Effect of waxing and packaging method on the quality of Pontianak Tangerine

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Abstract. Orange is a fruit that is easily subjected to physical, chemical and biological changes during storage. The change in behavior was due to the absence of handling of the fruit after harvest. To maintain the quality of the fruit and to extend the shelf life, the fruit was manipulated by waxing and packaging. The research objective was to determine the effect of waxing and proper packaging methods on the quality of Pontianak Tangerine fruit during storage 10 days after harvest. The research was conducted at the Post Harvest Laboratory of East Java AIAT in January 2018. The research design was arranged completely randomly with 2 treatment factors. The factors are wax dyeing (waxing and without waxing) and packaging methods (plastic baskets, black plastic bags, white plastic bags, transparent plastic, cardboard and fruit nets). The experiment was repeated 3 times per unit experiment / replication using 10 pieces. The results showed that on the second day after harvest there was a significant difference between the wax and the packaging method on fruit volume, fruit skin brightness color and fruit juice brightness color. Meanwhile, the waxing factor and packaging method were not different with respect to sugar content, acid content, fruit weight, juice volume, and fruit jueste color. For yellowish skin color, the packaging method is different but there is no difference in waxing, the packaging method with a white plastic bag is yellow. Observations on day 10 after harvesting wax did not affect fruit volume, fruit skin color, attack by plant-disturbing organisms, juice color, sugar content, acid and vitamin C levels, but had an effect on fruit weight, skin brightness, juice volume, juice brightness and juice yellowish color. The method of packaging affects the volume of fruit, volume of juice, yellowish juice color and vitamins C.

1. Introduction
Fruits are horticultural products that are easily subjected to physical, chemical and biological changes during storage. One third of the world's horticultural products cannot be consumed because they are damaged. Fruit is a living structure that will undergo physical and chemical changes after being harvested because the fruit ripening process will continue because the tissues and cells in the fruit are still alive and carry out respiration, the respiration process will cause a decrease in the quality and shelf life of the fruit [1].

These changes occur because there is no handling of the fruit. To overcome the above, so that the fruit can last a long time during storage, namely by waxing. Waxing is a process of coating the surface of horticultural products using wax emulsion in order to maintain quality and extend their shelf life. The wax functions as a protective coating against the loss of water from commodities and regulates the oxygen demand for respiration. Coating can suppress respiration and aspiration of fresh fruit and vegetables, can reduce post-harvest damage due to the respiration process so that these commodities have a longer shelf life and their selling value can be maintained [2]. Wax emulsion that can be used as a wax coating material must meet the requirements, namely that it does not affect the smell and
taste of the product to be coated, is easy to dry and if dry is not sticky, does not break easily, is shiny and slippery, does not produce a thick surface, is easy to obtain, is cheap. and most importantly not poisonous [3].

The process of post-harvest damage to fruit cannot be avoided, however, the freshness of the fruit during harvest release can still be maintained. A small break in the skin of the fruit can open the way for more damage during storage and transportation [4]. Post-harvest handling that focuses on storage and packaging aspects can be endeavored to extend the shelf life of citrus fruits. The use of ventilated packaging combined with the use of plastic film can extend the shelf life of guava fruit by up to 24 days with marketable texture and color conditions [5].

Citrus fruits will change in quality during the storage, distribution and marketing processes. A long marketing chain also requires a long shelf life with quality that is maintained so that the fruit that reaches the end consumer is still of the expected quality.

The use of packaging is an effort that can be done to protect agricultural products during the transportation and storage period from damage caused by external and internal factors [6]. The use of packaging is expected to limit the transpiration produced from agricultural products, both vegetables and fruits. After being released from the mother, the fruit is still in the process of respiration or respiration and if this condition is not controlled, it will be a trigger factor for fruit damage during the storage period. Packaging fruit in plastic and cardboard is the cheapest method of extending the shelf life of the fruit. The impact of waxing and the use of several types of packaging on the quality of citrus fruits during storage at room temperature needs to be done in an effort to improve the quality of oranges. Therefore, it is necessary to conduct research to determine the choice of packaging types and the best way of waxing citrus fruits during storage which are expected to maintain fruit quality. The results of the study are expected to be a recommendation for citrus farmers to make behavioral changes related to proper harvest and post-harvest handling so that they have added value and competitiveness. The purpose of this study was to determine the effect of waxing and packaging types on weight loss and damage to oranges (determined based on the physical damage observed visually) during storage at room temperature.

2. Material and Methods
2.1 Place and time of research
The orange wax research was carried out at the Post-Harvest Agricultural Laboratory of East Java AIAT in January 2018.

2.2 Research Tools and Materials
The tools used in the waxing process include stoves, basins, plastic baskets, filters, stirrers, flakes, knives and pans. The tools used in the analysis include measuring cups, digital scales, orange juice, blender, knife, color reader, pH meter and hand refractometer. The raw material used is Pontianak siam oranges obtained from the East Java AIAT Experimental Garden in Kepuharjo Village, Karangploso District, Malang Regency, East Java Province. Auxiliary materials are beeswax (wax), TEA and oleic acid obtained from the chemical shop Panadia Malang. The analytical materials were aquadest, filter paper, PP and NaOH indicators obtained from the chemical shop Panadia Malang.

2.3 Experimental design
The research design was arranged completely randomly with 2 treatment factors. Factor I: wax dyeing (P), namely waxing (P1) and without waxing (P2). Meanwhile, factor II: the method of packaging (K) plastic baskets (K1), black plastic bags (K2), white plastic bags (K3), transparent plastic (K4), cardboard boxes (K5) and fruit nets (K6). Each experimental or replication unit used 10 oranges as replications.
2.4 Material Preparation
Preparation begins with a manual harvesting process (plucked) on the stalk of the fruit using sharp scissors. Picking is done after all the water on the surface of the fruit is gone to reduce spoilage microbial contamination. Then do the initial sorting of chayote. After the initial harvesting and sorting process is complete, the Siamese oranges are taken to the Post-Harvest Technology Laboratory of East Java AIAT. Arriving at the Post Harvest Technology Laboratory, the chayote was re-sorted to obtain uniform siam oranges. After sorted the oranges are washed using Benlate 50 fungicide. Benlate 50 functions to clean the soil / dirt that is still attached and is able to suppress fungal growth. Then the oranges are washed again using clean water and drained until the water is gone.

2.5 Stages of Making Beeswax Emulsion
The emulsion is made of 1,000 ml consisting of a mixture of beeswax with a concentration of 6%. Here is a 6% concentration of beeswax. The first thing to do is cook the aquadest until it boils to a temperature of 100°C then put the beeswax which has been sliced into thin slices as much as 60% then stir until it dissolves in the aquadest, when it is dissolved, pour 20% TEA, stir again until evenly mixed. Add 10% oleic acid by stirring rapidly so that it doesn't clump. When it's hot, put the mixture in a blender and blend for 2 minutes. After all the ingredients are well blended, transfer the emulsion to the jar and cool the emulsion until it reaches room temperature of 45-50°C.

2.6 Coating application stage
Giving the emulsion layer is done by dipping it for 15 seconds directly into the emulsion and then the lime which has been coated is drained first and aerated until the emulsion layer on the chayote is dry. The chayote that had been given an emulsion layer was prepared according to the concentration level of beeswax treatment.

2.7 Observation Stages
In this study the observations were carried out objectively and subjectively to the control and the Siamese oranges which were treated on day to day 2 and 10 after harvest. Observations were carried out objectively on weight loss, skin color and pulp, vitamin C levels, total acid by iodometric filtration, acid levels (%), and total dissolved solids (0Brix) using a hand refractometer. Meanwhile, subjective observations were made on the intensity of damage, such as the impact of Plant Pest Organisms (OPT) during storage of chayote.

2.8 Data analysis
The research data were analyzed using analysis of variance and if there was a significant treatment effect (P> 0.05), it was continued with the Duncan's multiple range test (DMRT).

3. Results and Discussion
3.1 Physical and Chemical Characteristics of Pontianak Siam Orange
Oranges are a non-climacteric fruit group, meaning that when the fruit is picked (harvested) it does not cause a change of carbohydrates into sugar, besides that citrus fruit is also characterized by a low and relatively decreasing level of CO2 production and is not related to changes in fruit composition during ripening. Harvesting citrus fruit too early (early) causes sour taste and less attractive fruit color. Therefore, determining the right time to harvest is closely related to the quality of the desired fruit. Harvesting of citrus fruit at physiological maturity stage results in high fruit quality, sweet taste, and attractive rind.

Fresh citrus fruits after picking are still in the process of life. Some of the important life processes in citrus fruits are respiration, transpiration, and fruit ripening. This biochemical process (or nature) reduces the quality of freshness of citrus fruit, which can be seen from its appearance, weight loss and decreased nutritional value. Citrus including non-climacteric fruit. Non-climacteric fruit does not show a change (increase) in the rate of ethylene and CO2 production after harvest, meaning that citrus fruits
must be harvested after being ripe in the trees because they do not experience ripening. Apart from still carrying out the biochemical process, oranges also have chemical, physical and organoleptic properties. Ripe citrus fruit has a moisture content of 77-92%, during times of drought the water from the fruit is drawn to the leaves. The sugar content of the edible portion varies from 2-15%, usually about 12% in ripe sweet oranges. Protein content is less than 2% of the edible portion. Sweet citrus fruits contain 1-2% citric acid and may contain small amounts of tartaric, malic and oxalic acids. The vitamin C level is about 50 mg per 100 ml of orange juice. Vitamin A is also in oranges. The main glucoside bond in most citrus fruits is hesperidin. Lots of orange peel pectin [7].

This Pontianak Tangerine is round, the skin is smooth, greenish yellow and has black spots around the edges, the aroma is typical of Siamese orange, has an average weight. 95.36-126.98 g with a slightly soft fruit texture and has many seeds ranging from 4-13 seeds per fruit. The amount of juice produced ranged from 76.66 to 108.33 ml per fruit and was bright orange in color with total dissolved solids ranging from 18.09 to 19.43 brix and acid levels ranging from 2.51-2.74%. The following are the characteristics of Siamese and lime are presented in Table 1:

| Table 1. Physical Characteristics of Pontianak Tangerine |
|----------------------------------------------------------|
| Characteristics                                          | Pontianak Tangerine |
|----------------------------------------------------------|---------------------|
| Average                                                 | Range               |
| Fruit weight (gr)                                        | 111.85              | 95.39 + 126.98        |
| Fruit texture (m / s)                                    | 0.27                | 0.05 + 0.55           |
| Skin color                                               |                      |                      |
| L (Brightness)                                           | 53.0-55.4           |
| a * (Redness)                                            | -1.2 - (-5.0)       |
| b * (yellowish)                                          | 61.0 - 119.5        |
| Fruit volume (ml)                                        | 93.33               | 80 + 100              |
| Fruit juice volume (ml)                                  | 92.50               | 76.66 +108.33         |
| Number of seeds (fruit)                                  | 9                   | 4 + 13                |
| Fruit juice color                                        |                      |                      |
| L = 19.9 - 24.0                                          |                      |
| a = 2.6 - 3.5                                            |                      |
| b = 9.9 - 18.6                                           |                      |
| Acid content (%)                                         | 2.63                | 2.51 + 2.74           |
| TPT (%Brix)                                              | 18.76               | 18.09 + 19.43         |
| Fruit shape                                              | Round               |
| Fruity scent                                             | Typical siam orange |
| Skin appearance                                          | Smooth, there are black spots |

Source: Primary Data, 2018

3.2 Effect of fruit immersion on packaging method after 2 days after harvest
Fruit is a living structure that will undergo physical and chemical changes after being harvested. The ripening process of fruits will continue because the tissues and cells in the fruit are still alive and carry out respiration, the respiration process will cause a decrease in the quality and shelf life of the fruit [8].

In table 2, there is an interaction between dyeing and packaging methods on the physical properties of citrus fruits, namely fruit volume and color brightness after storage after 2 days after harvest. The lowest fruit volume was found in the waxing and packing treatment with cardboard, which was 93.33 ml, meaning that the density of the liquid was greater than the mass of the orange so that in measuring the volume of fruit, the oranges would float on the surface and the amount of water that came out was less. While the highest fruit volume was found in the waxy orange with a black plastic bag, namely 143.33 ml. This proves that wax coated oranges can protect the fruit from physical breakage and are packaged in cardboard more efficiently than those without waxing and packaged in other packages. This is because storing oranges at room temperature in cardboard packaging is more efficient and practical because the cardboard surface is smooth so it can protect the fruit from shaking/ friction.
between fruits. In addition, cardboard ventilation can optimize the rate of the air cycle so as to remove heat from respiration of citrus fruits.

In addition, the level of fruit maturity has an effect on fruit volume because the fruit harvested in the late ripening phase has a lower fruit weight. This occurs because citrus fruit is a non-climatic fruit group which is characterized by a decrease in the respiration rate after harvest until it reaches the senescence phase. Oranges that are harvested in the past maturity phase will experience degradation of the substrate contained therein and ultimately affect the weight of the fruit. Citrus fruits that have passed ripe have a short shelf life, the fruit soon becomes rotten and runny, accompanied by dark spots on the surface of the orange peel. In general, this damage is caused by microorganisms such as fungi that have infected the fruit[10].

The wax coating on the surface of the fruit can prevent the evaporation of water so that it can slow down the withered, inhibit the rate of respiration and polish the skin of the fruit so that it adds to its appeal to consumers. The highest brightness color of orange peels 2 days after harvest was in the treatment of oranges without waxing and packed with fruit nets with a value of L = 53.06, while the lowest brightness color of orange peels was in the treatment of oranges with wax and packed with fruit nets with a value of L = 44, 67. The higher the L value, the brighter the color. Oranges without wax coating experience fruit respiration faster, so that the skin color will turn yellow faster than oranges that are coated with wax, the respiratory rate is slower. The wax layer aims to partially cover the stomata (pores) of fruits and vegetables [11]. The brightness of the orange juice is the same as the brightness of the orange peel, that is, the color of the orange juice which is coated with wax has a brighter color than those without wax coating and this is in accordance with the function of waxing the fruit.

Table 2. Interaction of Dyeing and Packaging Method on Physical Properties of Oranges (volume, color brightness) after 2 days after harvest

| Treatment                              | Fruit volume (ml) | Skin tone brightness (L) | Fruit juice color brightness (L) |
|----------------------------------------|-------------------|--------------------------|---------------------------------|
| Plastics waxing and packaging          | 116.67 abc        | 49.23 cd                 | 23.87 a                         |
| Black plastic bag waxing and packaging | 143.33 a          | 48.46 cd                 | 20.37 d                         |
| White plastic bag twisting and packaging | 103.33 bc       | 46.75 ef                 | 24.07 a                         |
| Transparent plastic coating and packaging | 126.67 ab    | 50.47 bcd                | 19.63 de                        |
| Winding and packing with cardboard     | 93.33 e           | 49.33 cd                 | 20.17 de                        |
| Winding and packing with fruit nets    | 96.67 e           | 44.67 ef                 | 22.13 c                         |
| No wax, plastic basket packaging       | 126.67 ab         | 52.58 ab                 | 22.10 c                         |
| No wax, black plastic bag packaging   | 116.67 abc        | 48.64 cd                 | 22.00 c                         |
| No wax, white plastic bag packaging   | 103.33 bc         | 48.51 cd                 | 23.13 ab                        |
| No wax, transparent plastic packaging | 123.33 abc        | 52.81 a                  | 22.40 bc                        |
| No wax, cardboard packaging           | 143.33 a          | 46.35 ef                 | 19.30 e                         |
| No wax, fruit net packaging           | 103.33 bc         | 53.06 a                  | 21.57 c                         |

Note: Numbers accompanied by the same letter in the same column are not significantly different in the 5% LSD test.

Table 3. Effect of Dyeing and Packaging on TPT and Citrus Acid Levels.

| Dyeing    | TPT (0Brix) | Fruit acid content (%) |
|-----------|-------------|------------------------|
| Winding   | 19.38 a     | 2.89 a                 |
| No waxing | 19.70 a     | 3.11 a                 |
| Packing way |            |                        |
| Plastic basket | 20.58 a | 3.00 a                 |
| Black plastic bag | 19.41 a | 3.10 a                 |
| White plastic bag | 19.80 a | 3.11 a                 |
Transparent plastic 20.35 a  3.18 a  
Cardboard 17.92 a  2.77 a  
Fruit net 19.17 a  2.84 a  

Note: The numbers accompanied by the same letter in the same column are not significantly different in the 5% LSD test.

Table 3 shows that there is no interaction between dyeing and packaging on TPT and citrus fruit acid levels. The TPT value and fruit acid content in oranges without wax coating were higher (19.70°Brix and 3.1%) compared to oranges with wax coating (19.38°Brix and 2.89%) at 2HST because oranges without wax coating experienced a faster drying process. This is in accordance with the opinion [13] which stated that the high total dissolved solids indicated that the fruit was undergoing a faster starch reform process which indicated that the ripening process was also fast.

Table 4 shows that during storage 2 days after harvest there was no interaction between immersion and packaging on fruit weight, fruit juice volume and fruit juice color (b*). Fruit weight is proportional to volume of fruit juice. The heavier the fruit weight, the more juice volume will be. The fruit weight in the white plastic bag (95.39 g) is lighter than the fruit net (126.98 g). This is because in the plastic bag packaging, the fruit is evaporated faster so that the water content of the fruit is reduced. Fruit with lower weight causes loss of freshness, the fruit becomes wrinkled with wrinkled skin so that the appearance of the fruit becomes unattractive and is no longer fit for the market. The skin of the fruit that has been wrinkled can cause the natural protective function to be disturbed so that it is unable to prevent loss of moisture and results in weight loss of the fruit during storage [9]. Fruit juice color did not significantly affect storage 2 days after harvest,

Table 4. Effect of Dyeing and Packaging Method on the Physical Properties of Oranges (fruit weight, fruit juice volume and skin color)  

| Treatment          | Fruit weight (g) | Juice Volume (ml) | Yellowish juice color (b*) |
|--------------------|------------------|-------------------|---------------------------|
| Dyeing             |                  |                   |                           |
| Winding            | 121.53 a         | 55.44 a           | 13.69 a                   |
| No waxing          | 116.05 a         | 54.17 a           | 13.60 a                   |
| Packing way        |                  |                   |                           |
| Plastic basket     | 120.68 a         | 52.83 a           | 14.33 a                   |
| Black plastic bag  | 126.25 a         | 64.33 a           | 11.73 a                   |
| White plastic bag  | 95.39 a          | 50.50 a           | 17.96 a                   |
| Transparent plastic| 122.70 a         | 61.00 a           | 11.43 a                   |
| Cardboard          | 120.72 a         | 52.91 a           | 13.26 a                   |
| Fruit net          | 126.98 a         | 47.25 a           | 13.13 a                   |

Note: Numbers accompanied by the same letter in the same column are not significantly different in the 5% LSD test.

3.3 Effect of fruit immersion on the packaging method of oranges for 10 days of storage

The type of packaging determines the level of damage to the fruit during its shelf life. The effectiveness of packaging used for agricultural products is packaging that can protect the product from physical impact or pressure that occurs during storage so as to reduce sensitivity to rot and increase shelf life.

Based on Table 5, oranges without wax dye (78.89) have a more yellow skin color (b*) than oranges with wax (94.88). This is because oranges without wax undergo a faster respiration process and ripen so that the skin color changes more quickly. Meanwhile, oranges with fruit net packaging have a brighter yellow color than oranges in plastic packaging. This is because in a good air circulation net packaging so that the respiratory process is faster. According to [17], that the higher the wax concentration, the smaller the air cavity so that the process of respiration and oxidation is slower and the degradation process of chlorophyll is inhibited, thus the fruit color change is slower. In
addition, these conditions can reduce the oxygen concentration and increase the fruit's internal carbon dioxide so that it resembles a modified atmosphere [16]. This will slow down the fruit ripening process. Changes in the color of the fruit skin that is getting yellow can be caused by degradation of chlorophyll and the increase in carotene in the fruit [18].

**Table 5. Effect of Dyeing and Packaging Method on Physical Properties of Oranges at 10 Days After Harvest (weight, volume of skin color, skin brightness, pest attack)**

| Treatment          | Fruit weight (g) | Fruit volume (ml) | Yellowish skin color (b*) | OPT attack (%) |
|--------------------|------------------|-------------------|---------------------------|---------------|
| Dyeing             |                  |                   |                           |               |
| Winding            | 115.03 a         | 98.89 a           | 78.89 b                   | 8.52 b        |
| No waxing          | 104.81 b         | 92.78 a           | 94.88 a                   | 13.64 a       |
| Packing way        |                  |                   |                           |               |
| Plastic basket     | 100.36 a         | 76.66 c           | 55.75 c                   | 20.46 a       |
| Black plastic bag  | 118.05 a         | 108.33 a          | 84.98 b                   | 11.36 b       |
| White plastic bag  | 111.33 a         | 101.66 ab         | 74.40 bc                  | 9.88 bc       |
| Transparent plastic | 110.06 a       | 96.66 ab          | 79.20 bc                  | 13.30 b       |
| Cardboard          | 101.15 a         | 88.33 bc          | 106.77 ab                 | 5.74 c        |
| Fruit net          | 118.57 a         | 103.33 ab         | 120.20 a                  | 5.74 c        |

Note: The numbers accompanied by the same letter in the same column are not significantly different in the 5% LSD test.

However, the method of packaging is inversely related to the attack of Plant Pest Organisms (OPT). Oranges with wax coating (13.64%) had greater pest attacks than without waxing (8.52) and packaging with plastic baskets (20.46%) had greater pest attacks than fruit nets and cardboard nets (5.74) . Waxing can suppress respiration and transpiration too quickly from fresh fruits and vegetables because it can reduce the activity of respiratory enzymes so that it can delay the ripening process [14]. The method of waxing did not significantly affect the volume of citrus fruit.

**Table 6. Effect of Dyeing and Packaging Method on the Quality of Orange Juice (volume, color and brightness)**

| Treatment               | Juice volume (ml) | Juice brightness (L) | Reddish green juice color | Yellowish juice color (b*) |
|-------------------------|-------------------|----------------------|---------------------------|---------------------------|
| Dyeing                  |                   |                      |                           |                           |
| Winding                 | 53.44 a           | 23.57 a              | 3.53 a                    | 13.78 b                   |
| No waxing               | 48.33 b           | 22.14 b              | 2.42 a                    | 18.55 a                   |
| Packing way             |                   |                      |                           |                           |
| Kranjang ranspa         | 45.00 c           | 23.98 a              | 2.93 a                    | 24.28 a                   |
| Black ranspa bag        | 53.67 ab          | 22.23 a              | 2.18 a                    | 15.95 bc                  |
| White ranspa bag        | 51.83 abc         | 22.10 a              | 2.16 a                    | 16.87 b                   |
| Transparent plastic     | 48.50 bc          | 22.10 a              | 2.71 a                    | 14.28 bc                  |
| Cardboard               | 47.83 bc          | 22.91 a              | 4.36 a                    | 13.13 c                   |
| Fruit net               | 58.50 a           | 23.68 a              | 3.50 a                    | 12.45 c                   |

Note: The numbers accompanied by the same letter in the same column are not significantly different in the 5% LSD test.

Based on Table 7, it can be seen that after storing oranges after 10 days of harvesting with immersion treatment and packaging methods did not have a significant effect (P> 5%) on the acid content of oranges. Acid levels tend to decrease after storage 10 days after harvest. According to Rachmawati (2010) the decrease that occurs in total pyruvic acid and organic acids aerobically
becomes CH2O5 and the energy or acid is used as a substrate in the respiration process. Total Dissolved Solids (TPT) increased after storage 10 days after harvest.

| Table 7. Effect of Dyeing and Packaging Method on the Chemical Properties of Oranges (TPT, Acid and Vitamin C) |
|---------------------------------------------------|-------------------------------|-----------------|
| Treatment     | TPT (0Brix) | Acid content (%) | Vit. C (mg / 100 g) |
| Dyeing        |              |                  |                   |
| Winding       | 18.74 a     | 2.63 a           | 24.61 a           |
| No waxing     | 19.05 a     | 2.60 a           | 23.92 a           |
| Packing way   |              |                  |                   |
| Kranjang ranspa | 19.46 a   | 2.67 a           | 28.77 ab          |
| Black ranspa bag | 18.35 a  | 2.57 a           | 20.61 bc          |
| White ranspa bag | 18.09 a  | 2.63 a           | 17.12 c           |
| Transparent plastic | 19.43 a  | 2.56 a           | 23.86 abc         |
| Cardboard     | 19.21 a     | 2.74 a           | 24.64 abc         |
| Fruit net     | 18.82 a     | 2.51 a           | 30.59 a           |

Note: Numbers accompanied by the same letter in the same column are not significantly different in the 5% LSD test.

Total Dissolved Solids (TPT) increased after storage 10 days after harvest. This is in accordance with the opinion[15] which states that high total dissolved solids indicate that the fruit undergoes a faster starch reform process which indicates that the ripening process is also fast. [2] stated that wax coating can inhibit the metabolic rate of polysaccharides so that the fruit sugar content can be maintained. The immersion treatment did not have a significant effect on the vitamin C content, while the method of packaging with plastic bags had lower levels of vitamin C (17.12 mg / 100 g) compared to packaging with fruit nets (30.59 mg / 100 g). This is because in plastic bag packaging the oxidation process runs fast because the packaging is closed and there is less air in it compared to mesh packaging, where the oxidation process is very slow due to respiration and also slow. According to[15], the decrease in Vitamin C during storage occurs due to the oxidation process.

4. Conclusion
Storage on the second day after harvest, there was a significant difference between waxing and packaging methods on fruit volume, skin color and fruit juice color. Meanwhile, the waxing factor and packaging method were not different with respect to total dissolved solids (TPT), acid content, fruit weight, juice volume, and fruit juice color. For yellowish skin color, the packaging method is different but there is no difference in waxing, the packaging method with a white plastic bag is yellow.

Observations on day 10 after harvesting wax did not affect fruit volume, fruit skin color, attack by plant-disturbing organisms, juice color, total dissolved solids (TPT), acid and vitamin C levels, but had an effect on fruit weight, skin brightness, juice volume, juice brightness and juice yellowish color. The way of packaging affects the volume of fruit, volume of juice, yellowish juice color and vitamins. C Wax coating and packaging using fruit nets are more effective and safer in maintaining the quality of oranges for 10 days of storage.

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