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Study on the presence of oxalate ions in guava and sapota fruits

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Abstract

The oxalate content of guava and sapota fruits at different stages of ripening were found out by permanganometric method. Oxalate rich foods are usually restricted to some degree, particularly in patients with high urinary oxalate level. Guava and sapota fruit have the highest percentage of vitamin C among citrus fruits. It also contains oxalate amount of which varies with ripening of the fruit. During ripening of guava and sapota fruit; the oxalate content increases progressively and the fully ripe fruit has the maximum oxalate content. Oxalate form an insoluble complex with calcium in the urine, or hyper-oxaluria, is even more important to stone formation than high levels of calcium or hypercalcicuria. Excessive intake of food and drink containing oxalate leads to calcium oxalate stone. Also, excessive intake of vitamin C which metabolized to oxalate may lead to hyper calcicuria and an increase in stone formation. Pain medications can be prescribed for symptom relief. Surgical techniques have also been developed to remove kidney stones.

Keywords: permanganometric method, hyper-oxaluria, hypercalcicuria, vitamin C etc.

1. Introduction

Oxalate (IUPAC ethandionate) is the dianion with the formula $C_2O_4^{2-}$ also written as $(COO)^{2-}$ 2. either name is often used for derivation, such as salts of oxalic acid for example, sodium oxalate $2((Na)^{+2}C_2O_4^{2-})$ or esters. For example, Dimethyl oxalate $((CH_3)_2C_2O_4$ also forms coordination compounds where it is abbreviated as ox. Many metal ions from insoluble precipitates with oxalate, a prominent example calcium oxalate, the primary constituents of most common kind of kidney stones. Guava, a native of Central America was introduced to India in the 17th century and lea became naturalised in the state of, Bihar. It is a small profusely branched tree, bearing solitary white flowers. The fruits are medium sized globoze with whitish greenish skins. The fruits in a berry with a pulpy edible meso. The guava plant is extremely hardy and can tolerate prolonged dry and drought periods, but not frost. It requires 60.80 inches of rain full. It is capable of growing in poor alkaline or poorly drained soils with p^H ranging from 4.5 to 7.5. The plant is propagated by stem and stem cutting. It is a more successful method of cultivation. The plant yields fruits twice a year. The important varieties are Allahabad Safeda, Chiffidas, Lucknow 49, Hafsi, Harijha, Habshie etc. Sapota in a large and highly ornamental evergreen tree that can reach a night of 15 to 45 metre. It is mainly propagated by grafting. Which ensures the new plant has the same choolaeteristic as the parent, especially its fruit, as it doesnot grow true to seed. It is also considerably faster than growing trees by seed, producing fruit in 3 to 5 years, growns from seed needs seven years of growth. In florida, the fruit is zaarrested from May to July with some cultivars available all years.

2. Objectives of the study

i) To study the oxalate content in Guava fruit and Sapota fruit.
ii) To compare the oxalate content of different days ripened Guava and Sapota fruit.

3. Materials and Methods

Chemicals required

Dilute H_2SO_4, N/20 $KMnO_4$ Solution.

Apparatus Required

100 ml measuring flask, pestle and motor beaker. Filtration flask, funnel, burette, pipette, filter paper.

Materials Required

Pulp of guava and sapota fruits at different stage of ripening, 0.005N $KMnO_4$ and dil. H_2SO_4.

Methodology

Procedure

The first step is to standardised $KMnO_4$. In order to stadardise the N/20 $KMnO_4$ solution we prepare 0.05N oxalic acid.

Preparation of standard oxalic acid:

Weight accurately about 1.2g of oxalic acid and make up into 200ml standard flask using distilled water.

Standardisation of $KMnO_4$
(Standard oxalic acid x $KMnO_4$)

Fill up the burette with potassium permanganate solution after washing and rinsing the burette. Pipette out 20 ml of standard oxalic acid solution in to a clean conical flask. Add an equal volume of dilute sulphuric acid and heat the mixture at 60°C. Titrate against potassium permanganate solution. The end point is the appearance of permanent pale pink colour. Repeat the titration to get concordant value and calculate the normality of potassium permanganate solution.

Standardisation of Free oxalate ion present in the given fruit pulps

Procedure

Oxalate ions are extracted from the fruit by boiling pulp with dil. H_2SO_4. Then oxalate ion are estimated volumetric by titrating the solution with standard $Kmno_4$ solution.

Weight 50.0 gm of fresh guava and crush is to a fine pulp using pestle motor. Transfer the crushed pulp to a beaker and add about 50 ml dil. H_2SO_4 to it. Boil the content for about 10 min. Cool and filter the content up to 100 ml measuring flask make the volume up to 100 ml by adding distilled water. Pipette out 10ml of this solution into the other 100ml standard measuring flask. Take in to a titration flask and add 20 ml of dil H_2SO_4 acid to it. Heat the mixture to about 60°C and titrate it against N/20 $KMnO_4$ solution taken in a burette. The end point in appearance of permanent pale pink colour. Repeat the above experiment) with 50.0 gm of 1, 2, 3 and 4 days old guava fruit.

4. Calculation

Calculation of strength of oxalic acid

Equivalent weight of oxalic acid = 63

Normality of Oxalic Acid $= \frac{\text{Weight / liter}}{\text{Equivalent weight}}$

$= \frac{0.7\times5}{63}$

Normality of Oxalic acid = 0.06 N

Calculation of strength of $KMnO_4$

Volume of oxalic acid V_1 = 20 ml

Strength of oxalic acid N_1 = 0.061N

Volume of $KMnO_4$ V_2 = 23

Normality of $KMnO_4$ N_2 = ?

$V_1N_1 = V_2 N_2$

$N_2 = V_1N_1/V_2$

= 20 x 0.061 / 23

Normality of $KMnO_4$ (N_2) = 0.053N

Calculation of amount of oxalate ions in guava fruit

Weight of guava fruit taken each time = 50 g

Volume of guava extract taken for each titration = 20 ml

Table 3.1

Types of fruit	Burette Reading		Volume of $KMnO_4$ (ml)	Concordant Value (ml)
	Initial	Final		
Fresh fruit	0 0	5.5 5.5	5.5 5.5	5.5
One day old	0 0	7.3 7.3	7.3 7.3	7.3
Two days old	0 0	8.2 8.2	8.2 8.2	8.2
Three days old	0 0	8.9 8.9	8.9 8.9	8.9
Four days old	0 0	9.6 9.6	9.6 9.6	9.6
Five days old	0 0	10.3 10.3	10.3 10.3	10.3

Normality of the $KMnO_4$ solution used for titration=0.053 N

i) For Fresh guava fruit

Volume of $KMnO_4$ Solution V_1 = 5.5 ml

Normality of $KMnO_4$ solution N_1 = 0.053 N

Volume of guava fruit extract V_2 = 20 ml

Normality of the oxalate ions in the guava extract N_2 =?

$V_1N_1 = V_2N_2$

$N_2 = V_1N_1/V_2$

N_2 = 5.5 x0.053/20

= 0.014575 N

Amount of oxalate ions in 1000g fresh guava extract

= $N_{oxalate}$ x 44 x 100/1000 x 1000/50 g/litre

= 0.03084 x 44 x 2

= 1.2826 g/litre

Calculation of amount of oxalate ions in Sapota fruits

Weight of Sapota fruit taken each time = 50 g

Volume of Sapota extract taken for each titration = 10 ml

Table 3.2

Types of fruit	Burette Reading		Volume of KMnO4 (ml)	Concordant Value
	Initial	Final		
Fresh fruit	0 0	9.7 9.7	9.7 9.7	9.7 ml
One day old	0 0	10.2 10.2	10.2 10.2	10.2 ml
Two days old	0 0	11.2 11.2	11.2 11.2	11.2 ml
Three days old	0 0	11.9 11.9	11.9 11.9	11.9 ml
Four days old	0 0	12.7 12.7	12.7 12.7	12.7 ml
Five days old	0 0	13.3 13.3	13.3 13.3	13.3 ml

Normality of the $KMnO_4$ solution used for titration = 0.04746 N

ii) For Fresh sapota fruit

Volume of $KMnO_4$ Solution V_1 = 9.7 ml

Normality of $KMnO_4$ solution N_1 = 0.053 N

Volume of sapota fruit extract V_2 = 20 ml

Normality of the oxalate ions in the sapota extract N_2 = ?

$V_1N_1 = V_2N_2$

$N_2 = V_1N_1/V_2$

N_2 = 9.7 x0.053/20

= 0.025705 N

Equivalent weight of oxalate ion = 44

Amount of oxalate ions in 1000g fresh sapota extract

= $N_{oxalate}$ x 44 x 100/1000 x 1000/50 g/litre

= 0.025705x 44 x 2 g/ litre

= 2.26204 g/litre

5. Result and Discussion

The oxalate content of guava and sapota fruits at different stages of ripening were found out by permanganometric method. The results are given below:

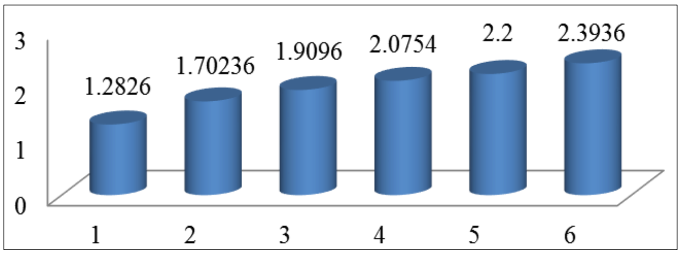
Table 4.1

Sample	Weight of oxalate ion in 50g of guava fruits (g/litr)
Fresh guava	1.2826
First day guava	1.70236
Second day guava	1.9096
Third day guava	2.0754
Fourth day guava	2.2
Fifth day guava	2.3936

Table 4.2

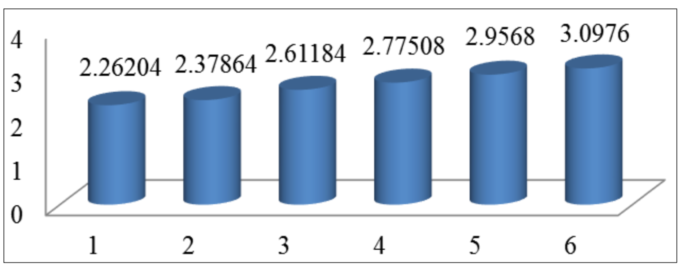
Sample	Weight of oxalate ion in 50g of sapota fruits (g/litre)
Fresh sapota	2.26204
First day sapota	2.37864
Second day sapota	2.61184
Third day sapota	2.77508
Fourth day sapota	2.9568
Fifth day sapota	3.0976

From the above table it was found that the amount of oxalate content varies with ripening of fruits. Among the five days of guava and sapota fruits, fresh fruits had minimum oxalate content. As days went on during ripening the oxalate content increased progressive and had the maximum oxalate content in the fully ripe fruit.



1. Fresh guava 2. First day guava 3. Second day guava
4. Third day guava 5. Fourth day guava 6. Fifth day guava

Fig 4.1: Chart representing the changes in oxalate content of guava fruit during ripening



1. Fresh sapota 2. First day sapota 3. Second day sapota
4. Third day sapota 5. Fourth day sapota 6. Fifth day sapota

Fig 4.2: Chart representing the changes in oxalate content of sapota fruit during ripening

6. Conclusion

This project centered upon estimating the amount of oxalate present in the sapota and guava fruits during ripening. The oxalate content was on the increase in both the fruits and the days passed on, that is as the ripening proceeded. It should be noted that the increase in oxalate content was mere in sapota than in Guava. The presence of oxalate in injurious to health. Oxalate rich foods are usually restricted to some degree, particularly in patients with high urinary oxalate level. Guava and sapota fruit have the highest percentage of vitamin C among citrus fruits. It also contains oxalate amount of which varies with ripening of the fruit. During ripening of guava and sapota fruit; the oxalate content increases progressively and the fully ripe fruit has the maximum oxalate content. Oxalate form an insoluble complex with calcium in the urine, or hyper-oxaluria, is even more important to stone formation than high levels of calcium or hypercalcicuria. Excessive intake of food and drink containing oxalate leads to calcium oxalate stone. Also, excessive intake of vitamin C which metabolized to oxalate may lead to hyper calcicuria and an increase in stone formation. Pain medications can be prescribed for symptom relief. Surgical techniques have also been developed to remove kidney stones. Rather than having to undergo treatment, it is best to avoid kidney stone in the first place. Avoid calcium rich foods and drink more water. Water helps to flush away that form stones in the kidneys.

7. References

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