Determination of Vitamin C Levels in Limes(Citrus aurantifolia Swingle) and Lemon (Citrus limon (L.) Burm. f.) Using the UV Vis Spectrophotometric Method

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ABSTRACT

Vitamin C or ascorbic acid is one of the vitamins needed by the body which functions to help the body's metabolic processes and plays a role in the formation of intercellular collagen. The source of vitamin C in food mostly comes from fresh vegetables and fruit. Limes and lemons are plants that contain vitamin C and have many benefits for the body. This research The aim was to determine the levels of vitamin C in limes (Citrus aurantifolia) and lemon (Citrus Limon) are planted in the area Situmandala Rancah District using UV-Vis Spectrophotometry at a wavelength of 400-600 nm. The samples for this research were limes and lemons. The results of this research showed that the vitamin C level in limes was 0.218% and in lemons it was 0.816%.

INTRODUCTION

Vitamin C is an important nutrient for biochemical processes in the human body. The human body cannot produce ascorbic acid, so it must be obtained from food intake. Vitamin C deficiency in humans can cause various diseases including bleeding of the gums (especially in the gums), joint pain, and fatigue (B.K Kramer, 2019). Sources of Vitamin C can include fruit, vegetables, fish and several other processed products. Lestari (2019). Deficiency can cause atherosclerosis. Vitamin C has a relationship with cholesterol metabolism. Vitamin C deficiency causes increased cholesterol synthesis (Khomsan, 2010). In the research that has been carried out, the vitamin C levels in Berastagi oranges and tangerines show that the vitamin C levels in Berastagi oranges are higher than in Tangerines with a difference of 0.88% (Yolla, 2020).

Lemon is a fruit that is rich in vitamin C and antioxidants which are beneficial for the human body. Lemon contains 3.7% citric acid and vitamin C 40-50 mg / 100 g (Kristanto, 2013). Lemon has many benefits for the body and has a low pH of 2.74. Water with lemon slices will taste fresh and have a distinctive aroma, not sweet like juice or fruit juice because there are no added additives (Haitami et al., 2017). Determination of vitamin C contained in food and drink samples can be determined using the titrimetry method (Rahmawati, et al., 2016; Siti, et al., 2016). There are many methods that can be used to determine vitamin C levels in samples, including titrimetric method (Rahmah Kurnia Ramdan, 2019) and spectrophotometry (Li Y et al, 2007). Determination of vitamin C levels was carried out using titrimetry and UV spectrophotometry methods on vegetable samples based on time, cooking process and frozen (Intisar et al, 2019). The UV-Vis spectrophotometer method is more accurate than the titration method in determining vitamin C levels in samples. The UV-Vis spectrophotometer has a UV wavelength of 200 – 400 nm and a visible wavelength of 400 – 700 nm. In this wavelength range, the analyte compound provides its absorbance (Pratama et al., 2018). The maximum wavelength of vitamin C is 266 nm (Mulyani, 2018). Determination of vitamin C levels using the ultraviolet spectrophotometric method with validation tests (Ramdan and Wulandari 2023). The method consists of tests for accuracy, sensitivity, linearity, detection limit and quantitation limit (Dayane et al, 2016).

TOOLS AND MATERIALS

The ingredients used in this research were lime juice, lemon juice, standard vitamin C, 2,6 dichlorophenol indophenol, HCL, Mg powder, amyl alcohol. The tools used are 100 ml, 200 ml measuring flasks, test tubes, volume pipettes, analytical scales, UV Vis spectrophotometric instruments, Erlenmeyer, beakerglass.

METHODS

a. Preparation of materials

The lime used is a thin-skinned lime 200 ml of green, and 200 ml of lemon which is embedded in the Situmandala area, Rancah District.

b. Phytochemical screening

Flavonoid screening Flavonoid screening in lime and lemons was carried out by taking 5 ml of each, then add 1 ml of concentrated HCL, 0.2 grams of Mg powder, and 1 ml of amyl alcohol, then shake and let it separate and change color.

c. Preparation of 1000 ppm Stock Solution.

Weigh 100 mg of Vitamin C into a measuring flask 100 ml, dissolve using distilled water until the limit mark, shake until dissolved.

d. Preparation of 2,6-Dichlorophenol Indofenol Solution

This reagent is prepared by dissolving 50 mg of Na 2,6-Dichlorophenol Indofenol which has been stored in a desiccator in 200 ml of water to which 50 mg of sodium has been added bicarbonate, then shake vigorously.

e. Preparation of Vitamin C Standard Series Solutions

Make a vitamin C 10 solution ppm, 20 ppm, 30 ppm, 40 ppm, 50 ppm, and 60 ppm with take each 0.5 ml, 1 ml, 1.5 ml, 2 ml, 2.5 ml, and 3 ml of 1000 ppm stock solution, were added into 50 ml measuring flask then add distilled water to the mark. Add 2,6-Dichlorophenol Indofenol solution until color change occurs.

f. Determination of Maximum Wavelength

Determination of the maximum wavelength was carried out in the range 400-600 nm using a solution at a concentration of 10 ppm.

g. Determining Operating Time

Determining the operating time was carried out using a 10 ppm vitamin C solution, measured every 5 minutes for 1 hour until a constant absorbance value was obtained.

h. Determination of the Standard Curve

The series solutions that have been prepared have their absorbance values measured at a wavelength of 400-600 nm. The concentration of the series solution is 10 ppm, 20 ppm, 30 ppm, 40 ppm, 50 ppm, 60 ppm, and also blank. After obtaining the absorbance value, a linear equation was created between the concentration and absorbance value to obtain a standard curve equation.

i. Calculation of Vitamin C levels in samples

Samples of lime and lemon were filtered and then taken 5 ml each, put into a 100 measuring flask ml then add distilled water until the length is marked wave 400-600 nm. After that, the absorbance value was measured, plug it into the linear equation of the standard standard curve.

j. Data analysis

The data obtained is in the form of absorbance values then entered into the standard curve linear equation formula as a function of Y from the standard curve results (Sugiyono, 2012), through the equation: Y= bx+a.

From the equation above, the x value will be obtained as the concentration of vitamin C in the sample (ppm). Next, the percent content is calculated using the equation:

$$\% \text{ vitamin C levels} = \frac{concentration \; x \; volume \; x \; dilution \; factor}{sample \; weight} x \; 100\%$$

RESULTS

a. Phutochemical screening

Table.1 Results of phytochemical screening on limes and lemons

Phytochemical substances	Reagent	Sample of lime	lemons	Result
Flavonoid	Mg powder, HCl, Amyl alcohol	+	+	Yellow

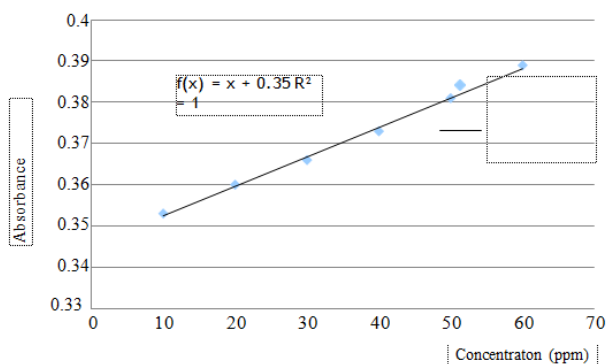b. Results of determining the standard curve

Figure.1 Vitamin C standard curve

c. Results of determining vitamin C levels

Table.2 Results of determining lime levels

Sample replication	Weight of sample (gr)	Absorbance	Level vitamin C (%)	Average (%)
1	5 gr	0.409	0,182	
2	5 gr	0.441	0,273	0,218 %
3	5 gr	0.415	0,199	

Table.3 Results of determining lemon levels

Sample replication	Weight of sample(gr)	Absorbance	Level Vitami C (%)	Average (%)
1	5 gr	0.618	0,779	
2	5 gr	0.622	0,905	0,816 %
3	5 gr	0.613	0,765	

DISCUSSION

From the results of this research, it can be seen that the concentration in the lime sample was 0.218%, and in the lemon sample it was 0.816%. According to the AKG, children over one year old need a vitamin C intake of 40-45 mg. Meanwhile, teenagers aged over 12 years need to meet their daily vitamin C needs of 65-90 mg. So it can be concluded that the level of vitamin C contained in 100 grams of lime juice planted in the Situmandala area, Rancah subdistrict contains vitamin C levels of 218 mg, while the level of vitamin C contained in lemons weighing 100 grams of juice contains vitamin C of 816 mg, so that a person consuming 1 lime or lemon with an average water content of 50 grams can exceed the adequate intake of vitamin C.

CONCLUSION

The conclusion from this research is that the vitamin C level in limes is 0.218%, and in orange samples it is 0.816%. Lemons have four times higher vitamin C content than limes.

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