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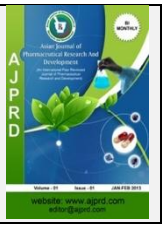

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Research Article

Determination of Vitamin C (Ascorbic Acid) Content from Orange Fruit (*Citrus reticulata* Blanco) Based on Temperature and Storage Time

Mega Yulia, Miftahur Rahmi, Hilmarni

Akademi Farmasi Imam Bonjol, Bukittinggi, West Sumatera, Indonesia

A B S T R A C T

The province of West Sumatera in Indonesia prioritizes three types of fruit: orange, mangosteen, and banana in its production every year. Orange fruit be one of the people favorite fruits because rich in vitamin C, good taste and affordable prices. There are various ways of storing orange fruit, some are stored in the refrigerator and some in room temperature, eaten directly or stored for several days. Based on that reasons research on vitamin C content in orange fruit based on temperature and storage time has been conducted. The objective of this research was to determine the effects of temperature (refrigeration temperature/8^{o}C and room temperature/30^{o}C) and storage time (1, 3 and 7 days) on vitamin C content in orange fruit. The orange fruit were squeezed, filtered and diluted 100 times. All prepared solution of orange fruit has been measured with uv-visible spectrophotometer at wavelength of maximum absorbance264 nm. The results revealed that is a decreased vitamin C content in orange fruit based on temperature and storage time. Where orange fruit are stored at room temperature decreased faster more than orange fruit that stored in refrigeration temperature and orange fruit with storage time 7 days have decreased more than orange fruit that stored for 3 days or 1 day. In conclusion is vitamin C content decreases accelerate with higher storage temperature and longer storage time.

Keywords: Citrus reticulata Blanco, Vitamin C, Temperature, Storage Time.

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*Address for Correspondence:
Mega Yulia, Akademi Farmasi Imam Bonjol, Bukittinggi, West Sumatera, Indonesia.

INTRODUCTION

Indonesia is the fourth most populous country in the world after China, India and the United States[1]. Indonesia has 34 provinces, one of that is West Sumatera. The province of West Sumatera prioritizes three types of fruit: orange, mangosteen, and banana in its production every year. Orange fruit be one of the people favorite fruits because rich in vitamin C, good taste and affordable prices. Vitamin C is a water-soluble and temperature-sensitive vitamin found in living organisms[2]. It is an essential nutrient for various metabolism in the human body. Vitamin C is important for the growth and repair of the body such as bone, teeth, skin and other tissues[2]. The deficiency of vitamin C caused scurvy [3].The disease spectrum of scurvy is quite varied and includes dermatological, dental, bone and systemic manifestations[4].

Recommended Dietary Allowance (RDA) of vitamin C, as suggested by the Institute of Medicine 90 mg for males and 75 mg for females [5]. Human body is not able to make vitamin C on its own [5]. Therefore important to include plenty of vitamin C from food we eat, particularly fruit and vegetables. Food sources high in vitamin C include citrus fruits (orange, lemon, lime, grapefruit), papaya, mango, kiwi, strawberries, tomatoes, spinach, broccoli, peppers (red, yellow and orange), and asparagus [6]. Vitamin C is very unstable to air, light, heat, moisture, metal ions, oxygen, and base[7]. Therefore vitamin needs to be maintained in their storage to make them are not easily damaged.

Orange fruit is widely bought by people in large quantities because it is rich in vitamin C, delicious and cheap. Therefore there are various ways of storing orange fruit by

the people, some are stored in the refrigerator and some in room temperature, eaten directly or stored for several days. The objective of this research was to determine the effects of temperature (refrigeration temperature/8°C and room temperature/30°C) and storage time (1, 3 and 7 days) on vitamin C content in oranges fruit.

MATERIAL AND METHODS

Instrument

A Shimadzu The T70 series of uv-visible spectrophotometer with the optical path length of UV cells 10 mm is used.

Materials

Orange fruit (*Citrus reticulata* Blanco), distilled water, standard crystalline of vitamin C.

Sample Collection

Fresh orange fruit were directly collected from orange farm in Panta Pauh Matur, Agam Regency, Province of West Sumatera, Indonesia.

Sample Preparation

Orange fruit were sorted by similarity in size and weight (100-105 g), washed selected sample with distilled water to remove adhering dirting particles. Then divided into two groups, the first group for storage in room temperature and the second group for storage in refrigeration temperature. Each group divided again into 3 parts and labeled with 1, 3 and 7 based on storage time. Every part consists of 3 orange fruit. In the first day of storage time (orange fruit with labeled 1) analyzed vitamin C content by using uv-visible spectrophotometer, and the same handling for samples labeled 3 and 7.

Preparation of Stock Solution of Vitamin C 200 ppm

The stock solution of vitamin C was prepared by dissolving an accurate weight of 0.01 g of standard crystalline vitamin C with distilled water until border mark in 50 mL volumetric flask, shaken gently until a homogenous dispersion.

Determination of Wavelength of Maximum Absorbance of Vitamin C Solution

Take 0.5 mL vitamin C Solution 200 ppm from the stock solution and put it into a 10 mL volumetric flask. Then it was diluted up to the mark by distilled water and shaken it with gently until a homogenous dispersion, to make it into concentration 10 ppm. The maximum absorption is measured at a wavelength of 200-400 nm using the distilled water blank.

Preparation of the Calibration Curve of Vitamin C

Pipetted 0.2 mL, 0.3 mL, 0.4 mL, 0.5 mL and 0.6 mL from 200 ppm vitamin C solution (stock solution) into a 10 mL volumetric flask to make a concentration 4, 6, 8, 10 and 12 ppm. Then add with distilled water until border mark and shaken with gently until homogenous. Measured their absorption at the wavelength of maximum absorbance obtained before.

Determination of Vitamin C Content in Sample

Squeezed orange fruit, filtered it with clean flannel to get clearly fresh orange fruit solution. Then pipetted accurate 1 mL from freshly oranges fruit solution and diluted with 10 mL distilled water in 10 mL volumetric flask (M1). Pipetted accurate 1 mL from (M1) put into a 10 mL volumetric flask, add with distilled water until border mark and shaken it with gently until homogenous. Measured vitamin C content by using uv-visible spectrophotometer[8].

RESULTS

From this research that has been done the following results are obtained:

1. Determination of wavelength of maximum absorbance of vitamin C Solution occurred at 264 nm.
2. Determination absorption calibration curve of vitamin C has obtained regression equation y = 0.06226 x + 0.06172 with r2 = 0.9996.
3. Determination of vitamin C content in the oranges fruit obtained vitamin C content bellow:

Table 1: Vitamin C content in Orange Fruit using UV-Visible Spectrophotometer

Storage Time (in day)	Storage Temperature	
	Refrigeration Temperature (8°C)	Room Temperature (30°C)
1	4.7590 mg/L	5.5997 mg/L
3	4.1487 mg/L	5.2143 mg/L
7	3.4100 mg/L	3.6670 mg/L

DISCUSSION

Determination of vitamin C content use uv-visible spectrophotometer. Spectrophotometer has been preferred because it is a simple and fast method [9-11]. The wavelength of maximum absorbance of vitamin C solution used standard crystalline of vitamin C with a concentration of 10 ppm and measured in the wavelength range 200-400 nm. The wavelength of maximum absorbance of vitamin C solution is presented in figure 1. Figure 1 showed that the maximum absorption was at 264 nm, which is similar to the value previously reported, which was used to determine the analysis of vitamin C content in oranges fruit[12].

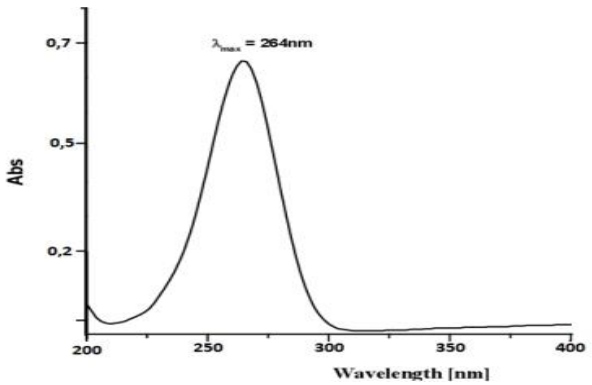

Figure 1: The wavelength of maximum absorbance of vitamin C 10 ppm

Determination absorption of the calibration curve of vitamin C has been carried out using series of vitamin C solutions (4, 6, 8, 10, 12 ppm). This series has been prepared from the stock solution of vitamin C 200 ppm. This measurement obtained regression equation y = 0.06226 x + 0.06172 with r2 = 0.9996 (y is the absorbance value and x is the compound content).

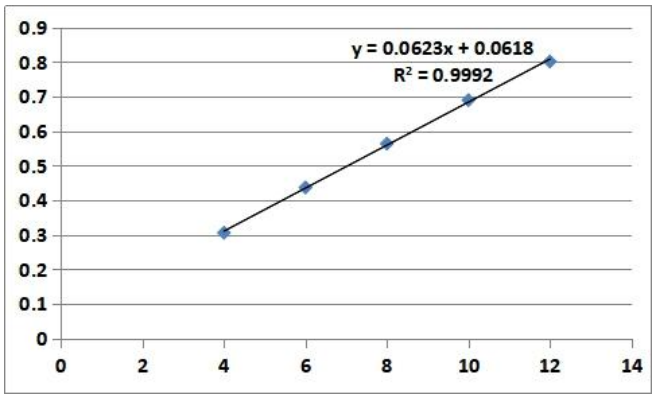

Figure 2: Calibration curve of vitamin C at wavelength 264 nm

To determine the vitamin C content in orange fruit, oranges fruit sorted by similarity in size and weight (100-105 g) to make a similarity of sample and washed with distilled water to remove adhering dirting particles. Then divided into several parts based on storage temperature and storage time. Then sample squeezed, filtered and diluted by pipetted accurate 1 mL sample transfer into a 10 mL volumetric flask, add with distilled water until border mark and shaken it with gently until homogenous (diluted 10 times).Then diluted again with taking accurate 1 mL sample pipetted from (diluted 10 times) put into a 10 mL volumetric flask, add it with distilled water until border mark and shaken it with gently until homogenous (diluted 100 times). This diluted 100 times is only used for oranges fruit that stored for 1 and 3 days, while orange fruit that stored for 7 days used diluted 50 times, because based measurement result of vitamin C content at diluted 100 times showed the absorbance value is too low and does not enter into the range absorbance of Lambert-Beer Law. According to Day and Underwood the relationship between absorbance and concentration will be linear if the absorbance value of the solution from 0.2 to 0.8 is often referred to as the law of lambert beer. If the absorbance obtained is greater or smaller then the relationship is not linear[13]. For making diluted 50 times, first pipetted accurate 1 mL sample solution into a 10 mL volumetric flask, add it with distilled water until border mark and shaken it with gently until homogenous (diluted 10 times), then diluted again by pipetted 2 mL sample from (diluted 10 times) into a 10 mL volumetric flask, add it with distilled water until border mark and shaken it with gently until homogenous (diluted 50 times), measured vitamin C absorbance at wavelength 264 nm by using uv-visible spectrophotometer.

Vitamin C content of orange fruit after stored at two kind temperatures: refrigeration temperature and room temperature for 1, 3 and 7 days show difference values presented in table 1. The difference in vitamin C content significant decreased in orange fruit that stored in 3 to7 days. Where in refrigeration temperature on storage time 3 to 7 days vitamin C content decreased 0.7387 mg/L and for room temperature on storage time 3 to 7 days vitamin C content decreased 1.5473 mg/L. These results indicate that temperature and storage time can be the factors that can reduce vitamin C content. Vitamin C content decreased faster at room temperature than orange fruit that stored in refrigeration temperature. This is similar to previous studies.[14] studied about vitamin C content of some fruit juices where the concentration of vitamin C decreased faster in room temperature than refrigeration temperature which vitamin C is lost during storage and significant loss of ascorbic acid in citrus fruits not so in pineapple, pawpaw and carrot samples[14]. It was also observed that the heating time has a significant effect on the vitamin C content of all vegetables, as the heating time increases, the percentage loss of vitamin C increases too[15-17]. Others study has been shown that temperature, the form of vitamin and the matrix are the factors affecting most the stability of vitamin C in foods and beverages. Lower storage temperature brings about higher retention of vitamin C[18] Thus the conclusion is the vitamin C content in oranges fruit effected by storage temperature and storage time, wherein vitamin C content decreases accelerated with higher storage temperature and longer storage time.

CONCLUSION

Based on the research we can conclude that vitamin C content in oranges fruit effected by storage temperature and storage time, wherein vitamin C content decreases faster in room temperature than refrigeration temperature and more decreases stored in 7 days than 3 days or 1 day, so vitamin C content decreases accelerate with higher storage temperature and longer storage time.

In this study, information is presented on the effect of storage temperature and storage time on the vitamin C content of orange fruit, which could generate useful information for consumers and may encourage them to consume orange fruit at appropriate storage conditions. Wherein the best storage temperature and storage time for optimal vitamin C content are in the low temperature and in the late storage time. Further studies on the effect of storage temperature and storage time of fresh orange juice will help and give more information to consumers, nutritionists, and government for health-promoting programs.

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REFERENCES

1. Anonymous. *An Overview of Spatial Policy in Asian and European Countries. Ministry of Land, Infrastructure, Transport and Tourism. Japan*. Accessed from https://www.mlit.go.jp on June 2019 ;12
2. Devaki, SJ and Reshma LR. 2017. *Vitamin C: Sources, Functions, Sensing and Analysis*. Internet :Intechopen.
3. Irma RV, Yessi A, Sepsina R, et al. 2023. *Dasar-Dasar Ilmu Gizi*. Padang : PT. Global Eksekutif Teknologi.
4. Clemens Z and Csaba T. Vitamin C and Disease: Insights from the Evolutionary Perspective.*Journal of Evolution and Health*,2019; 1(1):13.
5. Naidu KA. Vitamin C in human health and disease is still a mystery ? An overview. *Nutritional Journal*, 2003; 2(1):1-10.
6. Kucharski H and Julek Z. 2009. *Handbook of Vitamin C Research*. New York: Nova Science PublishersInc.
7. Barrita JLS, Maria SSS. 2013. *Antioxidant Role of Ascorbic Acid and His Protective Effects on Chronic Diseases*. Internet: Intechopen.
8. Desai AP and Shuchi D. UV Spectroscopic Method for Determination of Vitamin C (Ascorbic Acid) Content in Different Fruits in South Gujarat Region. Int J Environ Sci Nat Res, 2019; 21(1):0041-044.
9. Elgailani IEH, Mohamed AMGE, Elnoor AAN, Omer EAA, Ahmed MAA. Comparison of Two Methods for The Determination of Vitamin C (Ascorbic Acid) in Some Fruits. *American Journal of Chemistry*, 2017; 2(1):1-7.
10. Yulia M and Riki R. Uji Aktivitas Antioksidan Ekstrak Bunga Tahi Kotok (Tagetes erecta L.) Dengan Metode DPPH (1, 1-Difenil-2-Pikrihidrazil). *Scientia Jurnal Farmasi dan Kesehatan*, 2018; 8(1):98-103.
11. Yulia M and Riki R. Uji Aktivitas Antioksidan Teh Daun Sirsak (Annona Muricata Linn) Berdasarkan Teknik Pengolahan. *Jurnal Katalisator*, 2019; 4(2):84-90.
12. Carr AC and Margreet CMV. 2014.*Vitamin C and Human Health*. Switzerland: MDPI.
13. Day RA, Underwood AL. 2001. *Analisis Kimia Kuantitatif*, 6th ed. Jakarta: Erlangga.
14. Ajibola VO, Babatunde OA, Suleiman S. The Effect of Storage Method on the Vitamin C Content in Some Tropical Fruit Juices. *Trends in Applied Research*, 2009; 4(2):79-84.
15. Igwemmar NC, Kolawole SA, Imran IA. Effect of Heating on Vitamin C Content Of Some Selected Vegetables. *International Journal of Scientific & Technology Research, 2013;* 2(11):209-212.
16. Lee S, Choi Y, Jeong HS, Lee J, Sung. Effect of different cooking methods on the content of vitamins and true retention in selected vegetables. *Food Sci Biotechnol*, 2017; 27(2):333-342.
17. Giannakourou MC, Taoukis PS. Effect of Alternative Preservation Steps and Storage on Vitamin C Stability in Fruit and Vegetable Products: Critical Review and Kinetic Modelling Approaches. *Foods*, 2021; 10(11):2630.
18. Steskova A, Monica M, Emilia L. Vitamin C degradation during storage of fortified foods. *Journal of Food and Nutrition Research*,*2006;* 45 (2):55-61.