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Chemistry
Explore, 2010, Page No. 21-23
Vol. II No. I

Determination of Ascorbic Acid in Fruits and Vegetables

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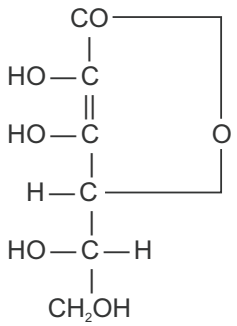
In the study we have analyzed commonly available various edible fruits and vegetables with a view of determining Ascorbic Acid in them. Ascorbic Acid is soluble in water with pleasant acidic taste and it has antioxidant properties. The L- enantiomer is also known as vitamin C. Molecular formula is $C_6H_8O_6$. Fresh fruits and vegetables are the richest source and is more abundant in Amla lemon, guavas, oranges, green chilli etc. It helps in fighting bacterial infections. It's salt is commonly used as antioxidant food additives. The deprotonated form has two resonance structures. Severe deficiency of Ascorbic Acid results in scurvy. The principle used is the reduction of 2,6-dichlorophenol-indophenol by an acid solution of Ascorbic Acid. Five samples of various edible fruits and five samples of various vegetables were also analyzed using titrimetric method. It was found that in taken samples of fruits Amla had the highest amount (640mg/100ml) and Grapes had the lowest amount (20mg/100ml) and in taken samples vegetables Turnip leaves had greater amount (160mg/100ml) and least amount was found in Radish leaves (80mg/100ml).It was also noted that Ascorbic Acid was comparatively more in mixed fruits than in mixed vegetables.

Key words *: Ascorbic Acid, Titrimetric method.*

Introduction : The isolation of ascorbic acid was carried out by Zilva during 1917-1927. At the time of its discovery around 1920 it was called hexuronic acid by some researchers (Abubakar, J.A. et. al., 1990). Its appearance is white to yellow crystals. Walter Haworth and has co-workers in 1933 established the chemical structure and he was awarded Nobel Prize in 1937 for his work in determining the structure (The chemical nature of vitamin C). The IUPAC name is L-3-ketothreo-hexuronic acid lactone. Its structure is as (K.A. Goel and K.V. Shastri)



L – Ascorbic Acid

It has molecular mass 176.12g/mol, density 1.65g/cm^3, melting point 190-192°C. It is insoluble in diethyl ether, chloroform, benzene (The chemical nature of vitamin C). It is found in plants, animal and single cell organisms. Most of the plants and animals can synthesize except for man, primates guinea pigs etc. Fresh fruits and green vegetables are the richest source (Davidson, S. et. al., 1972). It behaves as vinylogous carboxylic acid wherein the double bond transmits electron pairs between the hydroxyl and the carbonyl. The deprotonated form has two resonance structures differing in position of double bond. Another way to look at Ascorbic Acid is to consider it as an enol (AOAC 1980 official methods of analysis of the association of official analytical chemist,1980). It is also a powerful reducing agent and reduces Felhings solution in cold acid and its sodium, potassium and calcium salts are commonly used as antioxidant food additives. For this purpose, the fat soluble esters of ascorbic acid with long chain fatty acid can be used as food antioxidants (P.K. Stumpf). Ascorbic acid is essential for the formation of collagen and fibrous tissue

for normal intercellular matrices in teeth, bone, cartilage, connective tissue and skin and for the structural integrity of capillary walls. It also aids in fighting bacterial infections and interacts with other nutrients (Stone, Irwin, 1972). Signs of deficiency of Ascorbic acid are bleeding gums, tendency to bruise, swollen or painful joints, nose bleeds, anemia, lowered resistance to infections and slow healing of wounds and fractures .Severe deficiency results in scurvy (Achinewhu, S.C., 1983).

Principle :

The principle is based on the reduction of the 2,6-dichlorophenol-indophenol by acid solution of Ascorbic Acid. The reducing capacity of the extract of the sample is directly proportional to the Ascorbic Acid content (A.K. Gupta, M.L. Varshney).

Method :

The method used was titration.2,6-dichlorophenol-indophenol solution was prepared and standardization was done. Juice from the taken samples were extracted and filtered. 10ml of the juice was diluted to 100ml with 1% oxalic acid.10ml of filtrate was titrated with standardized dye indictor solution to a faint pink colour. Titration was repeated till we got the concurrent reading. The formula used was ExVxV1/V2x100/W where E is factor of dye indicator V is the concurrent reading V1 is volume to which juice was diluted V2 is volume of the filtrate taken for titration W is the volume initially taken for determination(A.K. Gupta, M.L. Varshney).

Calculation of E

Concentration of vitamin C in standard solution = 10mg/ml.

Amount of vitamin C in 10ml of standard solution=100mg.

Let x ml of dye is required for the oxidation of vitamin C in 10ml of standard solution

$\therefore$ 1 ml of dye is required for oxidation of 100 mg of vitamin C

= 100/x mg of vitamin C

E = 100/x × 1/1000 mg of vitamin C

Result :

Name of the fruits and vegetables	Volume of the juice (ml)	Concu-rrent reading	Ascorbic Acid (mg/100ml)
Amla	10	3.2	640
Orange	10	0.2	40
Grapes	10	0.1	20
Lemon	10	0.3	60
Nimbu (Ghaghra)	10	0.2	40
Turnip leaves	10	0.9	180
Hara Dhania	10	0.8	160
Cabbage	10	0.6	120
Green Chilli	10	0.5	110
Radish leaves	10	0.4	80

Discussion :

In taken samples of fruits the highest amount of Ascorbic Acid was in Amla i.e. 640 mg/100ml. Lemon juice had 60 mg / 100ml, Nimbu (Ghaghra) and orange juice has 40 mg/100ml and the lowest was in Grapes 20 mg/100ml. In the samples vegetables Turnip leaf (Shalgam Ka Sag) had 180 mg/100ml. Coriander leaves (Hara Dhania) 160 mg/100ml, Cabbage 120 mg/100ml, Green Chilli 110mg/100ml, Radish leaves (Mulli Ka Sag) 80mg/100ml. Mixed fruits had higher amount i.e.160mg/100ml and mixed vegetables had lower amount i.e.130mg/100ml.

Conclusion :

The experiment that we performed clearly show that fruits and vegetables are the richest source of Ascorbic Acid. Hence we conclude that in taken samples of fruits Amla had the highest amount and grapes had the lowest amount of ascorbic acid. Similarly in taken samples of vegetables turnip leaves had the greater amount and Radish leaves has lower amount. Mixed fruits has comparatively more Ascorbic Acid than the mixed vegetables.

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