DETERMINATION OF VITAMIN C RED GUAVA (PSIDIUM GUAJAVA LINN) FRUIT JUICE, WITH VARIATION OF BEVERAGE PACKAGING

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Abstract- The quantitative analysis of vitamin C content from variations beverage packaging containing red guava (Psidium Guajava Linn) fruit juice had been done. In this study, 4 samples were obtained from the shopping center in Garut and Bandung City. Samples were tested quantitatively by 2,6-dichlorophenol indophenol titration method. The results showed different concentration of 4 samples consist of tetra pack packaging, tin, glass, and plastic bottles, such as; 17.99 mg/100 gr, 31.46 mg/100 gr, 13.00 mg/100 gr, and 12.01 mg/100 gr, respectively. These result indicated that the packaging variations affected to the level of vitamin C content which was characterized by decreased levels of vitamin C. It means the levels of vitamin C from this research were not in accordance to nutritional value information on the packaging. Tetra pack packaging was the most stable compared to other packaging even though it had a shorter expired date than with other.

Index Terms— Vitamin C, variations beverage packaging, red guava, titration 2,6- dichlorophenol indophenol.

I. INTRODUCTION

Vitamin C is one of the nutrients and having function as antioxidants, effectively to protect free radicals that can damage cells. Low intake of fiber can be affect the intake of vitamin, because fiber vegetables, and fruits are also a good source of vitamin C [3].

One of the food products that are processed in the form of packaging, which is currently circulating in the market is fruit-flavored soft drinks in containers. Fruit drinks packaging is very easy to find in department stores (supermarket) [3].

Absolute human needs vitamin C from outside the body. In fact, people prefer to drink fruit beverage packaging compared to the vitamin C in fresh fruits, which are easily found anytime and their use is relatively more practical.

This research can give the information to public and consumer, about they daily intake of vitamin C and the most vitamin C stable in several variations of guava fruit beverage packaging.

Based on the above researchers wanted to determine levels of vitamin C in some beverage packaging red guava fruit (Psidium guajava L) determined by titration methods 2,6-diklorofenol indofenol, which one of the most stable beverage packaging levels of vitamin C in some variations of the packaging used. The benefits of doing this study to determine the levels of vitamin C and source of information on the levels of vitamin C in some guava fruit beverage packaging .

II. LITERATURE REVIEW

A. Morphology of Plants

Guava (Psidium guajava) is a well known cultivated tree because of the paste and jelly made from its fruits. The fruit (which is technically a type of berry) has a thin, yellow, slightly sour edible outer layer; within, there are numerous yellow seeds more than 3 to 5 mm long in a juicy pinkish or yellow pulp. The fruits are unusually rich in vitamin C. The outer layer of the fruit is preserved and canned commercially, as is the juice.

B. Nutrient Ingredients

Guava fruit have nutrient levels, in 100 grams of fresh guava fruit content complete content 0.9 g protein, 0.3 g fat, 12.2 g carbohydrate, 14 g calcium, phosphorus 28 mg, iron 1.1 mg, vitamin A 25 SI, 0.02 mg vitamin B1, vitamin C 87 mg and 86 grams of water with total calories by 49 calories. Seeds dried guava containing [2] 14% protein and 13% starch.

C. Benefits Consumption Guava

Guava fruit can be eaten fresh. Fruits are raw or undercooked widely used for rujakan. In addition, the fruit was processed into syrup, fruit juice, nectar, jelly, jam, confectionery, and dodol. In the medical world guava into drugs that can treat various diseases, among others : swollen gums, mouth sores, etc. [2].

D. Vitamin C

Vitamin C is a white crystalline water-soluble. In the dry state of vitamin C is quite stable, but under no circumstances soluble, vitamin C is easily destroyed by exposure to air (oxidation), especially when exposed to heat. Oxidation is accelerated by the presence of copper and iron. Vitamin C is unstable in alkaline solutions, but fairly stable in acidic solutions. Vitamin C is the most unstable vitamin [4].

The primary role of vitamin C to keep the structure of collagen is a protein that connector to all net fibers, skin, tendons, cartilage, and other tissues of human body. Collagen can heal broken bones, bruises, minor bleeding, and minor injuries. Vitamin C also plays an important role in helping the absorption of iron and

sharpen awareness. As an antioxidant, vitamin C can neutralize free radicals throughout the body. Through the influence of laxatives, vitamin C can also improve the disposal of feces [1].

The function of Vitamin C

The function of Vitamin C is to help the liver neutralize toxins or drugs, prevent cancer, antioxidants, and to the growth of bones and teeth [9]. The daily requirement of vitamin C for adults is about 60 mg, for pregnant women 95 mg, children 45 mg, and infants 35 mg, due to the pollution in the environment, among others by the fumes of motor vehicles and smoke, the use of vitamin C needs to be increased up to twice as much (10) of 120 mg.

Sources of Vitamin C

Fruits and vegetables fresh is Sources of the richest natural vitamin C. Vitamin C is often called Fresh Food Vitamins, raw fruit contains more vitamin C than ripe fruit. Vitamin C is water soluble and can be easily damaged by oxidation, heat and alkali. Because it's so not a lot of vitamin C is lost, and the incision should be avoided excessive destruction. Cooking with little water and sealed until tender much destroys vitamin C [1].

E. Titration Method 2,6-diklorofenol indofenol (DCPIP)

Reagents 2.6 diklorofenol has the chemical formula 2,6- (Cl) 2C 6H 3OH have physical and chemical properties include essentially solid form, molar mass of 163 g / mol, 211ºC boiling point, melting point of 56-58ºC, and the solubility in water 2000 mg / L. These compounds can cause skin irritation, eye irritation, toxic and flammable. 2,6-diklorofenol indofenol solution serves as a dye or indicator that gives a color change during the titration. 2,6-DCPIP solution in neutral or alkaline atmosphere will be blue were under acidic conditions will be pink. When 2,6-DCPIP reduced by ascorbic acid it would be colorless, and when all the ascorbic acid has been reducing 2,6-DCPIP then the excess solution of 2,6-DCPIP little already be seen by the staining [4].

The principle of the vitamin C content analysis of 2,6-DCPIP titration method is to set the levels of vitamin C in food by titration with 2,6-DCPIP where there is a reduction reaction of 2,6- DCPIP the presence of vitamin C in an acid solution. Ascorbic acid to reduce the 2,6- DCPIP in a solution that is colorless. End point marked with a color change to pink in acidic conditions [7].

In this titration, when all the ascorbic acid in the solution has been used up, there will not be any electrons available to reduce the DCPIPH and the solution remains pink due to the DCPIPH. The end point is a pink color that persists for 10 seconds or more, if there is not enough ascorbic acid to reduce all of the DCPIPH.

F. Packaging

Tetrapack

Packaging is commonly used as a milk beverage, tea, juice, and more. The following are the layers that exist in aseptic packaging paper and tetrapack are sorted from the outermost layer to the innermost layer are: Polyethylene (LDPE), paper cartons, polyethylene (LDPE), aluminum foil, Adhesive polymer, and M-polyethylene. The packaging is made with aseptic and UHT packaging.

Glass

Packaging glass used for baby food, fruit juices, pasta sauces, fish and meat depends on the acid product, whether sterilized or pasteurized. Advantages of glass packaging impermeable to water, gases, odors and microorganisms, do not react with packed product, and can be recycled.

Tin Can

A tin can, tin steel can, steel packaging or a can, is a container for the distribution or storage of goods, composed of thin metal. Many cans require opening by cutting the "end" open; others have removable covers. Cans hold diverse contents: foods, beverages, oil, chemicals, etc. Steel cans are made of tinplate (tin-coated steel) or of tin-free steel. In some locations, even aluminium cans are called "tin cans". However, it is now widely used tin-free steel is steel coated with chromium to prevent corrosion [8].

Plastic Bottle

A plastic bottle is a bottle constructed from plastic. The size ranges from very small sample bottles to large. Although plastic has many advantages, there are also weaknesses plastic when used as food packaging, which is a certain type (eg PET) does not stand the heat, releasing potentially harmful compounds that are derived from the residual monomers from polymers and plastics are materials that are difficult biodegradable so it can pollute the environment [9].

III. METHODS

Vitamin C was measured using 2,6-DFIF titration method. The samples studied are some beverage packaging guava (Psidium guajava L.) with different packaging are : tetrapack, glass, cans, and plastic bottles.

In this study, the first phase to validate methods of analysis that 2,6-DPCIP titration method first determines the accuracy, precision and detection limits. The second stage examination vitamin C content in guava fruit beverage packaging using a method that has been validated. Preparing a sample by measuring the sample volume packaging fruit drinks. From the above experimental results can be calculated amount of vitamin C in every 100 grams of beverage packaging Guava fruits studied.

According to AOAC 2002, the levels of vitamin C can be calculated using the formula:

Levels of vitamin C (mg / g) = $\frac{(Vt-Vb) \times \text{equality} \times Vi}{Vp \times Bs}$

III. EQUIPMENT AND MATERIALS

Equipment

The tools used for titration and analysis of 2,6-DCPIP vitamin C by using 2.6 –DCPIP are an analytical balance, 100 mL flask, desiccator, brown glass bottle, 100 mL flask, stir bar, funnel, blender, filter paper, measuring flask of 50 mL, 250 mL flask, 250 ml glas beaker, micro pipette, pipette, and tissue.

Materials

Materials used are guava, guava fruit beverage packaging with a variety of containers with an expiration date (expiration date) in particular, 2,6-DCPIP (Merck), ascorbic acid (Merck), glacial acetic acid (Merck), distilled water, metaphosphate acetic acid (Merck), concentrated sodium bicarbonate (APS Ajax Finecham).

IV. RESEARCH

A. Sample Collection and Determination

Samples used for validation of the titration method 2,6-DCPIP red guava fruit (Psidium guajava. L) obtained from the area Tarogong Garut district. While the sample studied for quantitative analysis of vitamin C are a couple of drinks packaging guava (Psidium guajava L.) containing vitamin C to be studied with different packaging are tetrapack, glass, cans, and plastic bottles.

B. Preparation of Samples

Samples are cleaned, weighed about 100 grams and then cut into small pieces put into a blender and then added about 20 mL of metaphosphate-acetic put in a blender, then blended, then weighed 10g then added 100 mL volumetric flask and add sour metaphosphate-acetate until the line mark. Homogenized, and then filtered.

C. Preparation of Reagent solution

A solution of 2,6-diklorofenol indofenol (DCPIP)

Dissolve 50 mg of sodium 2,6-DFIF that has been stored in a desiccator, then added 50 mL of water containing 40 mg of Na bicarbonate concentrated when it is dissolved to 200 mL of water added. Then filtered into a brown glass bottle. 2,6-DCPIP standard solution used within 3 days and standardized before use.

Quantitative Test on Samples

A total of 4 samples were taken each 5 mL in 100 mL Erlenmeyer each added 2 mL of strong acid and shaken metaphosphate then a solution of 2,6-DCPIP titration and titration is stopped until the pink solution.

V. RESULTS AND DISCUSSION

The human body does not naturally provide Vitamin C, and it is classified as "water-soluble". Vitamin C weighs 176.1 grams and has a molar mass of 68 grams per mole. Its density measures around 1.694 grams per cubic centimeter with a melting point of 190 degrees Celsius. Vitamin C boils at 553 degrees Celsius. Vitamin C is a white crystalline water-soluble. In the dry state of vitamin C is quite stable, but under no circumstances soluble, vitamin C is easily destroyed by exposure to air (oxidation), especially when exposed to heat [4].

In this study, the determination of vitamin C levels in samples of beverage packaging such as plastic bottles, tetrapack, cans and glass bottles. This is done to determine the most stable vitamin C levels between the packaging variations. In this study, the first phase of the analytical method validation 2,6-DCPIP titration method to determine in advance the accuracy, precision and limit of detection . Determination of vitamin C content of guava juice is done to validate 2,6-DCPIP titration method. The accuracy of test results is done by adding a standard solution of vitamin C. A good analytical method has an accuracy range of average recovery test for analyte concentration of 0.001% -0.01% in the samples tested was 90% -107% [10]. Percent recovery obtained by 91.96%. These results indicate a closeness between the results of the analysis with the real values of 2,6-DCPIP titration method used in this study fit for use and provide valid.

Precision test done to prove the accuracy of the practitioner or a work based on the level of accuracy of the results of the analysis indicated standard deviation (SD) and the relative standard deviation [15]. Levels of vitamin C in the juice plus the standard 25 mg vitamin C obtained from measurements taken as 6 replication is entered into the equation precision test. Value percent this research RSD 1.7394%. Accuracy of the tool can be good if the value of RSD less than 11% [10]. 1.7394 % RSD value is less than 11%, which means that the 2.6-DCPIP titration method used has good accuracy prices so that the instrument fit for use in the analysis of vitamin C. The limit of detection was defined as the lowest analyte concentration that was detected by the method specified confidence level [10]. Detection limits obtained by the concentration of 2 ppm. The next stage is the determination of the levels of vitamin C in the sample. The principle of the vitamin C content analysis of 2,6-DCPIP titration method is to set the levels of vitamin C in food by titration with 2,6-DCPIP where there is a reduction reaction of 2,6-DCPIP the presence of vitamin C in an acid solution. Ascorbic acid to reduce the 2,6-DCPIP in a solution that is colorless. Function of reagent as an indicator of electron-accepting color and vitamin C which will change the dye from blue to red. End point marked with a color change to pink in acidic conditions]. Samples metaphosphate-acetic acid is added to prevent oxidation of vitamin C in the sample as long as the vitamin C will be a lot of exposure to oxygen, heat, and others. Therefore, to prevent excessive oxidation then added metaphosphate-acetic acid. In addition, metaphosphate-acetic acid solution also

serves to separate the vitamin C that is bound to protein.

The reactions occurring 2,6-DCPIP and vitamin C can be seen in Figure 1

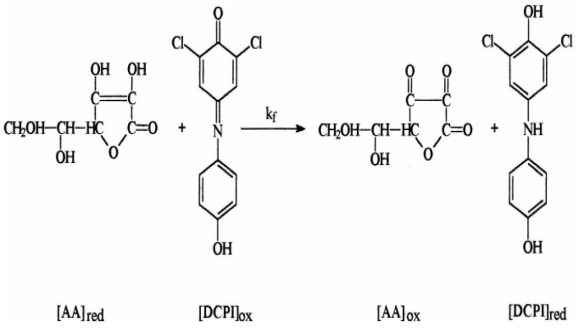

Fig. 1 Oxidation Vitamin C with 2,6-DCPIP

Assay of vitamin C in this study using the titration method in triplo. This method uses a dye solution as pentiter and sample solution as titrant. The sample used in this study beverage packaging, namely red guava fruit drink plastic bottles, tetrapack, cans and glass bottles. Then compare it with nutritional value information contained on the packaging label. Levels of vitamin C which is indicated on the packaging label expressed in percent RDA. Here, the information content of vitamin C contained on the packaging label per serving the drink plastic bottles (120%) in 150 mL, tetrapak (115%) in 250 ml cans (260%) in 238 mL glass bottles (20%) in 33 mL. To obtain the sequence of levels of vitamin C based label do the calculation in the same volume that is 100 grams for all products, for example in tetrapak contained 100 grams of vitamin C as much as 115% RDA.

The calculations are as follows:

$$\text{Mass vitamin C} = \frac{\text{mass of vitamin C}}{100} \times \text{RDA Vit C}$$

$$= \frac{115}{100} \times 60 \text{ mg}$$

$$= 69 \text{ mg}$$

$$\text{Mass Vitamin C in 100 mg} = \frac{100 \text{ mg}}{250 \text{ mg}} \times 69 \text{ mg}$$

$$= 27.6 \text{ mg}$$

When compared with information from the packaging label, all products have vitamin C levels decline. The order of the vitamin C content in percent of RDA per 100 grams by the label are as follows:

1. Beverage cans (65.54 mg / 100 g)
2. Beverage Packaging tetrapack (27.6 mg / 100 g)
3. Drink bottles plastic (48 mg / 100 g)
4. Drink a glass bottle packaging (36.36 mg / 100 g)

in the research that has decreased very high to a low run private consecutively on beverage packaging plastic bottles, glass bottles, cans, and tetrapack. Sample 1 juice in plastic bottles which have advantages and disadvantages as follows; advantages: the nature of gas and water vapor permeability of plastic packaging materials low, causing a longer shelf life of the product. While the drawbacks that the monomer substances and small molecule contained in plastic that can migrate into the packaged foodstuffs. Migration occurs as influenced by the temperature of food or storage and processing. The higher the temperature, the more monomers can migrate into. And based on the measurement results on Monday, June 13 th, 2016 on the drink plastic bottles has a vitamin C content of 12.01 mg / 100 g, which amount is measured 7 months ahead of expiration. While on the packaging label for 48 mg / 100 g . This shows that the levels of vitamin C in beverages plastic bottles experienced a drastic decline, it is because in addition to processing, the expiration date is also the transmission of light into the packaging, sometimes required in order to view the contents of the packaging.

Sample 2 juice in tetrapack packaging. The process of making the packaging consists of six layers arranged from the outermost layer to the innermost layer:

a. Polyethylene (LDPE) is the layer that provides protection from humidity environmental outside of the package.

b. Paperboard serves as the guardian of the stability of the form and give the strength of the various pressures.

c. Polyethylene (LDPE) in the third layer serves as an adhesive.

d. Aluminum foil is useful to keep the liquid from light, oxygen, and
off-flavorsas well as maintaining the stability of taste.

e. Adhesive polymer in the fifth layer serves as an adhesive.

f. M-polyethylene is the innermost layer that serves as a sealing.

This packaging has advantages and disadvantages. Those advantages are created by and UHT aseptic packaging. Aseptic packaging is packaging material in a container that meets the four conditions, in the sterile container products or place and environment in product filling and packing containers used must be sealed to prevent re-contamination during storage. While the UHT (Ultra High Temperature) that is heating to a high temperature (135ºC-150ºC) for 2-5 seconds. And based on the measurement results on Monday, June 13 th, 2016 at tetrapack packaging beverages have vitamin C content of 17.99 mg / 100 g which amount was measured 5 months before expiration. While on the packaging label of 27.6 mg / 100 g This shows that the levels of vitamin C in tetrapack packaging beverages has decreased, it is caused during processing and storage.

3 samples of juice in cans which have advantages and disadvantages as follows; advantages that can reduce the concentration of oxygen, so as to reduce the possibility of changes due to oxidation reactions such as oxidation of vitamins, fats, discoloration and corrosion processes. If the storage conditions

allowing the microbes to grow, then the microbes would multiply and spoil the food in the cans. And based on the measurement results on Monday, June 13 th, 2016 on beverage cans had higher levels of vitamin C that is 31.46 mg / 100 g, which amounts are measured 6 months before expiry. While on the packaging label of 65.54 mg / 100 g This shows that the levels of vitamin C in beverage cans experienced a drastic decline, it is because in addition to processing, expiration date cans also have a corrosive nature caused much residual oxygen in foodstuffs, especially in air spaces, temperature, and storage time.

Sample 4 juice in a bottle glass has advantages and disadvantages as follows; ie the excess glass packaging does not react with the product packed.. And based on the measurement results on Monday, June 13th, 2016 on the beverage packing glass bottles have the vitamin C content of 13.00 mg / 100 g, which amount is measured 7 months ahead of expiration. While on the packaging label of 36.36 mg / 100 g This shows that the levels of vitamin C in the packaged beverage glass bottles decreased. This is due in addition to the processing and storage glass bottle packaging also has the properties of invisibility is less favorable for vitamin C is sensitive to light.

Table I Result Quantitative Analysis Of Sample

Sample Packaging	Titration	Weight Sample (gram)	Volume 2.6-DCPIP as Volume Titration (mL)	Level (mg/100gr)	Average Level (mg/100gr)	Level Packaging (mg/100gr)	Expired Date
Plastic Bottle	1	10.015	0.6	13,12			
	2	10.032	0.5	9.82	12.01	48	January, 11, 2017
	3	10.026	0.6	13.10			
Tetrapack	1	10.362	0.6	19.02			
	2	10.445	0.5	18.87	17.99	27.6	November, 7, 2016
	3	10.217	0.6	16.08			
Tin Can	1	10.030	1.2	32.76			
	2	10.221	1.2	32.14	31.46	65.46	Desember, 23, 2016
	3	10.027	1.1	29.49			
Glasses Bottle	1	10.050	0.6	13,07			
	2	10.040	0.6	13.09	13.00	36.36	January, 21, 2017
	3	10.220	0.6	12			

CONCLUSIONS

The results of quantitative assay of vitamin C in some variation of beverage packaging using 2,6-DCPIP obtained vitamin C content of red guava fruit drinks packaging tetrapack measured at 5 months prior to the expiry of 17.99 mg / 100 g whereas on the packaging label of 27.6 mg / 100 g, cans were measured at 6 months before the expiry of 31.46 / 100 g while the label packaging by 65.54 mg / 100 g, the glass bottles was measured at 7 months before expired at 13.00 mg / 100 g while the label packaging by 36.36 mg / 100 g and plastic bottles were measured at 7 months before the expiry of 12.01 / 100 g while the label is 48 mg / 100 g. This indicates that the packaging variations affect levels of vitamin C were characterized by a decrease in the levels of vitamin C, so that the levels of vitamin C research results do not match the information on the packaging of nutritional value. Beverage packaging the most stable compared to other packaging is tetrapack beverage packaging due to decreased vitamin C is less even though the expiration date is closer than any other packaging that they have a longer time expired.

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