible movies is a film or thin layer with a thickness of less than 0.25 mm which is useful as a protective food product. This study aims to determine the effect of adding chitosan to edible films made from jackfruit seed starch on the mechanical properties and biodegradation of edible films. The addition of variations in the concentration of chitosan as much as 0%, 0.5%, 1%, 1.5%, and 2%. Based on the results of the analysis of the data obtained, it is stated that the addition of chitosan affects the thickness, tensile strength and biodegradation of the edible film. The maximum tensile strength was obtained with the addition of 1% chitosan of 13.9 Mpa. The thickness of the edible film increases with the addition of the concentration of chitosan, while the biodegradation of the edible film decreases with the addition of the concentration of chitosan.Edible film is a fil or thin layer with a thickness of less than 0.25 mm which is useful as a protect food products. This study aims to determine the effect of adding chitosan to edible film made from jackfruit seed starch on the mechanical properties and biodegradation of edible films. The addition of variation in the concentration of chitosan as much as 0%, 0.5%, 1%, 1.5% and 2%. Based on the results of the analysis of the data obtained, it is stated that the addition of chitosn affects the thickness, tensile strength and biodegradation of the edible films. The maximum tensile strength was obtained with the addition of 1% chitosan concentration of 13.9 Mpa. The tickness of the edible film increases with the addition of the concentration of chitosan,
Keywords: Chitosan, Starch, Edible Film, Tensile Strength, Biodegradation

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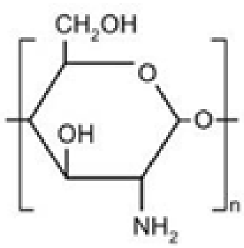
## I. INTRODUCTION

Plastic isa polymer made from raw materials derived from fossil fuel reserves. Excessive use of plastic in everyday life can have a bad impact on the environment because it can lead to environmental pollution which is very dangerous for the lives of living things because plastic is very difficult to recycle and difficult to degrade naturally. The environment that can be polluted is air, soil and water(Dewata, 2019).

In Indonesia, plastic waste ranks as the second largest of the total waste of 5.4 million tons per year (Fransiska et al., 2018). One of the causes of the production of this plastic waste is the use of plastic as food packaging. This packaging plastic has a weakness, namely the migration of plastic monomer substances into food, the longer the contact between the plastic packaging and the food, the greater the number of monomers that migrate and threaten human health. Therefore, an environmentally friendly plastic alternative is needed, one of which is edible film.

Edible film is made from natural materials in the form of a thin layer that can be eaten with a thickness of 0.25 mm (Miller & Krochta, 1997). The components that make up edible films come from natural materials such as polysaccharides. Polysaccharides that are often used in the manufacture of edible films are starch, due to their abundance in nature, especially in plants. Plants store a lot of starch in the tubers, roots and seeds of plants. Jackfruit is a plant that contains a lot of starch in its seeds(Rizal et al., 2013). The starch content in jackfruit seeds is used as a raw material for making edible films.

Based on research conducted by (Fransiska et al., 2018)Edible films made from starch with polyethylene glycol plasticizer have weaknesses, namely low resistance to water due to their hydrophilic nature and low mechanical and chemical properties of the edible film. This weakness can be overcome by adding hydrophobic substances to edible films such as chitosan.




Picture1. Chitosan Structure(Joseph, 2011)

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## II. RESEARCH METHODS

### 2.1. Tools and materials

This study uses tools such as glassware, heater, mesh shaker, magnetic stirrer, thermometer, micrometer screw, edible film mold, oven, desiccator, tensile strength and the instrument used is FTIR.

### 2.2 Extraction of Starch

Jackfruit seeds are cleaned, the epidermis is washed and cut into small pieces, then soaked in whiting water for ± 1 hour. Then the jackfruit seeds are mashed using a blender and aquades are added. Jackfruit seed pulp is filtered and deposited for ± 12 hours. The starch precipitate in the form of a paste was then dried at 70°C for 4 hours in the oven. The process of extracting starch from jackfruit seeds uses the method(Nurfitasari et al., 2018).

### 2.3 . Edible Film Synthesis

*Edible movies*made by dissolving 5 grams of jackfruit seed starch with 100 ml of distilled water and adding 2 ml of polyethylene glycol. Then the solution was heated at a temperature of 70-80°C for 15 minutes and then stirred using a magnetic stirrer. Then 2 ml of chitosan was added with a variation of 0% addition; 0.5% ; 1% ; 1.5% and 2% w/v. Pour the edible film solution into the mold and cool it at room temperature and then dry it using an oven at 60°C for 4 hours..

### 2.4. Edible film characterization

#### 2.4.1 Edible film Thickness Test

Measuring 5 different points on the edible film. Then add up the thickness and divide by many points so that the average thickness of the edible film is obtained.

$$Thickness = \frac{Thickness\ of\ 5 point}{5}$$

#### 2.4.2 Tensile Strength Test

The tensile strength / tensile strength is a measure of the maximum tensile or tension that the edible film can withstand when it is pulled until before the edible film breaks or tears.(Miller & Krochta, 1997). The edible film sample was clamped at both ends using a tensile strength tool. Then the tool is operated until the sample breaks. You will see the value of the tensile strength (Mpa) and the percent elongation of the sample on the monitor.

$$Tensile\ strength = \frac{F}{Ao}$$

Information :

F : Load given (N)
A0 : Sample cross-sectional area (M2)

2.4.3 Edible film biodegradation test

Biodegradation is a measure of the ability of a material to be properly degraded in the environment. The biodegradation test was carried out using the modified method carried out by Panjaitan (2017). The edible film was cut to a size of 2 cm x 6 cm and then weighed using an analytical balance to obtain the initial weight (W1). Edible films were buried in the soil to a depth of 15 cm for 15 days (intervals of 3, 6, 9, 12 and 15 days). Next, samples were taken from the soil. Then weighed to obtain the weight of the buried film (W2). Percentage of mass loss from edible film can be determined by using the equation:

$$\% Weight\ (W) = \frac{W1-W2}{W1} \times 100\%$$ (Panjaitan et al., 2017)

2.4.4 FTIR Test

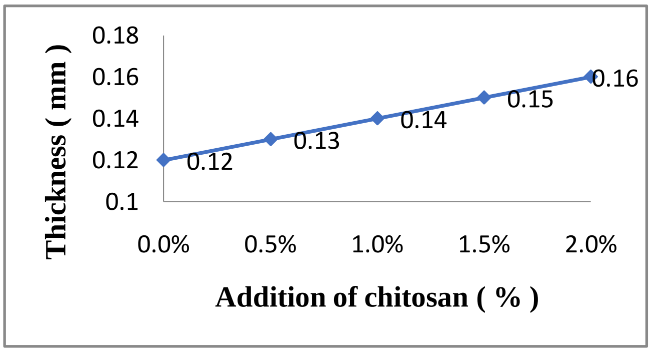
The characterization of edible films using FTIR at wave numbers of 4000 – 600 cm-1 aims to determine the functional groups and bonds contained in the edible film samples.

Picture2. *Edible Film from jackfruit seed starch with the addition of chitosan*

## III. RESULTS AND DISCUSSION

**Edible film thickness**

The thickness of the edible film affects the mechanical properties such as tensile strength and elongation of the edible film. Thick edible films increase tensile strength but decrease elongation(Ariska et al., 2015). The thickness of the edible film is influenced by several components such as the area of the mold and the total amount of solids in the solution (Park et al., 1996). Following are the results of the analysis of the thickness of the edible film from jackfruit seed starch with the addition of chitosan.

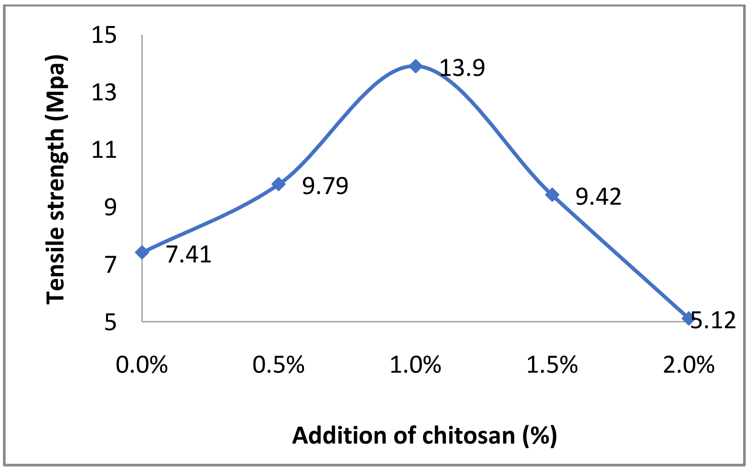



Picture3. Effect of addition of chitosan on thickness *edible film*

The thickness of the edible film increases with the increase in the amount of chitosan concentration. This is because the higher the concentration of chitosan used, it will increase the total dissolved solids in the solution forming the edible film, so that after the drying process it produces a thick edible film.(Dody Handito, 2011). The value of the thickness of the edible film produced is below the maximum standard of edible film thickness according to the Japanese Industrial Standard, which is 0.25 mm. This shows that the edible film obtained is good.

**Tensile Strength (Tensile Strength) edible film**

The tensile strength test of the edible film is carried out to determine the maximum pressure that can be held until finally before the edible film breaks(Apriyanti & Mahatmanti, 2013; Umar & Dewata, 2017; Umar *et al.,* 2019)




Picture4. Effect of addition of chitosan on tensile strength *edible film*

The value of the tensile strength of edible films increases with the increase in the concentration of chitosan. The increase in tensile strength was due to the fact that chitosan can form hydrogen bonds between chains with amylose and

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amylopectin in starch. The higher the concentration of chitosan added, the more hydrogen bonds formed so that the edible film produced was stronger. Edible film with a high tensile strength value indicates that the edible film has a strong structure and is not easily broken(Widiarto et al., nd; Iswandi, 2012). The overall tensile strength value of edible film produced with the addition of chitosan has met the minimum tensile strength standard set by the Japanese Industrial Standard, which is 3.92 Mpa.

**Biodegradation of edible film**

The edible film biodegradation test was conducted to determine whether the edible film produced could be decomposed by microorganisms within a certain time interval. This biodegradation test was carried out by burying the resulting edible film and then calculating the mass percent before and after the burial of the edible film.

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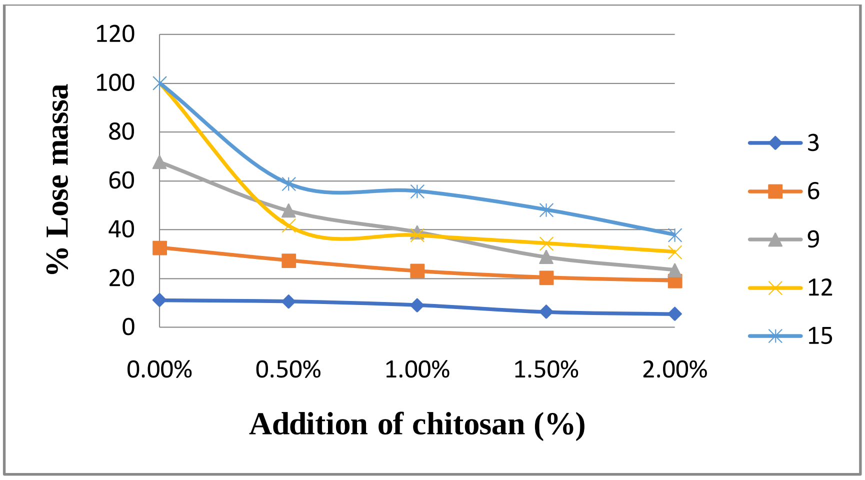
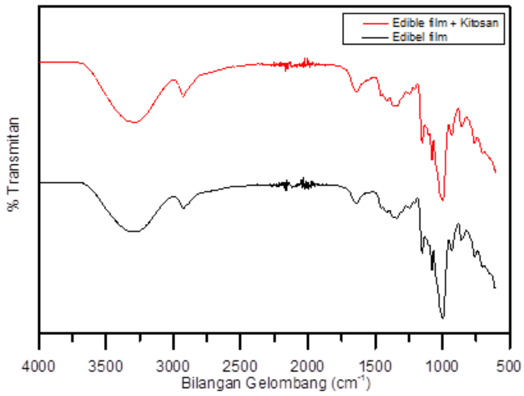



Picture5. Effect of addition of chitosan on biodegradation *edible film*

Biodegradation of edible film decreased along with the increasing concentration of chitosan used. The decrease in the value of biodegradation is due to the antimicrobial properties of chitosan, which inhibits the degradation process of edible film. The degraded edible film is characterized by the presence of damage to the edible film after burial. According to research conducted by(Udjiana et al., 2019; Dewata & Umar, 2019;Iswandi & Dewata, 2020) stated that the increase in the concentration of chitosan used made the edible film more difficult to degrade, because chitosan is hydrophobic which can protect the edible film from water contained in the soil.

**FTIR**

The FTIR instrument was used to characterize the functional groups contained in edible films produced at wave numbers of 4000 – 600 cm-1.




Picture6. FTIR spectra*Edible Film and Edible Film + Chitosan*

Based on the picture above, the edible film sample without the addition of chitosan and with the addition of chitosan shows the presence of OH bonds at a

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wave number of around 3500 – 3200 cm-1, CH bonds at a wave number of around 3000 – 2840 cm-1, and CO (carbonyl) bonds at a wavelength of about 3000 – 2840 cm-1. wave 1085 – 1050 cm-1, and the NH bond which is the intensity of the NH bond medium at a wavelength of 1650 – 1580 cm-1. The test results of functional group analysis using FTIR showed that no new functional groups were formed. This indicates that the edible film synthesis process is a process of physical change.

## IV.CONCLUSION

The addition of variations in the concentration of chitosan in edible films affects the thickness, tensile strength and biodegradation of edible films. The value of thickness and tensile strength increased along with the addition of the concentration of chitosan, while the value of biodegradation of edible film decreased with the addition of the concentration of chitosan.The FTIR spectra of edible films without the addition of chitosan and edible films with the addition of chitosan have OH, CH, CO and NH bonds.

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