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The Characteristic of Minimmaly Processed Jack Fruit With Wrapping Composite Film From Hydroxypropilcelullose Which Syntesized From Pineapple Crown During Storage

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ABSTRACT: This study aims to evaluate the effect of the addition of Hydroxypropylcellulose (HPC) as film composite from the pineapple crown to the physical, chemical and biochemical characteristics of the minimum treated jackfruit. Steps being taken in this research are HPC synthesis and its application on the minimum processed jackfruit, then measured some parameters such as weight loss, vitamin C levels, total soluble solids (TSS), reduction sugars, organic acids (HPLC), and volatile compounds (GC-MS). The results show that addition of HPC as composite film to minimum processed jackfruit has loss of weight value is 7,86%, TSS value is 4 Brix, acid number ranging from 1.84 to 1.87, vitamin C levels amounting to 34.86%, and reducing sugar content is 1.78%. Identification of organic acids showed that the content of malic acid in the treatment of plastic and HPC packaging is still higher than the control treatment during storage. Identification volatile compounds using GC-MS show that in minimal processed jackfruit before and after storage has 16 volatile compounds, with the main compounds are isopentyl isovalerate, butylisovalerate, palmitic acid, and ethyl isovalerate.

KEYWORDS: composite films, hidroxypropilcellulose, minimally processed, jackfruit., pineapple crowns

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I. INTRODUCTION

The desire of people to live in a way that is practical in all respects, especially in terms of food consumption makes people to think and apply the right technology. For example when people eat fruit, the fruit has been processed in a minimum be fast becoming a popular alternative choice for everyone. Some types of tropical fruits such as jackfruit has a sweet taste and a very distinctive flavor and liked by the public and contains 95% of calories, 13.8 mg of vitamin C per 100 g of material and is also rich in vitamin B6, Potassium, Calcium, and iron. Jackfruit contains chemical compounds such as colorings flavone, morin, dihydromorin, cynomacurin, artocarpin, isoartocarpin, cyloartocarpin, artocarpesin, oxydihydroartocarpesin, artocarpetin, norartocarpetin, cycloartinone, and artocarpanone[1].

The magnitude of the benefits of nutrients and compounds contained in fruit jackfruit making a fruit favored by many people. But in its presentation jackfruit is not practical because of its large size and berdami containing sticky sap and require considerable time in preparing and presenting it before consumption. As a solution if it will be consumed fast is to peel or minimally processed. However jackfruit treated minimal or peeled skin and released has the disadvantage of shelf life could not last long and when in contact with air will result in changes occur that degrade the quality of the fruit, such as changes in shrinkage weight, changes in nutritional value, discoloration due to enzymatic browning, changes in taste, aroma changes. These changes are related to the components contained in jackfruit, such as vitamin C, carbohydrates and flavone compounds[2]. Such as tropical fruits in general, jackfruit including perishable food ingredient because it has easily damaged properties caused by the activity of respiration and the change in the physical, chemical, and biochemical still continues even after harvesting. To overcome these problems it is necessary to find an alternative form of the use of packaging in jackfruit treated so minimal physical changes, chemistry, and biochemistry can be maintained as much as possible. Plastic packaging has been widely used in minimally processed jackfruit on the market but we need to realize that the use of plastic as a packaging will pollute the environment and affect the ecology because the plastic is a material that can not be broken down by microbes in nature. Alternative packaging materials for jackfruit are processed in a minimum is in the form of edible packaging film, since the edible film does not cause adverse effects to the environment is different packaging materials made of synthetic material such as polyethilen, polystyrene and resin that are nondegradable. Edible films have several advantages as a packaging material, among others, can protect the product, show the original appearance of the product, safe for the environment and can be eaten.

One of the materials that can be used as a basis for making edible coating material is a cellulose derivative other than sodium carboxymethilcellulose like hidroxypropilcellulose (HPC). Existence abundant natural cellulose in the form of by-products lignocellulose produced from a number of industrial agriculture has not been used commercially but is only used as feed. Pineapple crown as products of pineapple by 15-20% and is a source of considerable potential cellulose[3,4]. Composite film was made of protein and lipids mixture or carbohydrate and lipid mixture and they have lower *wvtr*[5,6]. HPC is one of cellulose modification that is made by reacting cellulose alkali with propylene oxide at the high temperature and pressure. HPC could be applied in food industry like film, thickener, stabilizer[6]. This study aims: to evaluate the use of composite film HPC cellulose crown pineapple on a jackfruit arable minimal and compared to packaging made from CMC commercial, control treatment and packaging plastics on the physical characteristics of jackfruit treated minimum, include test weight loss and chemical properties jackfruit treated minimal covering vitamin C, crude fiber, color, total dissolved solids, pH, sugar content, organic acids (HPLC), volatile compounds (GC-MS).

II. METHODS

2.1 Cellulose extraction of pineapple crown

Pineapple crown was obtained from West Kalimantan, Indonesia. Cellulose extraction refers to modified method[3,8]. Pineapple crown was cut ± 1 cm, was dried with cabinet dryer. After dried, it is blended and sifted using sieve 60 mesh and analyzed water content, ash water and cellulose content. The flour of pineapple crown was cooked with NaOH solution (15%) at 100 C for 3,5 h. Residue was filtrated, washed, bleached with NaOCl 5%. Then washed with aquadest so it is odorless. It is dried with oven at 60° C for 8 h.

2.2 Synthesize of hidroxypropilcellulose

Cellulose flour (60 mesh) was dissolved with isopropanol 20 ml/g to Synthesize of HPC[9,10]. And then alkalisation with 25% NaOH during an hour at 25°C. It was conducted using waterbath and shaked with shaker. Then they were added propylene oxide 2 mL/g cellulose. Hydroxypropilasi was conducted during three hours at 55°C in waterbath and shaked with shaker. Netralization process was done using acetic acid 90%. After that was filtrated and washed four times using alcohol 70%. They were dryed using cabinet dryer at 60°C, blended and siftedusing sieve 60 mesh. They were analysed for functional group (FTIR-Spectroscopy) and cristalinity (X-ray diffraction).

2.3 The making of composite film

HPC was weighe as much as 1.6% and dissolved in distilled water. To enhance the process of dissolving the mixture was allowed to stand overnight. The solution that has been formed is then added coconut oil at a concentration of 10% (w/w) as the hydrophobic component and polyethylene glycol with a concentration of 10% (w/w) as plasticizer and emulsifier. The mixture is then stirred and heated using a magnetic stirrer with the temperature set at 70° C for 1 hour. The solution obtained was then cooled at room temperature. To facilitate pouring at high concentrations it by heating to a temperature of 60° C for 15 minutes. After that, the solution was poured into petridish as much as 20 mL. Petridish already containing the solution is then dried using a drying oven at 40° C. After the film becomes dry and then removed from the petridish. The film has been formed incubated for 3 days in storage boxes that contain a silica gel[11].

2.4 Applications of films

Minimally processed jackfruit placed in a bowl wrapped in the film. The bowl is then placed in a room humidity of 70% with a temperature of 29° C. The fruit that had been wrapped in a bowl of applications is then weighed and its contents every day to determine % shrinkage weight. In addition to heavy losses, physicochemical properties were also analyzed during storage include vitamin C, crude fiber, color, total dissolved solids, pH, sugars, organic acids (HPLC), and volatile compounds (GC-MS).

2.5 Analysis of sugars and organic acids using HPLC

Minimally processed jackfruit samples that had been coated edible film blended and then in homogenizing. Jackfruit pure diluted to as much as 10 to 50 ml of water bi-des and purified by centrifuged at

12,000 rpm for 20 minutes. The extract was filtered through Millipore filter 0.45 µm and 20 mL of sample was used for HPLC analysis[12].

2.6 Extraction of flavor compounds minimally processed jackfruit coated composite films HPC pineapple crown with GC-MS.

The procedure works as follows: the extraction of flavor compounds is conducted by blending jackfruit samples of 200 g with 200 mL of water distillate using a blender. The suspension is transferred into a 1000 mL erlenmeyer and added 200 mL dichloromethane. Then placed in a shaker bath and agitation for 2 hours at 125 rpm. The emulsion that formed was centrifuged at 9820 x g at 4° C for 15 minutes. Fluid extracts included in the sediments separating funnel and extracted twice with 100 mL diklorometane. The extract was concentrated up to 5 mL using a rotary vacuum evaporator. Furthermore, the concentrate through the purging of nitrogen gas in order to obtain final concentrations of 1 mL were stored at -20^{o}C for analysis of flavor compounds[13].

III. RESULTS AND DISCUSSION

3.1 Loss of Weight

The observations in Table I shows the weight loss minimally processed jackfruit highest in the control treatment that is equal to 8.64% and the lowest weight loss is in treatment with plastic packaging, namely 0.99%. As for the treatment packaging weight HPC shrinkage of 7.86%. This means that the use of packers can reduce weight loss in minimal processed jackfruit. Packaging can serve as barier against CO_2, O_2 and water. Control treatments can accelerate packaging fruit respiration and loss of water in the fruit. Evaporation of the fruit will be accelerated so that the stored water in the cell or the space between cells increases, as a result of water will be released into the air and the cell will lose water. Transpiration process can be inhibited as a result of minimal packaging processed jackfruit in plastics and packaging HPC perforated effectively reduce water loss in minimal processed jackfruit.

Tabel I: The physical, chemical and biochemical characteristics minimally processed jackfruit are wrapped with the film composite HPC pineapple crown afterstorage

No	Physical, Chemical and Biochemical Characteristics	Sample	Contents During Storage
1	Loss of weight	Control	8,64%
		HPC	7,86%
		Plastic	0,99%
2	Vitamin C	Control	30,08%
		HPC	34,86%
		Plastic	37,54%
3	Acid number	Control	1,87%
		HPC	1,84%
		Plastic	1,87%
4	Reduction sugar	Control	2,58%
		HPC	1,78%
		Plastic	2,21%
5	Total soluble solid	Control	5 Brix
		HPC	4 Brix
		Plastic	3,5 Brix

3.2 TSS (total soluble solids)

Table shows the total soluble solids (TSS) for the control treatment had the highest score is 5 Brix, for value is the lowest TSS treatment of plastic packaging of 3.5 Brix. For packaging HPC 4 Brix. Total soluble solids showed a total sugar contained in processed jackfruit minimal. During storage increased levels of sugar. The increase in total soluble solids in the jackfruit occurs because solving complex components such as polymeric carbohydrates, especially starch into sucrose, glucose and fructose. These simple compounds are readily soluble in water. The decline in total dissolved solids can be caused by the use of simple sugars as a substrate in the process of respiration. The use of such plastic packaging and packaging HPC was found to reduce elevated total dissolved solids. During the fruit still do respiration will go through three phases namely the breakdown of polysaccharides into simple sugars that cause sugar levels to rise and followed by oxidation of simple sugars to pyruvic acid and other organic acids and consequently levels sugar down, next came the transformation of pyruvate and organic acids, aerobically to CO_2, H_2O and energy and ultimately organic acids dropped significantly[13]. During the ripening period sugar content increased, then decreased again when aging[14].

3.3 Acid Numbers

Table I shows that the acid number ranges from 1.84 to 1.87%. The decline in value of total sugars due to the maturation process caused by respiration processes that transform glucose into simple sugars, then proceed with the formation of pyruvic acid and other organic acids, aerobically[13,15]. This will cause an increase in the total value of the acid and lowering the pH value of fruit during storage. An increase in the total value of the organic acid can be caused by microbial activity (anaerobic) can hydrolyze the carbohydrates and simple sugars into organic acids[15].

3.4 Vitamin C

The levels of vitamin C ranged from 30.08 to 37.54%. Value of vitamin C the lowest seen in the control treatment, while for packaging HPC value of Vitamin C by 34.86%, and for plastic packaging amounted to 37.54%. This indicates that the packaging provides protection against minimally processed jackfruit during storage of various contacts with oksigen.Penurunan damage especially vitamin C content during storage can be caused due to the oxidation to dehydroascorbic acid by the enzyme ascorbic acid oxidase as a result of the activities of microorganisms[16]. This can be caused because the fruit ahead of ripe and ripe, vitamin C decreased as a result of degraded into dehydroascorbic acids. A decrease of ascorbic acid content more quickly on ripe fruit, caused by microbial activity to hydrolyze carbohydrates and simple sugars into organic acids[13].

3.5 Sugar Reduction

Table shows the reduction sugar ranged between 1.78 to 2.58%. The highest reducing sugar is treated control at 2.58%, and for the plastic packaging of 2.21%, and for packaging HPC by 1.78%. Increased levels of reducing sugars during storage, obviously caused by enzymatis process, namely the change starch into glucose and fructose by the enzyme amylloglucosidase, glucokinase and fructokinase a natural ripening process of fruit. In the fruit is packed with plastic packing and HPC was found to inhibit the process of change starch into glucose and fructose.

3.6 Analysis of Organic Acids

The concentration of organic acid minimally processed jackfruit that was not packed at day 0 as shown in the results based on the sequence of peak in Fig. 1(A): there are 7 organic acid, they are Oxalic acid 0.08105 mg/100 g, Succinic acid 6.75838 mg / 100 g, D-Malic acid 3.93230 mg / 100 g, L-Malic acid 16.60226 mg/100 g, L-ascorbic acid 8.39365 mg/100 g, Citric acid 1.65297 mg/100 g, D-galacturonic acid 0.09383 mg/100 g.

The content of malic acid have been found in minimally processed jackfruit on the day prior to storage (day 0). While citric acid is found in much smaller amounts. After storage, the content of malic acid found in minimally processed jackfruit diminishing while the citric acid increased. Treatment packaging using plastic packaging and HPC was found to inhibit maturity compared to control treatment (without packaging). It can be seen from the content of malic acid in the treatment of plastic packaging and HPC is still higher than the control treatment during storage. A content of malic acid is found in unripe fruit (the first day). Instead ripe fruit (days 5 and to 6) contains a high amount of citric acid[12].

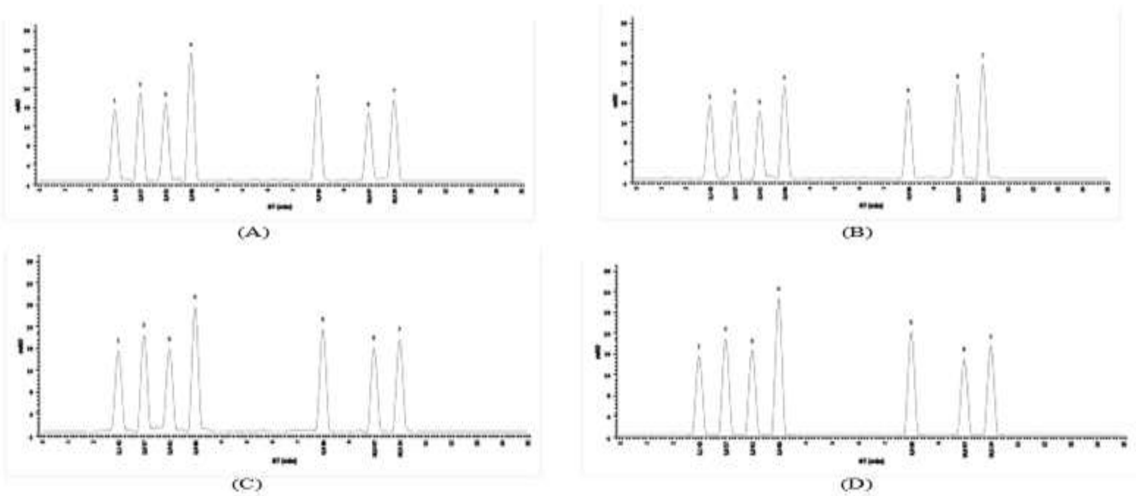

Fig 1: (A) organic acids minimally processed jackfruit that was not packed at day 0; (B) organic acids minimally processed jackfruit that was not packed at day 1; (C) organic acids minimally processed

jackfruit packed plastic on day 1; (D) The organic acid is minimally processed jackfruit are packaged HPC composite films on day 1

Figure 1(C) shows the concentration of organic acids minimally processed jackfruit packed plastic on day 1, as shown in the results based on the sequence of peak: Oxalic acid 0.07522 mg/100 g, Succinic acid 6.29039 mg /100 g, D-Malic acid 3.18996 mg/100 g, L-Malic acid 13.11794 mg/100 g, L-ascorbic acid 7.56081 mg/100 g, Citric acid 2.70699 mg/100 g, D-galacturonic acid 0.08561 mg/100 g. Figure 1(D) shows the concentration of organic acid minimally processed jackfruit are package HPC composite films on day 1, as shown in the results based on the sequence of peak: Oxalic acid 0.07629 mg/100 g, Succinic acid 6.70697 mg/100 g, D-Malic acid 3.89830 mg/100 g, L-Malic acid 16.07595 mg/100 g, L-ascorbic acid 8.26429 mg/100 g, Citric acid 1.87940 mg/100 g, D-galacturonic acid 0.02700 mg/100 g. Based on the data above can be seen that the content of organic acids of the treatment of using plastic and treatment using HPC almost the same but there are some organic acids of minimally processed jackfruit packed by HPC more higher than packed by plastic. The organic acid can protect jackfruit from microorganism contamination, so it can extend the shelf life of the fruits.

3.7 Analysis of Volatile Compounds

Based on the identification of volatile compounds in minimal processed jackfruit with GC-MS (**Fig.2**), the jackfruit minimally processed before storage and after storage are 16 volatile compounds, with the main compounds are isopentyl isovalerate, butylisovalerate, palmitic acid, and ethyl isovalerate. Volatiles compound recovered from mature fruit there were many more esters and acetates[16]. When compared treatment before storage and after storage, there are some reduced levels of volatile compounds after minimally processed jackfruit storage. In the control treatment and decreased levels of plastic packaging butylisovalerate compound, but the decline was biggest with the control treatment. While packing pineapple crown HPC can maintain the volatile compounds.

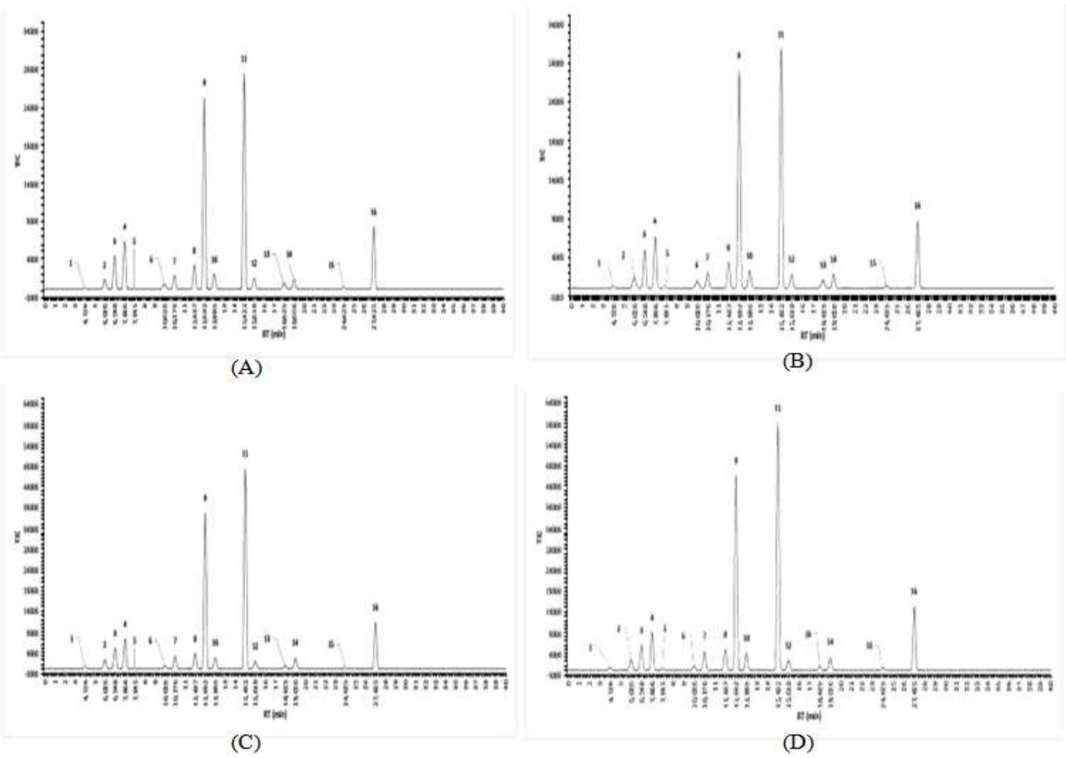

Fig. 2: (A) volatile compounds minimally processed jackfruit that was not packed at day 0; (B) volatile compounds minimally processed jackfruit that was not packed on day 1; (C) volatile Compounds minimally processed jackfruit packed plastic on day 1; (D) volatile compounds minimally processed jackfruit are packaged composite HPC films on day 1

IV. CONCLUSION

The conclusions of this study are:

1. Loss of weight jackfruit highest in control treatment that is equal to 8.64% and the lowest weight loss is in treatment with plastic packaging, namely 0.99%. As for the treatment packaging weight HPC shrinkage of 7.86%.
2. The total soluble solids (TSS) for the control treatment had the highest score is 5 Brix, for value is the lowest TSS treatment of plastic packaging of 3.5 Brix. for packaging HPC 4 Brix.
3. Vitamin C levels ranged from 30.08 to 37.54%. Lowest vitamin C levels seen in control treatment, while for packaging HPC value of Vitamin C by 34.86%, and for plastic packaging amounted to 37.54%.
4. Reducing sugar levels ranged from 1.78 to 2.58%. Reducing sugar highest control treatment of 2.58%, and for the plastic packaging of 2.21%, and for packaging HPC by 1.78%.
5. The content of malic acid have been found in minimally processed jackfruit on the day prior to storage (0 day). While citric acid is found in much smaller amounts. After storage, the content of malic acid found in minimally processed jackfruit diminishing while the citric acid increased.
6. Identification of volatile compounds in minimal processed jackfruit with GC-MS, the jackfruit minimally processed before storage and after storage are 16 volatile compounds, with the main compound isopentyl isovalerate, butylisovalerate, palmitic acid, ethyl isovalerate.

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