Effect of drying on antioxidant capacity, sugar content, water content, physical and organoleptic properties of dried candied Dewandaru fruit (Eugeia uniflora L.)

N K T Asri1, a) M Devi1, b) and S Soekopitojo1, c)

1Department of Industrial Technology, State University of Malang, 65145 Indonesia

Email: a) naufalkukuhtata97@gmail.com
       b) mazarina.devi.ft@um.ac.id
       c) soenar.soekopitojo.ft@um.ac.id

Abstract: Dewandaru fruit is a fruit that has many benefits for health. It’s distinctive characteristics make Dewandaru fruit suitable for use as food products in the form of dried sweets. This research is an experimental study using RAL to analyze chemical properties, physical properties and organoleptic properties of dried candied from dewandaru fruits with 4 treatments, drying time for 6 hours, 7 hours, 8 hours and 9 hours with 2 repetitions. The data obtained will be analyzed using One Way ANOVA followed by DMRT further test. The results showed that 9 hours of drying time had the highest chemical properties, namely the antioxidant capacity of 71.49 ppm, sugar content of 47.70 g / 100 grams and water content 35.33 gr/ 100 gram, the highest physical properties were at the reddish level (a +) which was 18.53 but low at the level of brightness (L), namely 9.23 and the yellow level (b +) , 57. While the physical properties of the texture of the 9 hour drying time had the highest yield, namely 0.1 Kg / cm2. The highest score for organoleptic properties were taste with 8 hours of drying time, color with 6 hours of drying time, aroma with 6 hours of drying time and no difference in texture.

Keywords: Dewandaru fruit, dried candied snack, chemical properties

1. Introduction

Many types of tropical fruits are produced in various parts of Indonesia. The diversity of fruit types is one of the factors in the utilization of fruit yields that are not optimal. Fruit is a food that has many benefits for the human body, one of which is the Dewandaru fruit (Eugenia uniflora L.). Dewandaru tree (Eugenia uniflora L.) is a plant that can bear fruit throughout the year regardless of the season. Dewandaru plant has a tree height of up to 5 meters and a round fruit shape with a diameter of approximately 1.5 centimeters with red fruit color [1]. Dewandaru fruit can be consumed fresh or processed as products such as jam, jelly, pickles, fruit juice and sweets [2].
Dried candied is processed food made from raw fruit which is processed by drying and adding sugar so that it is durable and long lasting [3]. The high water content in Dewandaru fruit makes this fruit easily damaged and rotten. The taste and aroma of the fruit is quite sharp and distinctive to make this fruit suitable for processing into dry sweets. The use of Dewandaru fruit as dry sweets is expected to be processed food which is rich in benefits from the chemical compounds of Dewandaru fruit which include anthocyanins, vitamin C, saponins and tannins. [4] where these compounds are a source of natural antioxidants in Dewandaru fruit. The antioxidant content of Dewandaru fruit is an anthocyanin compound due to the presence of a purple pigment. Anthocyanins are compounds that give fruits their purple color and act as natural antioxidants [5].

Antioxidant content of Dewandaru fruit oil, the average value of DPPH is 55 ppm. This shows that Dewandaru fruit has strong antioxidant activity [6]. Natural antioxidants in food ingredients can slow down the rate of free radical oxidation but also function as reducing compounds, prooxidants and quenchers of the singlet form of oxygen [7]. Despair and unpleasant taste that slightly disturbs the senses. Based on this, an effort to reduce the unpleasantness is added with cinnamon (Cinnamomum cassia). The components contained in cinnamon are sinamaldehyde and eugenol which act as aromas and antioxidants [8] and are able to help inhibit bacterial growth so that the product can last [9]. Dried candies are processed fruit products with the expected results in accordance with SNI 0718-83 2005.

The purpose of this study was to analyze the chemical properties which included antioxidant capacity, sugar content and moisture content, physical properties, namely color and texture and organoleptic properties, namely in the form of a hedonic test consisting of taste, color, aroma and texture of dried candied dewandaru fruit with treatment. drying time for 6 hours, 7 hours, 8 hours and 9 hours.

2. Method
This research is an experimental study with the aim of looking at the chemical, physical and organoleptic properties of Dewandaru fruit. This study used a completely randomized design (CRD) with 4 treatments including 6 hours drying time (P1), 7 hours drying time (P2), 8 hours drying time (P3) and 9 hours drying time (P4). Each treatment was repeated 2 times and tested for chemical properties consisting of antioxidant capacity, sugar content and moisture content, physical properties, namely color and texture and organoleptic properties consisting of taste, color, aroma and texture. The tools used in the manufacture of Dewandaru fruit dry sweets include scales, measuring cups, bowls, knives, stoves, pans, leadles, strainers, trays and cabinet dryers. The hedonic test data collection in this study used a panelist with a total of 35 people. Materials for making dry sweets include 100 grams of dewandaru fruit, 40% granulated sugar solution, 0.24% salt solution, 2% whiting water solution, 5% cinnamon and enough water.

3. Results and Discussion
3.1 Chemical Properties
The results showed that the fresh dewandaru fruit in this study had an average antioxidant capacity with an IC50 value of 88.94 ppm. Based on this, dewandaru fruit has a strong anti-oxidant capacity. The results of chemical and physical analysis of dewandaru fruit dried sweets can be seen in table 1.

3.1.1 Antioxidant Capacity. Based on the results of the analysis in Table 1. there is a significant difference, namely the longer the drying time, the stronger the antioxidant capacity of the dewandaru fruit. The increasing strength of the antioxidant capacity of Dewandaru fruit is influenced by the presence of antiocyanin compounds in the chemical content of Dewandaru fruit. The increasing level of red color concentration in the dried candied fruit of Dewandaru proved that the levels of anthocyanin
compounds that act as antioxidants are also increasing. According to [5] The red color of the fruit is caused by the presence of anthocyanin compounds. Anthocyanin is a compound that acts as a natural dye which is a class of flavonoid compounds [10]. Flavonoid compounds are secondary metabolites of polyphenols that have various bioactive effects which act as antioxidants [11]. Based on this, it was found that the longer the drying process the antioxidant capacity would increase. In addition, the content of active compounds in the form of cinnamaldehyde and cinnamic acid in additional ingredients, namely cinnamon in the manufacture of dried candied fruit, dewandaru has a role as a natural antioxidant [8] so that it can increase the strength of antioxidant capacity in dried candied Dewandaru fruit.

Table 1. Analysis Results of Chemical and Physical Properties of Dried Candied Dewandaru Fruit with Different Drying Time.

| Drying Time | Antioxidant Capacity (IC50, ppm) | Sugar level (gr / 100 gr) | Water content (%) | Color | Texture (Kg/cm²) |
|-------------|----------------------------------|---------------------------|-------------------|-------|-----------------|
| 6 hours     | 109.47a                          | 34.89a                    | 39.49a            | 14.94a| 6.91a           |
| 7 hours     | 92.29b                           | 39.84b                    | 38.1b             | 12.64b| 8.16b           |
| 8 hours     | 82.73c                           | 44.87c                    | 36.3c             | 10.78c| 11.21c          |
| 9 hours     | 71.49d                           | 47.70d                    | 35.33d            | 9.23d | 10.57c          |

Note: Different numerical notations indicate significant differences in each treatment.

3.1.2 Sugar Level

Based on the results of the analysis in Table 1, it shows that the longer the drying time, the dry sugar content of dewandaru fruit will increase. The drying process will reduce the moisture content in the ingredients, where the lower the water content, the higher the sugar content [3]. According to [12] the effect of heat on the drying process makes a product that contains sugar will cause the sucrose to be inverse where sucrose becomes glucose and fructose thereby increasing the solubility of sugar. Soaking the fruit in the sugar solution causes the sugar level in the fruit to increase because of the osmosis dehydration process, which is the discharge of water from the fruit and the entry of the sugar solution so that the sugar level will increase [13]. In the treatment, the drying time of 8 hours and 9 hours is in accordance with SNI No. 0718-83 2005 concerning dried fruit sweets while the others have not fulfilled.

3.1.3 Water content. Based on the results of chemical analysis, the moisture content in Table 1. shows that the moisture content of dewandaru fruit during the drying process is decreasing. According to (Winarno, 2008) the longer it takes to do the drying process, the smaller the moisture content in the material is due to the process of evaporation of water from the material. The drying time also affects the heat energy carried by the air during the drying process which causes the total mass of the liquid contained to evaporate more on the surface of the dry candy [14]. According to Kusmiadi (2011) in [15] The low value of water content in the dried candied fruit apart from the length of the drying process is also influenced by the soaking process of the fruit in the lime (Ca (OH) 2) solution during the process of making dry sweets. Immersion using calcium hydroxide causes the widening of the fruit molecule network so that a mechanical effect occurs, namely calcium penetrates the fruit tissue so that it becomes stronger due to reduced water content.

3.1.4 Physical Properties of Color. Based on the results of the research table 1. shows that the color notation system which includes L, a and b has a significant difference. Dried Dewandaru fruit which is red in color due to the presence of anthocyanins. According to [5], anthocyanin is a pigment that gives red color in fruits. The level of redness (a +) in the dried candied dewandaru fruit is the highest indicated by the drying time for 9 hours, but has a lower brightness (L) and a yellowish level (b +) compared to other drying time. The longer the drying time for the dewandaru fruit, the reddish level of the dewandaru fruit was increased. The final result of the highest redness was found in the 9-hour drying time, this was
due to the increasing sugar content in the sweets in line with the longer drying time. The high sugar content in dewandaru fruit dried sweets occurs due to a maillard reaction due to heating. The maillard reaction is a reaction between reducing sugars and primary amine groups due to high temperatures and a long time, it is characterized by a darker color (brown) in the product [16].

3.1.5 Physical Properties of Texture. Based on the analysis of the physical properties of the dewandaru dried candied fruit texture, it shows that the longer it dries, the harder the candy texture will be. According to [3] the longer the drying time of a product, the lower the water content, so that the gel system will cause the gel formation molecules to become denser and the value of tensile strength will be greater so that the texture will be harder. Meanwhile, according to [17] drying time can reduce the water content due to the evaporation process during drying so that the size of the material will be smaller than before and the texture will become harder. The sugar concentration in dry sweets affects the physical properties of the candy texture, the more sugar content, the tighter the bonds between molecules will cause the candy texture to be harder.

3.2 Organoleptic Properties

![Organoleptic Properties Dried Candied Dewandaru Fruit](image)

**Figure 1.** Organoleptic Properties of Dried Candied Dewandaru Fruit.

3.2.1 Taste. Figure 1 shows that the drying time affects the taste of the dried candied fruit of Dewandaru. Panelists gave their liking for the dry sweetness of Dewandaru fruit in the normal category. The dried candied dewandaru fruit has a sweet taste but is a little unpleasant so that it is not liked by the panelists. The sweet taste of sweets is caused by the sugar component during the soaking process. According to [16] a product can be felt because each panelist has the lowest concentration limit in determining the taste of the product. According to [14] the dry taste of dewandaru fruit is influenced by the drying time, the longer the drying time will cause the sucrose to be inverse, that is, sucrose will become glucose and fructose so that the sweetness of the candy product will decrease. Apart from being a flavor enhancer for sweets, the addition of sugar aims to binder the free water contained in the ingredients so that it acts as a preservative [16].

3.2.2 Color. Figure 1 shows that the 6 hour drying time was preferred by the panelists with the slightly like category. The color of dewandaru fruit that was preferred by the panelists was the lighter color of the candy, as it gave the appearance of a fresh, dried candy. The dark red color of dewandaru fruit dry sweets with long drying is due to the Maillard reaction. According to [3], Maillard reactions occur due to exposure to high temperatures and for a long time in which reducing sugar groups with amino acids will react to produce food products with a darker color. According to [5], Anthocyanins are easily
degraded due to exposure to heat and pH conditions, the color of anthocyanins will fade when environmental conditions have a low acidity or in a slightly neutral pH condition.

3.2.3 Aroma. Figure 1 shows that the aroma of dewandaru fruit that was preferred by the panelists was sweets with a drying time of 6 hours with a slightly like category. The drying time for 6 hours is preferred because it has a distinctive aroma of fresh dewandaru fruit. Dewandaru fruit contains curzerene compounds [6], where the curzerene compound is an aromatic terpenoid compound which gives a distinctive aroma to plants and spices. According to [14] aroma is a compound that easily evaporates when exposed to heat, the longer the drying time needed, the distinctive aroma of the material will fade. A less strong aroma in a food product will affect consumer interest and judgment, thus making consumers less interested in consuming the product.

3.2.4 Texture. Figure 1 shows that the drying time was not significantly different. Dewandaru dried candied fruit with a drying time of 6 hours resulted in a dry candy that was rather soft, did not experience much shrinkage and was rather dry. This is in accordance with the results of the analysis of the physical properties of the texture which gave the lowest value. Meanwhile, the drying time for 9 hours resulted in the dried candied dewandaru fruit which was a bit hard, the candies experienced shrinkage and dried on the outside. [3] temperature and drying time will affect the texture of the candy which is case hardening where the outside of the material is hard and wrinkled while it is soft on the inside of the material.

4. Conclusion
Based on the results of research and discussion on "The Effect of Drying Time on Antioxidant Capacity, Sugar Levels, Water Content, Physical Properties and Organoleptic Properties of Dried Candied Dewandaru Fruit" it can be concluded that:
1. The 9-hour drying time has the highest chemical properties, namely the antioxidant capacity of 71.49 ppm, sugar content of 47.70 gr / 100 gram and water content of 35.33 gr / 100 gram
2. Drying time of 9 hours has the highest physical properties results at the reddish level (a +), namely 18.53, but low at the brightness level (L), namely 9.23 and the yellowish level (b +) 10.57. While the physical properties of the texture of the 9 hour drying time had the highest yield, namely 0.1 Kg / cm²
3. The highest score for the hedonic test of dried dewandaru fruit was taste with 8 hours of drying time, color with 6 hours of drying time, aroma with 6 hours of drying time and no difference in texture.

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