

# Red Guava (*Psidium guajava* L.) Chemical Properties Characterization Using Different Packaging Methods During Storage

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## ABSTRACT

The limited shelf life of red guava fruit encourages efforts to maintain its shelf life by using the sealing and wrapping packaging method with storage at 9°C for 12 days. The purpose of this study was to determine the effect of packaging method and storage time on the chemical properties of red guava (*Psidium guajava* L.). This study used a factorial design consisting of 2 factors. The first factor is the packaging method (without packaging, sealing and wrapping). The second factor is storage time (day 0, day 3, day 6, day 9 and day 12). The results showed that the highest vitamin C content was in the sealing packaging method, namely on the 3rd day of storage at 3.3%. the highest water content value is 90.45% on the packaging method of wrapping storage on day 0, the highest value of total titrated acid in fruit with packaging method of packaging storage day 0 is 0.08%, while the highest value of total dissolved solids was 7.33°Brix on the 12th day storage sealing packaging method.

**Keywords:** chemical properties, red guava, storage time, and packaging method

## INTRODUCTION

Indonesia is a country that produces abundant horticultural commodities. One of the most popular and abundant horticultural products in the community is guava fruit. Guava is a fruit that is easy to find and is a fruit that has a very high vitamin C content. Guava fruit has a vitamin C content of 87 mg/100 grams (Padang & Maluku, 2017) which is higher than tomatoes, which is 21 mg/100 grams (Sari *et al.*, 2021). Guava is one of the horticultural products that is easily damaged so that without proper and proper treatment, guava will have a short shelf life and are easily damaged. The shelf life of guava stored at room temperature is only able

to last a few days while at peak CO<sub>2</sub> and ethylene production the shelf life is only 3-6 days after harvest (S. E Widodo *et al.*, 2012). The damage that occurs is usually caused by metabolic processes such as respiration and transpiration. The ongoing metabolic process will cause changes in food products. In addition to metabolic processes that damage commodities, there is physical damage due to various treatments carried out (Murtius & Hari, 2019).

One of the packaging that can maintain the quality of the product is plastic LDPE. The use of plastic LDPE is very effective and has advantages compared to other types of packaging. The advantages of

plastic are that it is strong, transparent and has permeability to oxygen, water vapor and CO<sub>2</sub> (Asridaya, 2019). Packaging methods that can be used to package a horticultural product are sealing and wrapping. Treatment using this method can inhibit the decline in product quality and prolong the shelf life of the product (Hamdani *et al.*, 2017). This limited shelf life encourages efforts to maintain the shelf life of red guava fruit by using sealing and wrapping packaging methods. The use of the sealing packaging method has the working principle of gluing plastic so as to minimize the possibility of air or water entering the material, so as to maintain product quality. While the use of wrapping packaging method is a form of modified atmosphere storage which has a principle, namely CO<sub>2</sub> in the packaging will be higher than O<sub>2</sub> so that respiration in fruit becomes low. The use of sealing and wrapping packaging methods is expected to be able to inhibit the high rate of transpiration and respiration. In addition, storage at a temperature of 9°C is an effort to slow down the metabolic process of the fruit (Murtiwulandari *et al.*, 2020). The purpose of this study was to determine the effect of packaging method and storage time on the chemical properties of red guava (*Psidium guajava* L.)

## MATERIALS AND METHODS

### Tools and Materials

The main ingredients needed in the research are red guava, a red brittle variety that have met the harvest requirements, namely the skin that is dark green turns light and yellowish (maturity rate 50% - 60%) (Mulato, 2015) obtained from the Juwana market, Pati Regency, Central Java, and LDPE plastic size of 30 cm x 15 cm with a thickness of 30 microns. While the analytical materials used in the study were 0.1 N NaOH, 1% phenolphthalein, aquades, amylum solution, 0.1 N iodine.

The main tool used in this research is a vacuum sealer machine brand Kris. While the tools used for analysis in the study were Erlenmeyer brand iwaki, funnel brand iwaki, measuring cup brand iwaki, dropper, beaker brand iwaki, burette brand iwaki, vacuum pump, oven brand mummert, iron tongs, aluminum cup, rag, storage rack, refrigerator brand LG-205L gross, blender brand cosmos CB-190, knife, scissors, spoon. , isolation.

### Research Methods

The research method used is a factorial design consisting of 2 factors, namely the packaging method and storage time. The packaging for red guava fruit is without packaging (control), sealing, and wrapping with a storage time of 12 days stored at a refrigerator temperature (9°C). While the analysis carried out in this study was the determination of vitamin C content, water content test, determination of total dissolved solids and total titrated acid.

### Research Implementation

The material that has been obtained is sorted to get relatively homogeneous fruit and the same level of maturity with the condition that the fruit skin is light yellowish green (maturity level 50% - 60%). After that, the samples were washed to remove the adhering dirt and drained to dry. Then the guava fruit was weighed  $\pm$  125 grams and packed according to the packaging method (control, sealing and wrapping) and then stored in a refrigerator at a temperature of 9°C for 12 days. Data collection on parameters is carried out with the following analysis:

1. Determination of Vitamin C Levels using the iodimetric method (Rahmawati & Hana, 2016).
2. Determination of Water Content (AOAC, 2005)
3. Determination of Total Dissolved Solids (Bayu *et al.*, 2017)

4. Determination of Total Titrated Acid (Megama, 2016)

## **RESULTS AND DISCUSSION**

### **Vitamin C levels**

One of the vitamins found in fruits that is needed by the body is Vitamin C. Vitamin C has a role as an effective antioxidant in warding off free radicals that can damage tissues and cells (Putri & Setiawati, 2015). One fruit that contains vitamin C is red guava fruit. Vitamin C levels in red guava fruit can be seen in Figure 1.

Based on Figure 1, the content of vitamin C in red guava fruit during 12 days of storage decreased. The highest vitamin C content in guava fruit was on the sealing packaging method on the 3rd day of storage, namely 3.33% on the sealing packaging method and the lowest vitamin C content on the 12th day storage control packaging method was 2.91%.

Figure 1 shows the vitamin C content, the longer the storage time the less vitamin C content. The content of vitamin C at a temperature of 9°C will experience a decrease in vitamin C faster, this can cause damage to the fruit cell structure by the freezing process (Dewi *et al.*, 2007).

The results of the analysis of the vitamin C content in Figure 1 show that the storage on the 12th day had the lowest vitamin C content compared to the vitamin C content on the previous day's storage. This is influenced by the storage temperature and the length of storage time, besides that the activity of enzymes that play a role in the process of overhauling vitamin C is still ongoing during storage (Naibaho, 2014).

The decrease in vitamin C content during storage can be caused by the nature of vitamin C which is easily soluble in water and easily oxidized by air or exposed to heat (Putri & Setiawati, 2015). In addition, packaging with LDPE plastic is able to inhibit the oxidation rate of red guava fruit so

that it will reduce the loss of vitamin C loss (Anggraini & Permatasari, 2017). So that the decrease in vitamin C content in red guava fruit is not significant.

### **Water content**

Changes in water content in a product is one of the determining factors for the quality of the product. Moisture content is one of the physical properties of the material which indicates the amount of water contained in the material. The water content of red guava fruit can be seen in Figure 2.

Based on the results of the analysis of the water content of the guava fruit, it can be seen in Figure 2 that the highest water content of all treatments is in the packaging method of wrapping storage on day 0 (90.45%) and the lowest water content in the storage control packaging method on day 6 (83.40%). The occurrence of a decrease in the water content of guava fruit during storage is a frequent occurrence, this is caused by the loss of water content in the fruit after the picking process until the fruit ripens. Water loss in fruit is also caused by increased respiration rate during fruit ripening, low humidity and too high storage temperature. An increase in the rate of respiration and transpiration in fruit can occur if the storage temperature is too high in the fruit, so that it can trigger easy water loss in the fruit (Yulianti *et al.*, 2016).

The water content of guava fruit in the sealing and wrapping packaging method seen in Figure 2 is more able to maintain the water content of the fruit when compared to the treatment without packaging (control), this is because both sealing and wrapping

packaging methods use LDPE plastic. Low permeability is able to suppress the rate of exit and entry of water vapor into the material. Low permeability can increase the moisture in the packaging so as to reduce the temperature in the packaging which will

suppress the process of water loss in the material (Johansyah *et al.*, 2014).

The existence of a hydrolysis process during ripening that requires a lot of water can cause an increase in water content so that the free water contained in the fruit tissue will come out along with enzyme activity (Djanis & Hanafi, 2009). Previous research on mustard greens packaged using LDPE plastic showed a decrease in water content on day 6. This is due to the transpiration process which can cause the water content to come out of the vegetables (Anggraini & Permatasari, 2017).

### **Total Dissolved Solids**

The fruit maturity indicator is one of the quality parameters of the fruit. The characteristics of an indicator of fruit maturity are fruit hardness, water content and total dissolved solids. Total soluble solids include pectin, reducing sugars, non-reducing sugars, proteins and organic acids. The interpretation of sweetness can be seen from the total dissolved solids because the sugar contained in fruits is classified as a lot (Kusumiyati *et al.*, 2019). The total dissolved solids content in red guava fruit can be seen in Figure 3.

Based on the results of the analysis in Figure 3 shows the total dissolved solids ranged from 6.00°Brix to 10.00°Brix. During storage, the total soluble solids in red guava fruit increased with increasing storage time.

The highest value of total dissolved solids was in the sample without packaging (control) on the 12th day of storage, which was 10.00°Brix and the lowest total dissolved solids in the sample with sealing and wrapping packaging methods was 6.00°Brix. This shows that the value of the total dissolved solids can accelerate the ripening of a fruit. Storage of fruit at low temperatures can reduce the rate of fruit ripeness. The delay in ripening time of fruit can extend its shelf life (Dhyan *et al.*, 2014). The increase in sugar in fruit is caused by the hydrolysis of

starch into glucose, fructose and sucrose compounds and the speed of this hydrolysis is greater than the speed of converting glucose into energy and water so that sugar accumulates in the tissues during storage (Naibaho, 2014). Total soluble solids and total sugar contained in guava fruit increased during ripening along with a decrease in fruit hardness. According to Yulianti *et al.* (2016), the starch content in guava fruit decreased significantly during the transition from mature green to overripe maturity. The use of wrapping packaging methods with LDPE plastic types is able to inhibit the rate of respiration so that it can inhibit the increase in total dissolved solids (Soesiladi E. Widodo *et al.*, 2016).

### **Total Titrated Acid**

The acid content in the fruit usually indicates the total titrated acid. The fruit will become sweet due to the ripening process which will undergo an overhaul of organic acids (Noorbaiti *et al.*, 2012). The total titrated acid in red guava fruit can be seen in Figure 4.

Based on the results of the analysis of the total titrated acid shown in Figure 4, it decreased during the storage of red guava fruit for 12 days. The highest total dissolved acid value was 0.08% on the 3<sup>rd</sup> day storage sealing packaging method, the 6<sup>th</sup> and 9<sup>th</sup> day storage without packaging method, and wrapping packaging method on the 0th day of storage. While the lowest total value of titrated acid was 0.04% on the 12<sup>th</sup> day storage wrapping packaging method. Acid content decreased due to the conversion of acid to form sugar after ripening, while the increase in acid content in fruit was caused by changes in polysaccharides (pectin, starch and hemicellulose) into simple soluble sugars (Julianti, 2012).

The decrease in organic acids contained in fruit during storage is used in the respiration process. These organic acids are



used as a source of fruit energy, so that the acidity value of the fruit can decrease (Umah, 2018). Ripe fruit will increase in sugar content and decrease in acid. An increase in sugar content and a decrease in acid content usually occurs in climacteric fruit. Guava fruit is a climacteric fruit so it will experience a decrease in acidity (Noorbaiti *et al.*, 2012). The acidity of the fruit will decrease after the maximum acid increase occurs. The total titrated acid in red guava fruit decreased after the 12<sup>th</sup> day of storage. This is used as an indicator that the fruit enters the senescence phase after the peak of maturity.

### CONCLUSION

The effect of packaging method and storage time of red guava fruit on chemical analysis was that the highest vitamin C content was the sealing method on the 3<sup>rd</sup> day of storage (3.33%) while the highest value in the control was 3.02 on day 0. The highest moisture content was in the packaging method of storage wrapping on day 0 (90.45%) while the control was 87,35%. The highest value of total dissolved solids was 7.33°Brix on the 12<sup>th</sup> day of sealing method, while the control was 10.00°Brix on the 12th day. The highest value of total titrated acid was in the packaging method of storage wrapping on the 0th day (0.08%) while for the control it was 0.08% on the 6<sup>th</sup> and 9<sup>th</sup> days.

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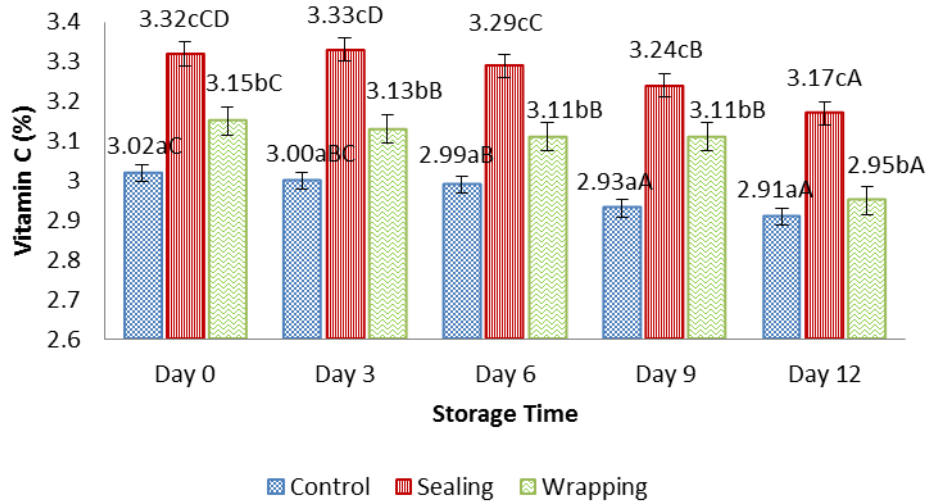


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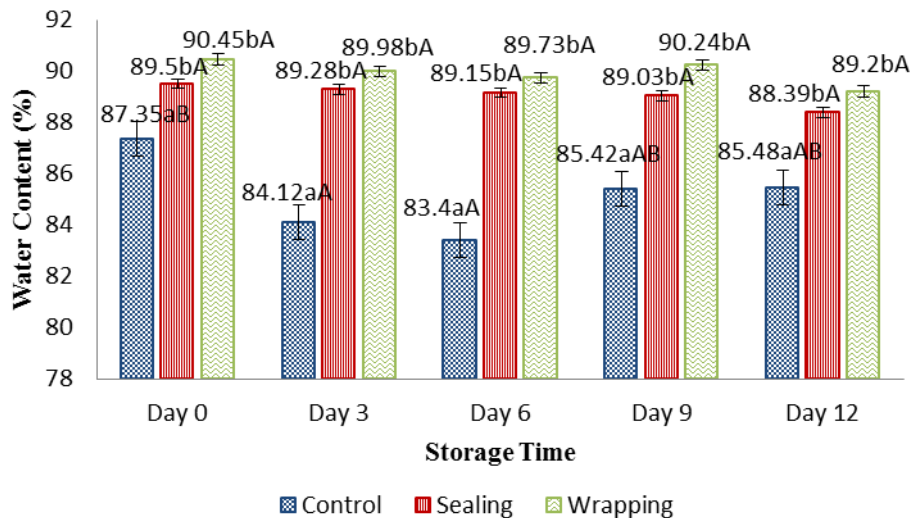
**Table 1.** Research Design

Packing Methods (P)	Storage Time (L)				
	0 Day (L <sub>1</sub> )	3 Days (L <sub>2</sub> )	6 Days (L <sub>3</sub> )	9 Days (L <sub>4</sub> )	12 Days (L <sub>5</sub> )
Control (P <sub>1</sub> )	P <sub>1</sub> L <sub>1</sub>	P <sub>1</sub> L <sub>2</sub>	P <sub>1</sub> L <sub>3</sub>	P <sub>1</sub> L <sub>4</sub>	P <sub>1</sub> L <sub>5</sub>
Sealing (P <sub>2</sub> )	P <sub>2</sub> L <sub>1</sub>	P <sub>2</sub> L <sub>2</sub>	P <sub>2</sub> L <sub>3</sub>	P <sub>2</sub> L <sub>4</sub>	P <sub>2</sub> L <sub>5</sub>
Wrapping (P <sub>3</sub> )	P <sub>3</sub> L <sub>1</sub>	P <sub>3</sub> L <sub>2</sub>	P <sub>3</sub> L <sub>3</sub>	P <sub>3</sub> L <sub>4</sub>	P <sub>3</sub> L <sub>5</sub>



**Figure 1.** Vitamin C (%) of Red Guava

Information: The same notation on the same day (indicated in lowercase notation) showed no significant difference at = 0.05. The same notation on the same packaging method (shown in uppercase notation) showed no significant difference at = 0.05

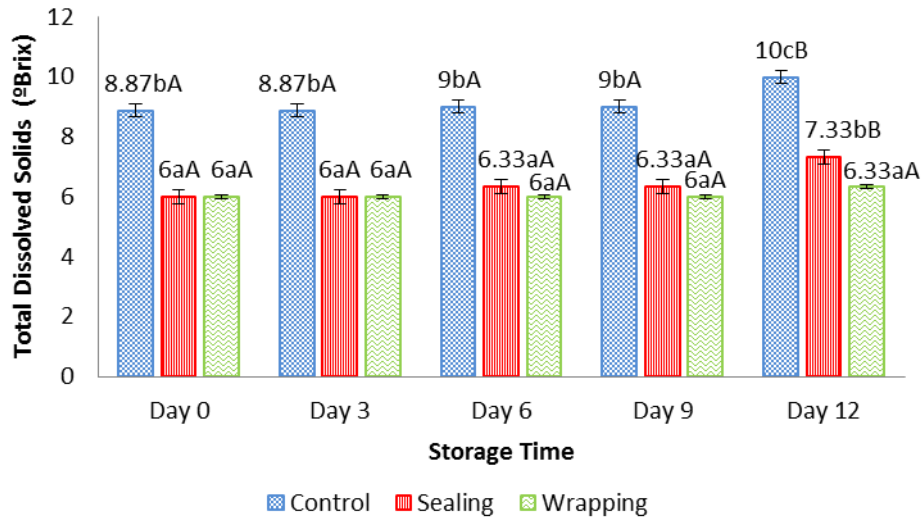


**Figure 2.** Water Content (%) of Red Guava

Information: The same notation on the same day (indicated in lowercase notation) showed no significant difference at = 0.05. The same notation on the same packaging method (shown in uppercase notation) showed no significant difference at = 0.05

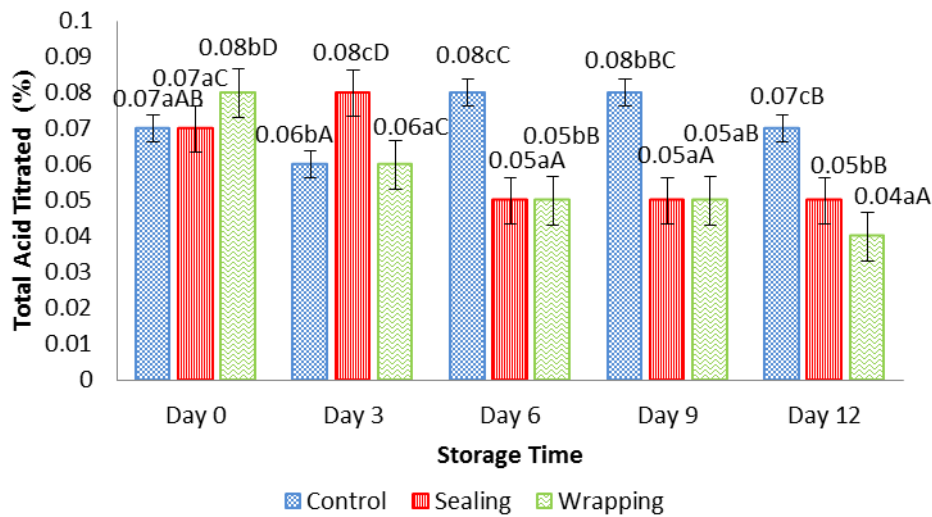






**Figure 3.** Total Dissolved Solids (°Brix) of Red Guava

Information: The same notation on the same day (indicated in lowercase notation) showed no significant difference at = 0.05. The same notation on the same packaging method (shown in uppercase notation) showed no significant difference at = 0.05



**Figure 4.** Total Titrated Acid (%) of Red Guava

Information: The same notation on the same day (indicated in lowercase notation) showed no significant difference at = 0.05. The same notation on the same packaging method (shown in uppercase notation) showed no significant difference at = 0.05