DETERMINATION OF VITAMIN C IN DIFFERENT STAGES OF FRUITS GROWING

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abstract: Ascorbic acid (AA) is a powerful antioxidant naturally present in many foods, especially fruits and vegetables, which play an important role in the prevention of infectious diseases. It is important in processes of oxidation and reduction in human organism, participating in several metabolic reactions. A simple method for the ascorbic acid (Vitamin C) in some fruit type utilizing a titrimetric method with potassium bromide is described. To observe source of Vitamin C in these fruits and how easy it's losing once with the vegetation period, we determine Vitamin C concentration from: leaves, tails, green fruits, respectively from fruits. The precision of the determination of Vitamin C was evaluated and it was found that the recovery of ascorbic acid was 97%. The precision of the method is good and the recovery of the analyte is nearly quantitative.

Introduction

Vitamin C, the L-enantiomer of ascorbic acid, is a water-soluble vitamin used by the body for several purposes. Most animals can synthesize their own vitamin C, but some animals, including primates, guinea pigs, and humans, cannot. Vitamin C was first isolated in 1928, and in 1932 it was proved to be the agent, which prevents scurvy. Citrus fruits (lime, lemon, orange, grapefruit) and tomatoes are good common sources of vitamin C. Other foods that are good sources of vitamin C include papaya, broccoli, brussels sprouts, blackberries, strawberries, cauliflower, spinach, cantaloupe, and blueberries.

The amount of Vitamin C in fruit depends on the precise variety of the fruit, the soil and climate in which it grew, and the length of time since it was picked. As a participant in hydroxylation, vitamin C is needed for the production of collagen in the connective tissue. Some tissues have a greater percentage of collagen, including: skin, mucous membranes, teeth, bones [1].

Vitamin C is also required for synthesis of dopamine, noradrenaline and adrenaline in the nervous system or in the adrenal glands. It is a strong antioxidant. [2]

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Lack of ascorbic acid in the daily diet leads to a disease called scurvy, a form of avitaminosis that is characterized by: loose teeth, superficial bleeding, fragility of blood vessels, poor healing, compromised immunity, mild anaemia. The dietary amounts recommended by various authorities are 50-150 mg of ascorbic acid per day. High doses (thousands of mg) are used but may result in diarrhea. Any excess of vitamin C is generally excreted in the urine Vitamin C is needed in the diet to prevent scurvy. It also has a reputation for being useful in the treatment of colds and flu. The evidence to support this idea, however, is ambiguous. [3]

Vitamin C is an important anti-oxidant, helps protect against cancers, heart disease, stress, it is part of the cellular chemistry that provides energy, it is essential for sperm production, and for making the collagen protein involved in the building and health of cartilage, joints, skin, and blood vessels. Vitamin C helps in maintaining a healthy immune system, it aids in neutralizing pollutants, is needed for antibody production, acts to increase the absorption of nutrients (including iron) in the gut, and thins the blood. Just to mention it's most important functions. [4]

Apple: *Malus pumila (M. domestica).* Apples vary from a 'fairly good' to a 'very good' source of vitamin C, as there are significant differences between the varieties. 'Crab apples', possibly *Malus sylvestris*, are listed as having very little vitamin C content (compared weight for weight to modern apples). Apples are a good source of the B vitamin 'biotin'. Apples are also a good source of a variety of minerals-magnesium, iron, chromium, and manganese. Apples (as distinct from the expressed juice) are a good source of soluble fiber, which has been shown to slow the release of sugars in the blood and also slightly drop blood cholesterol levels. Eating 100 grams of fresh red delicious apple with the skin on provides the total anti-oxidant activity equal to 1,500 milligrams of vitamin C. [5]

Apricot: *Prunus armeniac.* Apricot flowers are easily damaged by frost, and the plant really needs a hot, relatively dry growing season. Apricots can't be regarded as a significant source of vitamin C, but are a good source of vitamin A (as carotene)- one 35-gram apricot has 914 International Units of vitamin A, making them the third richest source of vitamin A of all the common commercial fruit. Canned apricots are also good source of Vitamin A, with one canned apricot having very approximately half the content of a fresh fruit. [6]

Cherry: *Prunus avium*. The first ancestral *Prunus* species probably arose in Central Asia, and gave rise to plums, apricots, peaches, almonds, and cherries. Sour cherries, *Prunus cerasus*, evolved from the sweet cherry, perhaps with infusion of genes from another Central Asian *Prunus* species. At 10 mg per 100 grams of flesh, both fresh sweet cherries and fresh sour cherries rank as a good source of vitamin C. But even *frozen* sour cherries have useful amounts-5mg/100gram. (there will almost certainly be differences between varieties). [7]

Though the literature is replete with the different types of methods for the analysis of such diversified products, efforts continue in the search of better methods. Such attempts to quantify ascorbic acid in these samples have resulted in a large number of methods: titrimetry, voltammetry, fluorometry, potentiometry, kinetic-based chemiluminiscence (CL), flow injection analyses, biosensors and chromatography with spectrometer detector. [8-13]

The aim of the present paper consist in determination of ascorbic acid concentration changes occurred along vegetation period in sour cherry - *Prunus cerasus,* apricot – *Prunus armeniac* and apple – *Malus pumila*.

Experimental

The titrimetric method

For determination of ascorbic acid we used titrimetric method with potassium brommat-bromide solution in the acid medium [14,15]. This method was optimized by the laboratory conditions. [16]

Ascorbic acid, $C_6H_8O_6$ is cleanly oxidized to dehydroascorbic acid by bromine. An unmeasured excess of potassium bromide is added to an acidified solution of the sample. The solution is titrated with standard potassium bromate to the first permanent appearance of excess bromine: this excess is then determined iodometrically with standard sodium thiosulfate. The entire titration must be performed without delay to prevent air-oxidation of the ascorbic acid.

The reagents

The reagents used have been: $Na_2S_2O_3$ 0,5N, $KBrO_3$-KBr 0,05N, $K_2Cr_2O_7$ 0,5N, H_2SO_4 1N, H_2SO_4 1:2, KI, starch indicator 1%. All reagents were of analytical-reagent grade and all solutions were prepared using distilled-deionized water.

Sample preparation

The biological samples consisted in apple, apricot and sour cherry harvested in May-August 2004.

To observe source of Vitamin C in these fruits and how easy it's losing once with the time and during the vegetation period, it has determined Vitamin C concentration from: tails, leaves, green fruits, respectively from fresh fruits.

The fruits were weighed, crushed, dissolved in water and transferred into a 100mL volumetric flask. After that, was filtered and for analysis we take a portion of this filtrate.

Results and discussion

The contents of L-ascorbic acid in different fruits were determined by titrimetric method and the results are given in Table 1 for apricot, in Table 2 for sour cherry and in the last for apple in Table 3.

It can observe that in leaves a height Vitamin C concentration exists, which tell us that Vitamin C provide from apricot leaves, respectively from apple leaves. In apricot flower exist a big ascorbic acid content and the possibility of saying that the vitamin come from flowers cannot be eliminated.

Table 1. **Vitamin C concentration in leaves and apricot.**

Data	Vitamin C content in apricot (mgAA/100g product)	
	Leaves	Fruits
10.05.2004	166.76	flowers 129.43
09.06.2004	109.6	67.18
16.06.2004	87.01	55.59
22.07.2004	31.20	green fruit 31.10
10.08.2004	30.18	fresh fruit 20.75*

**The vitamin C content in fresh apricot from literature is 8-20mgAA/100g products.[17]*

Table 2. Vitamin C concentration in tails, leaves and sour cherry.

Data	Vitamin C content in sour cherry (mgAA/100g product)		
	Tails	Leaves	Fruits
10.05.2004	165.40	151.64	flowers 143.2
09.06.2004	118.77	79.18	54.01
16.06.2004	112.30	75.42	green fruit 30.12
23.06.2004	77.53	61.55	fresh fruit 20.94*

**The vitamin C content in fresh sour cherry from literature is 10-20mgAA/100g products.[17]*

The source of Vitamin C in sour cherries it's coming from tails and the concentration of this vitamin in fruits it's decreasing once with growing fruits.

Table 3. Vitamin C concentration in leaves and apple.

Data	Vitamin C content in apple (mgAA/100g product)	
	Leaves	Fruits
10.05.2004	121.44	flowers 167.51
09.06.2004	59.91	49.49
16.06.2004	49.91	42.60
22.07.2004	38.91	Green fruit 25.21
17.09.2004	20.12	Fresh fruit 12.68*

**The vitamin C content in fresh apple from literature is 12mgAA/100g products.[17]*

After determinations, it can observe that in green apricot and green sour cherry is a higher concentration of vitamin C than in green apple and the same in the fresh fruit. The ascorbic acid contents its lower in fresh fruit than in other organs of fruit trees. Also, the ascorbic acid concentration obtained by volumetric method is in good agreement to the literature data.[17] After determinations, it can observe one variation of vitamin C concentration depending on vegetation period.

The precision of the determination of Vitamin C was evaluated under the optimum conditions mentioned in [18-21] It was found that the recovery of ascorbic acid was 97%. The precision of the method is good and the recovery of the analyte is nearly quantitative (>90%).

Also, the interferences are determined in [22] and it can be seen that citric acid, acetylsalicylic acid and sugar doesn't interfere in ascorbic acid determination if it is in the same concentration with the vitamin C or lower. The ascorbic acid concentration in fresh fruits determined with the titrimetric method described is in concordance with that showed in literature. [17]

Conclusions

As a result of this work, the titrimetric method was found to be advantageous comparatively to other methods reported in the literature: it is sensitive, economic, practical and less time-consuming.

The results obtained by the proposed procedure show that the method can be used for determination of Vitamin C in vegetable samples.

The method has been used for ascorbic acid determination on different type of fruits: green fruits, leaves fruit trees and fruits and also it have been used to show the distribution of this vitamin in different stages of fruits growing.

In this work a simple method for the ascorbic acid (Vitamin C) determination in some fruit type: apple, apricot and sour cherry utilizing a titrimetric method with potassium bromide were described.

The tails, leaves, flowers and fruits of apple, apricot and sour cherry were investigated. One can see that plants synthesized ascorbic acid in leaves to apricot and apple, respectively tails to sour cherry and the fruits absorb this vitamin.

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