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Literature Review Journal Analysis of Ascorbic Acid Levels in Fruits Using Titrimetric Method

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A B S T R A C T

Quantitative analysis is done to determine the levels of vitamin C in the sample. This review article will review the quantitative analysis method of vitamin C. The quantitative analysis used is an analysis using the titrimetric method. Vitamin C is a water-soluble antioxidant that affects the body's immune system. Vitamin C deficiency will result in the risk of contracting diseases, such as infectious diseases. Consumption of vitamin C of 100-200 mg/day can optimize body function at the tissue and cell levels. Fruits are a source of vitamin C that can be consumed to meet vitamin C needs

INTRODUCTION

Vitamins are organic substances that generally cannot be produced by the body. Vitamins function as organic catalysts, helping to regulate metabolic processes and maintain normal body functions. In the body, vitamins play a major role as regulators and co-formers of other nutrients, especially through the formation of enzymes, antibodies, and hormones. Each vitamin has a specific function that cannot be replaced by other vitamins or nutrients. Therefore, even though only small amounts such as milligrams or micrograms are needed, this amount is very important for health. (Moehji, 2001).

In general, vitamins are grouped based on their solubility into two types: fat-soluble vitamins and water-soluble vitamins. Fat-soluble vitamins include vitamin A (retinol), vitamin D (calciferol), vitamin

E (tocopherol), and vitamin K (menadione). Meanwhile, water-soluble vitamins include vitamin C, vitamin B1 (thiamine), vitamin B12 (cyanocobalamin), niacin, folic acid, pantothenic acid, and vitamin H (biotin) (Moehji, 2001).

Vitamin C or L-ascorbic acid is an acid compound with the empirical formula C6H8O6 (molecular weight 176.13). Vitamin C is a white crystal that is easily soluble in water. In dry conditions, vitamin C is quite stable; however, in solution, this vitamin is easily damaged by contact with air (oxidized), especially if exposed to heat. This oxidation process can be accelerated by the presence of metals such as copper and iron. Vitamin C is unstable in alkaline solutions, but relatively stable in acidic solutions. Vitamin C is difficult to dissolve in chloroform, ether, and benzene. This compound is more stable at low pH than high pH. Vitamin C is very easily damaged by heat because of its easily oxidized nature. Loss of vitamin C can occur due to heating that damages the structure, an alkaline environment during processing, or exposure to air that causes irreversible oxidation. The oxidation process in vitamin C is accelerated by heat, light, or oxidation enzymes, as well as by catalysts such as copper and iron. However, oxidation can be prevented by keeping vitamin C in acidic conditions or at low temperatures (Almatsier 2004)

Ascorbic acid, or better known as vitamin C, is one of the essential vitamins that is greatly needed by the human body. Vitamin C plays an important role in metabolic activities and the formation of intracellular collagen (Badriyah & Manggara, 2017). Fruits are high sources of vitamin C, such as berries, oranges, apples, tomatoes, jackfruit, mangoes, and pineapples. In addition, vitamin C functions to help the absorption and metabolism of iron. Vitamin C converts iron from ferric to ferrous in the small intestine so that it is more easily absorbed. Another function is as an infection preventative (Pauling, 1971). Research also shows that vitamin C is related to cholesterol metabolism, where vitamin C deficiency can increase cholesterol synthesis. (Khomsan, 2010). If the need for vitamin C consumption is met, the body will be protected from diseases caused by vitamin C deficiency (Siti et al., 2016).

The recommended daily intake of vitamin C for adults ranges from 30 to 100 mg, although individual needs may vary. Vitamin C deficiency can cause various health problems, such as mouth ulcers, chapped lips, weakness, muscle spasms, decreased appetite, bleeding gums, and dry mouth and eyes. In addition, vitamin C deficiency can also cause dry skin and hair loss. Many people consume vitamin C tablets available on the market as a substitute for vitamins that are usually obtained from natural sources. (Kharina, 2008). In addition, excessive consumption of vitamin C can cause diarrhea, kidney stone formation, and changes in the menstrual cycle in women, especially if vitamin C intake exceeds 1000 mg per day (Pangestu, 2010). Therefore, it is necessary to conduct a trial to measure vitamin C levels in order to overcome the problem of vitamin C deficiency or excess according to the needs of each individual.

LITERATURE REVIEW

Fruits that contain vitamin C have several characteristics, in terms of taste, color, and texture. The following are the criteria for fruits rich in vitamin C, namely, High Antioxidant content, Sour or Sweet-Sour Taste, Bright Fruit Color, High Water Content, Reactivity to Oxidation (Browning) and High Acid Content. Determination of vitamin C levels in food can be done through various methods, one of which is the titrimetric method. The titrimetric method is a chemical analysis procedure that measures the amount of titrant solution that reacts with the analyte. The titrant solution is a solution used in titration and is usually a standard solution, namely a solution with a known concentration. The titration process is carried out by adding titrant little by little to the analyte. The basic principle of the titrimetric method involves the oxidation of ascorbic acid by dichlorophenol-indophenol to dehydroascorbate compounds. The end point of titration is marked by the appearance of a red color indicating excess dichlorophenol-indophenol (Andarwulan and Koswara 1992).

METHODOLOGY

In compiling this article, the method used is a literature review method from various existing sources. We search for data and information from journals published between 2014 and 2024, then summarize the information and compile it into a prepared table. The topic we raise in this review article is Analysis of Ascorbic Acid Levels by Titrimetric Method

RESULTS AND DISCUSSION

Fruits are part of a plant that is formed from flowers after pollination and fertilization. The main function of the fruit is to protect and disperse seeds, which are the result of the fertilization of egg cells by pollen. In botany, fruit is defined as a structure that contains seeds and plays a crucial role in plant reproduction. Fruits are known not only for their varied shapes, colors, and flavors, but also for their abundant nutritional content and the health benefits they offer. Fruits contain various nutrients that are important for health, including vitamins, minerals, fiber, antioxidants, water, carbohydrates, and phytochemicals. Vitamins are a group of organic compounds that play an important role in cell growth and function, maintaining health, and ensuring that the body's metabolism runs smoothly (Putri & Setiawati, 2013). Many vitamins come from natural sources such as fruits, and some are synthesized in the laboratory. One example is vitamin C, which often gives fruit a sour taste. Vitamin C, also known as Lascorbic acid, is an acid compound with the empirical formula $C_6H_8O_6$ and a molecular weight of 176.12 g/mol (Porto et al., 2016). In its pure form, vitamin C appears as a white crystal that is colorless, odorless, and begins to melt at temperatures between 190-192°C (Febrian, Julianti & Rusmarilin, 2016). This compound has properties as a strong reducing agent and has a sour taste. Vitamin C is very soluble in polar compounds or water (1 g can dissolve completely in 3 ml of water), slightly soluble in alcohol (1 g dissolves in 50 ml of alcohol or 100 ml of glycerol), and insoluble in benzene, ether, chloroform, or oil (Sulistyowati, 2018). In addition, vitamin C is unstable in solution, especially when exposed to air, metals such as copper (Cu), iron (Fe), and light (Seal T, 2016). Vitamin C is an unstable compound in solution, especially when exposed to air, metals such as copper (Cu) and iron (Fe), and light (Seal T, 2016). This compound is a sugar acid that is found in abundance in fresh fruits and vegetables. Vitamin C functions as an antioxidant and plays an important role in the formation of collagen in the body, helps the absorption of iron, and maintains the health of capillary blood vessels, bones, and teeth. The recommended daily requirement for vitamin C intake ranges from 60-90 mg (Fitriana Y & Fitri A, 2020).

Antioxidants have the potential to boost the body's immune system and protect the body from various conditions associated with free radicals. Based on existing research, antioxidants can actively lower cholesterol levels in the body. This has been proven by the fact that this compound contributes to reducing cholesterol levels in the blood.

Titrimetric method is a quantitative analysis method used to determine the concentration of a substance in a solution by adding a standard solution (titrant) gradually until it reaches the end point of the reaction. This technique is based on the principle of chemical reactions, where the titrant reacts with the analyte (substance being analyzed) in a measurable amount. Titrimetric methods are widely used in various fields, such as chemistry, pharmacy, and food analysis, to analyze various compounds such as acids, bases, and salts.

The advantages of the Titrimetric Method include: high accuracy: accurate results thanks to the use of standard solutions, simple and economical: easy to do and low operational costs, various measurements: can measure various compounds, including acids, bases, and salts, easy to do: can be done, with basic equipment without in-depth training. reproducible results: Consistency of results if the procedure is followed correctly, versatile method: there are various types of titrations (acid-base, redox, complexation, precipitation), clear end point: the use of indicators makes it easy to determine the end point of the reaction. the titrimetric method is an important tool for the analysis of substances in solution, offering high efficiency and accuracy.

Table 1. Results Table Of Journal Review

No	Title of Journal	Chemical Compounds	Pharmacological Activity	References
1	The Production Of Mango (Mangifera Indica L) Powder Instant	Asam askorbat, Karotenoid dan Fenolik	F The reaction of mango fruit extract with diethyl ether showed antioxidant activity, as measured by the IC50 value of 75.22 ppm, while for Vitamin C, the IC50 value was 1.18 ppm.	Sri Agustini,
2	Vitamin C Analysis in Rambusa Fruit (Passiflora foetida L.)	Calcium, Iron, Antioxidants and Minerals and Vitamin C	The vitamin C content in raw rambusa fruit is 1.31 mg/g, while in ripe rambusa fruit, the content increases to 2.21 mg/g.	**Karmila & S, Nuryanti**

3	The Effect of Guava Juice Storage Factors on Vitamin C Content	Likopen, Karoten, Polifenol, dan Flavonoid	Antimicrobial, Antioxidant, Anti-Inflammatory, Antidiabetic	**Fenny Purbariny.**
4	Analysis of Vitamin C Levels in Lime (Citrus Aurantifolia Swing). and Sweet Orange (Citrus Sinensis) Using Lodometric Titration	Ascorbic Compounds, Iron, Collagen, Vitamin C, Antioxidants	Vitamin C is an unstable compound in solution, especially when exposed to air, metals such as copper (Cu) and iron (Fe), and light.	**Seal T**
5	Effect of Pasteurization Temperature on Color, Vitamin C and Betacarotene Content in Pineapple Starfruit Juice	Batacarotene, Carotenoids, Flavonoids	The vitamin C content in star fruit is quite high, reaching 35 mg per 100 grams, while pineapple contains 24 mg of vitamin C per 100 grams.	**Dep Kes**
6	Kinetic Study of the Effect of Storage Time on Vitamin C Levels in Malang Apples	Synthetic Additives, Ascorbic Acid, Dehydroascorbic Acid	The vitamin C content is expressed as a percentage (% w/w), which is the number of grams of vitamin C contained in 50 grams of Malang apples analyzed using the iodimetric titration method.	**Aprilianti**

7	Analysis of Vitamin C Levels in Mangosteen Fruit Sold at Terong Market, Makassar City	vitamin C	The vitamin C content in mangosteen sold at Pasar Terong, Makassar City, is 0.05909 mg per gram..	**Hasbi**
8	Determination of Vitamin C Levels and Crude Fiber Levels Contained in Starfruit, Mango, Pineapple and Papaya Fruits	vitamin C	The levels of vitamin C in star fruit, mango, pineapple, and papaya are 1.62 mg/g, 0.36 mg/g, 0.12 mg/g, and 6.77 mg/g, respectively.	**Fitriah Khoirunnisa**
9	Analysis of Vitamin C and Calcium in Jongi Fruit (DILLENIA SERRATA THUNB) Based on Ripeness Level	Vitamin C	The vitamin C content in jongi fruit varies based on its level of ripeness, namely 81.84 mg per 100 grams for those that are starting to ripen, 114.4 mg per 100 grams for those that are ripe, and 70.4 mg per 100 grams for those that are overripe.	**Miryam Betrice Kalase**
10	Analysis of Acid Content in Red Dragon Fruit (Hylocereus Polyrhizus) Using Iodimetry	Vitamin C	The vitamin C content in dragon fruit increased until the 6th day, reaching 19.6784 mg per 100 grams, but decreased on the 8th day to 14.1395 mg per 100 grams of sample.	**Mulawarman**

11	Application of Bamboo Shoot Extract as Natural GA3 Improves the Quality of Grapes (Vitis vinifera L.) Kediri Kuning Variety	Vitamin A, Vitamin B6, Vitamin C, Vitamin B1, Vitamin K, Gibberellic Acid (GA3)	Bamboo shoot extract with a concentration of 50% as a source of GA3 can increase the number of berries per bunch, berry weight per bunch, vitamin C content, antioxidant capacity, as well as the number of seeds per berry, seed weight per berry, and total acid.	**Jeni Rambu Yaku Danga**
12	Analisi Kandungan Vitamin C Pada Buah Sawo (Achras Zapota) Berdasarkan Lama Penyimpanan	Vitamin C	The vitamin C content in sapodilla fruit decreases with storage time, which is 5.9 mg per 100 grams on the 0th day of storage, 3.2 mg per 100 grams on the 5th day, and 2.7 mg per 100 grams on the 10th day.	**Insan Cendikia**
13	Perbandingan Hasil Penetapan Kadar Vitamin C pada Buah Kiwi (Actinidia deliciousa) dengan Menggunakan Metode Iodimetri dan Spektrofotometri UV-Vis	Vitamin C, A, dan E	Kiwi fruit is rich in various vitamins, including vitamins C, A, and E, which function as antioxidants to fight free radicals that can cause cell aging and trigger various diseases.	**Asrul**
			The vitamin C content in golden kiwi fruit is higher than that in green kiwi fruit, which is 105.4 mg per 100 grams for golden kiwi and 92.7 mg per 100 grams for green kiwi.	

14	Application of Iodometric Titration Method for Determination of Vitamin C Levels in Guava (Myrtaceae family)	Vitamin C	Guava is one of the fruits that contains vitamin C around 80 mg per 100 grams. Vitamin C functions as an antioxidant, and the vitamin C content in guava has benefits for treating scabies.	**Yeni Utami Dewi, Sumantri PIU**
15	Determination of Vitamin C Levels in Kalamansi Syrup Using Iodimetric Titration Method	Vitamin C, Citric Acid and Minerals	Kalamansi Syrup from Padang Serai, Sentra Beringin Raya, and Sentra Teluk Segara contains vitamin C, where Kalamansi Syrup from Sentra Teluk Segara has the highest vitamin C content, which is 0.050% (b/b).	**Usi, Dira & Krisyanella**
16	Digital Image Processing to Determine Ascorbic Acid Levels in Fruit Using Iodimetric Titration Method	Vitamin C, Iodine and Starch	The average percentage of ascorbic acid content in lime obtained using digital image processing is 0.037% and direct observation is 0.031% so that the average error in determining the ascorbic acid content in fruit using digital image processing is 17.54%.	**Yudho, Farrady & Mochtar**

17	Analysis of Vitamin C Levels in Oranges Using Iodometric Titration Method	Vitamin C, Iodine, Sulfuric Acid / Acetic Acid and Starch	The average vitamin C content in the Berastagi orange sample is 13.21%, while in the tangerine sample, the vitamin C content is 12.33%. Thus, there is a difference of 0.88% between the two types of oranges.	**Yolla & Ardhista**

CONCLUSIONS AND RECOMMENDATIONS

Based on our literature review, analysis of ascorbic acid in fruits using titrimetric method showed that mango fruit extract with diethyl ether has antioxidant activity with IC50 value of 75.22 ppm, while vitamin C has IC50 value of 1.18 ppm. Vitamin C content in rambusa fruit increases from 1.31 mg/g in raw condition to 2.21 mg/g when ripe. Star fruit contains 35 mg of vitamin C per 100 g, while pineapple contains 24 mg per 100 g. Vitamin C in golden kiwi is higher (105.4 mg/100 g) than green kiwi (92.7 mg/100 g). The average vitamin C content in Berastagi orange is 13.21%, while tangerine is 12.33%, with a difference of 0.88%. The highest ascorbic acid content is found in golden kiwi fruit.

FURTHER STUDY

This research still has limitations, so it is necessary to carry out further research related to the topic of Literature Review Journal Analysis of Ascorbic Acid Levels in Fruits Using Titrimetric Method in order to improve this research and add insight to readers.

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