

ANALYSIS OF VITAMIN C LEVELS IN ORANGES (*Citrus sinensis* L.) VISIT WITH THE IODIMETRY TITRATION METHOD

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ARTICLE INFORMATION

Received: 4 May 2025

Revised : 9 July 2025

Accepted: 27 August 2025

DOI:

KEYWORDS

Levels, Sweet Oranges, Lassembangi, Vitamin C, Iodimetry

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A B S T R A C T

Oranges are a fruit known to have a relatively high vitamin C content compared to other fruits. This also applies to sweet oranges (*Citrus sinensis* L.) in Lassembangi Village, Lasalimu District, Buton Regency, but the vitamin C content in fruits, especially oranges, can vary depending on temperature, soil, light, and other factors. Objectives of this study was to determine the vitamin C content in Lassembangi oranges (*Citrus sinensis* L.) using the iodimetric titration method. Method used is experimental in the laboratory using iodimetric titration. Iodimetric titration works based on the redox reaction between iodine as an oxidizer and vitamin C as a reducer, iodine will be converted into iodide by vitamin C and when all the vitamin C is used up, the excess iodine will react with starch to form a blue color and this blue color indicates the end point of the titration. Results of the research that has been conducted obtained an average value of vitamin C content in sweet oranges (*Citrus sinensis* L.) A Blood Pressure of 68.29 mg. Conclusion based on the results of the research of the vitamin C content contained in sweet oranges in Lassembangi village obtained an average result of 68.29 mg and the vitamin C content in this orange can be said to be quite high compared to some oranges in other areas.

INTRODUCTION

The abundant biological wealth in Indonesia is well known, including various types of plants, one of which is oranges. Of the many fruits that exist, oranges are one of the people's choices for consumption. This plant comes from the family *Rutaceae* by genus *Citrus* (Priyambodo *et al.*, 2019). Citrus fruits are an important commodity in almost every region. The high vitamin C content in oranges is useful in maintaining immunity, for example preventing influenza. Other ingredients contained in citrus fruits are phosphorus and lime which are good for bone growth in children (Siwilopo and Marcos, 2023).

In general, oranges are known as one of the few major sources of vitamin C that are important for health. The vitamin C content in 100 grams of citrus fruits has approximately 40 to 70 mg, depending on the variety. Along with maturity, vitamin C levels usually decrease. The flesh of citrus fruits is high in vitamin C which can help strengthen the immune system, help prevent infections, and support the collagen synthesis process (Adelina *et al.*, 2017). The human body is unable to produce or store vitamin C, so vitamin C intake must be obtained regularly from the outside so that daily needs are still met (Widiyani *et al.*, 2022).

Vitamins are complex compounds that play an important role in supporting various metabolic processes of the body, so their deficiency can increase the risk of disease and reduce body function (Permana *et al.*, 2018). Water-soluble vitamins are vitamins that are easily absorbed but not much of the body stores them so that the excess will be excreted through urine, vitamin C is a water-soluble vitamin. Vitamin C is one of several nutrients that can be an antioxidant (Fitriana *et al.*, 2020). Antioxidants are compounds that function to ward off free radicals (Syafriah and Teheni, 2023). In addition, vitamin C has the benefit of protecting white blood cells and red blood cells from enzymes released when digesting the bacteria that have been ingested, helping the formation of collagen, treating canker sores and providing an increase in immunity as well as being an antioxidant (Haque and Yanuarto, 2023).

Measuring the level of vitamin C (ascorbic acid) in fruit needs to be done because the concentration or level of vitamin C can vary depending on the type of fruit and environmental conditions. One of the several methods commonly used in quantitative analysis is iodimetric titration (Erwanto *et al.*, 2018). The iodimetry titration method is a quantitative analysis technique that utilizes an oxidation-reduction reaction with an iodine solution. Iodine will react with a reducing agent in this case ascorbic acid, analysis using an iodine reducing agent or direct titration is also known as iodimetry titration. In direct titration, vitamin C levels are quantitatively determined through their equivalent points (Asmal *et al.*, 2023). Vitamin C is a compound that is susceptible to n or easily oxidizes into dehydroascorbic acid, so its vitamin C content can decrease and make it more susceptible to damage (Febriyani *et al.*, 2023).

Referring to several previous studies, considering the many species of oranges such as lime, kaffir orange, grapefruit and many more, from several differences ranging from different types, forms and content of vitamin C in them, even oranges with the same seedlings planted in different areas can potentially produce fruits with different qualities, shapes, tastes and even the vitamin C content in them is also potentially different.

METHODOLOGY

This research is a type of quantitative research that applies experimental methods in the laboratory. This research will be held in May 2025 and will take place at the Pharmacy Laboratory of Baubau Polytechnic. The tools used in this study include burettes, bunsen, measuring cups, glass funnels, chemical cups, drip pipettes, tripods, analytical scales, horn spoons, staves and clamps, erlenmeyer stirring rods, filter paper, parchment paper, measuring flasks, gauze wire, watch glass and blenders. The materials used in the study were 1% amylum, KI crystals (Potassium Iodide), 0.01 N iodine solution, sodium thiosulfate ($\text{Na}_2\text{S}_2\text{O}_3$) and aquadest. The sample used was sweet orange fruit (*Citrus sinensis* L) Lasembangi, the sample was taken directly from a farmer's garden in Lasembangi village, South Lasalimu District.

Sample Preparation

Peel the oranges, then separate the seeds and the flesh of the oranges. After that, it is weighed as much as 100 grams, then blended with orange pulp until orange juice is obtained, then 25 mL of samples are taken and put into a measuring gourd, then diluted with aquadest until the boundary mark.

Manufacture of amylum 1% indicator

Amylum weighed 2 grams and dissolved using 100 mL of hot water in a beaker, the solution was used as an indicator (Fitriana and Fitri, 2020).

Manufacture of standard solution of 0.1 N Iodine

Weighted 4 grams of potassium iodide and dissolved in 100 mL of aquadest. Next, 3.17 grams of iodine was weighed and slowly put into a solution of potassium iodide while stirring until everything dissolved. Next, the transferred solution is transferred into a measuring flask and diluted with aquadest until the impression mark.

Manufacture of standard solution $\text{Na}_2\text{S}_2\text{O}_3$ 0.1 N

Weigh 6.5 grams of sodium thiosulfate, then put it in a beaker and dilute it with 250 mL of aquadest and stir until homogeneous.

Standardization of iodine solution (I_2)

Prepared with a standardized 0.1 N sodium thiosulfate, the iodine solution is taken as much as 25 mL and put into the erlenmeyer, 2 mL of 1% amylum is added and titrated with $\text{Na}_2\text{S}_2\text{O}_3$ which ends when the blue color of the solution has just disappeared, record the volume of $\text{Na}_2\text{S}_2\text{O}_3$ by looking at the number on the burette. The standardization of solution I_2 with $\text{Na}_2\text{S}_2\text{O}_3$ solution was carried out three times of replication (Triplo).

Formula:

$$\text{Baku } N_{\text{I}_2} = \frac{N_{\text{Na}_2\text{S}_2\text{O}_3} \times V_{\text{Na}_2\text{S}_2\text{O}_3}}{V_{\text{I}_2}}$$

N_{I_2} : Normality of Iodine

V_{I_2} : Titration Volume (mL)

$N_{\text{Na}_2\text{S}_2\text{O}_3}$: Normality of Sodium Thiosulfate

$V_{\text{Na}_2\text{S}_2\text{O}_3}$: Sodium Titration Volume Tiosulfate

Determination of Vitamin C levels of Lasembangi Oranges

Take 10 mL of Lasembangi orange filtrate, put it into 125 mL of erlenmeyer and add 2 mL of 1% amylum solution and 20 mL of aquadest. Next, it was titrated using a 0.1 N iodine solution until the color of the solution became blue violet, three times treatment.

Formula for calculating vitamin C levels:

$$\text{Vitamin C levels} = \frac{V_{\text{I}_2} \times N_{\text{I}_2} \times \text{MrC}_6\text{H}_8\text{O}_6 \times F_p}{\text{Lots of Samples}}$$

Description:

V_{I_2} : Titration volume (mL)

N_{I_2} : Normality of Iodine

Mr : Molar Mass

RESULTS & DISCUSSION

Before determining the level of vitamin C, the first step that needs to be taken is to determine the standardization of the I_2 solution. The purpose of standardization is to standardize iodine solutions as a secondary standard that must be standardized.

Table 4.1 Determination of Concentration Standardization I_2

Volume I_2	Volume $Na_2S_2O_3$			Average	Rate I_2 (N)
	I	II	III		
25 mL	17 mL	17 mL	17 mL	17 mL	0.068 N

Source : Primary Data, 2025

In table 4.1 Based on the titration results, a standard I_2 level of 0.068 N was obtained which will be used as a titer solution in the iodimetric titration method.

Furthermore, in this study, titration was carried out three times (Triplo) in order to find out how much vitamin C content is in sweet citrus fruits (*Citrus Sinesis L*) Lasembangi using the iodimetric titration method. It can be observed in the following table:

Table 4.2 Results of Determination of Vitamin C Levels in Sweet Oranges (*Citrus Sinesis L*) Lasembangi

Sample	Multiple Samples (mL)	Titran Volume (mL)	Replication	Vitamin C Levels (mg/gram)
Citrus fruits	10	14,5	I	69,41
	10	14,3	II	68,45
	10	14	III	67,02
Average				68.29 mg/gram

Source : Primary Data, 2025

In table 4.2 The average result of vitamin C levels in Lasembangi oranges was 58.29 mg/gram.

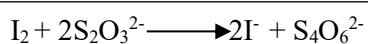
The iodimetry titration method was used in this study to determine the level of vitamin C (ascorbic acid) in sweet citrus fruits (*Citrus sinensis L*) Lasembangi. Iodimetric titration is known to be a redox titration with a standard solution of I_2 as the titrate.

The first thing that was done during the research was that the citrus fruit samples were peeled and separated from the peel and seeds. Then 100 grams of emudian oranges are weighed and blended until smooth and resembling juice, after which the sample is filtered using filter paper to take the filtrate. Furthermore, the samples that have been filtered are measured with a measuring cup of 25 mL and put into a measuring gourd, then aquadest is added to the mark and ready to be sampled. This filtration is carried out in order to get orange fruit filtrate that is free of coarse particles so as not to use the titration process.

Amylum is weighed as much as 2 grams, then dissolved in 100 mL of aquadest that has been heated after which the solution is cooled. Amylum is dissolved in hot water because amyllum is a starch that cannot be dissolved in cold water or plain water. Amyllum here serves as a color change indicator that marks the titration endpoint. Next, weigh KI (Potassium iodide) as much as 4 grams dissolved in 100 mL of aquadest. Potassium iodide helps iodine to dissolve by forming triiodide ions that are stable and soluble in water. I_2 weighed 3.17 grams and put into the KI solution little by little while stirring until completely dissolved. A 0.1 N iodine solution is used to test or detect the presence of amyllum. Once the iodine solution is dissolved with vitamin C, iodine is trapped in amyllum and turns blue at the titration endpoint.

In the titration for the standardization of sodium thiosulfate and iodine, the iodine solution added amyllum will form a blue complex. This blue color indicates the presence of free iodine in the solution. When titration is carried out with a solution of sodium thiosulfate, iodine undergoes a redox reaction, which is reduced to iodide ions, while sodium thiosulfate is oxidized into tetrathionate ions so that the titration end point is reached when all the iodine has reacted and causes the amyllum-iodine complex to decompose and the blue color disappears to become clear. In determining vitamin C levels, iodine reacts with dehydroascorbic acid. If all of the vitamin C is depleted, the remaining excess iodine will react with amyllum producing a blue color as the titration endpoint.

The chemical reactions of the Standardization of $Na_2S_2O_3$ and I_2 are:



The chemical reaction of ascorbic acid to dehydroascorbic acid is:

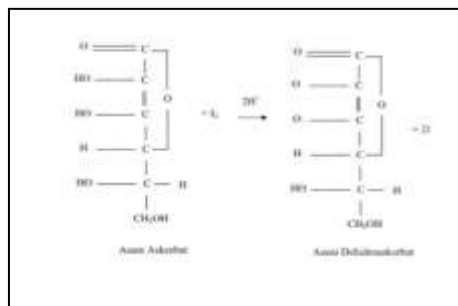


Figure 4.4 Reaction of ascorbic acid with iodine (Source; Hayati *et al.*, 2023)

To determine the vitamin C content of Lasembangi oranges, the samples used were taken directly from farmers' gardens in Lasembangi Village. The test was carried out three times and the results were obtained, the first test was 69.41 mg, the second test was 68.45 mg and the third test was 67.02 mg, which can be seen in table 4.2. There is a difference in each experiment because the test is done manually so that there is a difference in each titration.

According to (Rahayuningsih *et al.*, 2022) "Analysis of Vitamin C in Pasaman Oranges to Increase Immunity During the Covid-19 Pandemic" the average vitamin C level of Pasaman oranges is 48.32 mg per 100 grams. According to (Alhanannasir *et al.*, 2021) "Community Empowerment Through the Making of Orange Fruit Syrup in Sungai Ketupak Village, Cengal District" the content of vitamin C has various variations between varieties, approximately between 27-49 mg/100 grams of fruit pulp and orange juice has a content of 40-70 mg of vitamin C per 100 grams depending on the type of orange. While the results of research that have been carried out with citrus fruit samples in Lasembangi Village obtained an average result of vitamin C of 68.29 mg/gram of citrus fruits, the vitamin C content in citrus fruits can be said to be quite high.

Based on the results of the research that has been carried out, it was found that the vitamin C content in the sample is different from citrus fruits in other areas, depending on the environmental conditions where it is grown. Every factor such as soil, temperature, humidity and light directly affects the content of active compounds in a plant/plant, including Lasembangi citrus fruit, so the results obtained can be different from studies in other locations.

CONCLUSION

Based on the results of the analysis of vitamin C levels in sweet citrus *fruits (Citrus sinensis L.)* Visiting with the iodimetry titration method carried out, the average value of vitamin C levels of citrus fruits was obtained as much as 68.29 mg.

This study has a number of limitations, namely the samples used only come from one location so that they are not fully representative of the entire orange population in Lasembangi village. The vitamin C content in fruit is influenced by various factors such as environmental conditions, fruit age, light and harvest time, but this study does not control for all these variables. In addition, the iodimetry titration method used has limitations in terms of accuracy to read the titration endpoints.

ACKNOWLEDGMENTS

The author humbly thanked his beloved parents, who continued to pray, support and bestow affection on the author. Gratitude was also presented to Mrs. Apt. Sri Yolandari S. Farm., M.Si as supervisor 1 and Mr. Muhammad Tasjiddin Teheni, S.Si., M.Si as supervisor 2 who always provided input and direction during this preparation.

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