Project Report on

"Study of oxalate ion content in guava fruit"

Submitted By

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Certificate

This is to certify that project report entitled **"Study of Oxalate Ion Content in Guava Fruit"** are carried out by students mentioned below. They have been satisfactorily completed their project work for academic year 2022-23. The project has been approved as it satisfies the academic requirement in respect of project work prescribed for the Master of Science. M.Sc-I

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AIM :

- To study the presence of oxalate ion in guava fruit at different stages of ripening.

Introduction :

- Guava is a common sweet fruit found in India and many other places around the world. Guavas are plants in the Myrtle family (Myrtaceae) genus Psidium (meaning "pomegranate" in Latin), which contains about 100 species of tropical shrub. On ripening it turns yellow in color. Rich in vitamin C, this fruit is a rich source of oxalate ion whose content varies during the different stages of ripening.
- Guavas have a pronounced and typical fragrance, similar to lemon rind but less in strength.

What is Oxalate?

- It is a carboxylic acid, primarily found in plants and animals. It is not an essential molecule and is excreted form our body, unchanged. Our body either produces oxalate on its own or converts other molecules like vitamin C to oxalate.
- External sources like food also contribute to the accumulation of oxalate in our body. The oxalate present in the body is excreted in the form of urine as waste.
- Too much of oxalate in our urine results in a medical condition called hyperoxaluria, commonly referred to as kidney stones. Diet is looked upon as a preventive measure in addition to medication to treat kidney stones.

Theory

- Oxalate ions are extracted from the fruit by boiling pulp with dilute H_2SO_4. The oxalate ions are estimated volumetrically, by titrating the solution with $KMnO_4$ solution.
- A reagent, called the titrant, of a known concentration (a standard solution and volume is used to react with a solution of the analyte or titrant, whose concentration is not known.
- Using a calibrated burette or chemistry pipetting syringe to add the titrant, it is possible to determine the exact amount that has been consumed when the endpoint is reached.
- The endpoint is the point at which the titration is complete, as determined by an indicator. This is ideally the same volume as the equivalence point.

Constituent	% values
Water	76.10
Protein	1.50
Fats	0.20
Calcium	0.01
Phosphorus	0.04
Vitamin "C"	0.03
Organic matter	14.50

$$[5e^- + 8H^+ + MnO_4 \rightarrow Mn^{2+} + 4H_2O]*2$$

$$[C_2O_4^{2-} \rightarrow 2CO_2 + 2e^-]*5$$

$$16H^+ + 2MnO_4^- + 5C_2O_4^{2-} \rightarrow 10CO_2 + 2Mn^{2+} + 8H_2O$$

- The volume of added titrant at which the number of moles of titrant is equal to the number of moles of analyte, or some multiple thereof (as in polyprotic acids). In the classic strong acid-strong base titration, the endpoint of a titration is the point at which the pH of the reactant is just about equal to 7, and often when the solution takes on a persisting solid colour as in the pink of phenolphthalein indicator.

REQUIREMENTS

(A) Apparatus

100 ml measuring flask

Burette

Pestle & Mortar

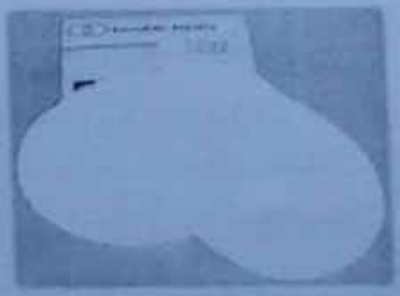
Beaker

Funnel

Papers

Weighing machine

Filter



(B) CHEMICALS

- dil H_2SO_4
- (N /10) $KMnO_4$ solution

(c) Guava fruits at different stages of ripening .

Chemical Equations

! MOLECULAR EQUATIONS

$2KMnO_4 + 3H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 2H_2O + 4[O]$ $HOOC - COOH.2H_2O + [O] \rightarrow 2CO_2 + 2H_2O \times 5$

$2KMnO_4 + 3H_2SO_4 + 5HOOC\text{-}COOH.2H_2O \rightarrow K_2SO_4 + 2MnSO_4 + 18H_2O + 10CO_2$

Ionic Equations

$MnO_4^- + 16H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O \times 2$ $C_2O_4^{2-} \rightarrow 2CO_2 + 2e^- \times 5$

$2MnO_4^- + 16H^+ + 5C_2O_4^{2-} \rightarrow 2Mn^{2+} + 8H_2O + 10CO_2$

Procedure

- Weighed 50 g of fresh guava and crushed it to a fine pulp using pestle and mortar.
- Transferred the crushed pulp to a beaker and added about 50 ml dilute H_2SO_4 to it.
- Boiled the content for about 10 minutes. Cooled and filtered the contents in a 100 ml measuring flask.
- Made up the volume 100 ml by adding ample amount of distilled water.
- Took 20 ml of the solution from the flask and added 20 ml of dilute sulphuric acid to it.
- Heated the mixture to about 60°C and titrated it against (N/10) $KMnO_4$ solution taken in a burette till the end point had an appearance of pink colour.
- Repeated the above experiment with 50 g of 1 day, 2 day and 3 day old guava fruits.

Precautions

- There should be no parallax while taking measurements.
- Spillage of chemicals should be checked.
- Avoid the use of burette having a rubber tap as $KMnO_4$ attacks rubber.
- In order to get some idea about the temperature of the solution touch the flask with the back side of your hand, when it becomes unbearable to touch the required temperature is reached.
- Add about an equal volume of dil H_2SO_4 to the guava extract to be titrated (say a full test tube) before adding $KMnO_4$.
- Read the upper meniscus while taking burette reading with $KMnO_4$ solution.
- In case, on addition of $KMnO_4$ a brown ppt. appears, this shows that either H_2SO_4 has not been added or has been added in insufficient amount. In such a case, throw away the solution and titrate again.

Observations

- Weight of the guava fruit for each time was 50 g.
- Volume of guava extract taken for each titration was 10 ml.
- Normality of $KMnO_4$ solution was (1 / 10).
- End point : Colour changes to pink

Guava solution	Burette reading initial	Final Reading	Volume of $KMnO_4$	Constant Reading
Raw	150	18	132	136.06
Semi ripened	150	13	137	
Ripened	150	10.8	139.2	

Calculations

The Raw Guava

$\therefore N_1V_1 = N_2V_2$

$\therefore N_1 \times 10 = (1 / 10) \times 132$

$\therefore N_1 = 132 / 100 = 1.32$

Strength of oxalate in fresh guava extract

= normality x Eq. mass of oxalate ion

= 1.32 /100 x 44g / litre of diluted extract

$= 0.581 g L^{-1}$

FOR Semi Repped Guava (1 day old)

Strength of oxalate in one day old guava extract

= 1.37 /100 x 44g / litre of diluted extract

$= 0.603 g L^{-1}$

For the Repped Guava

Strength of oxalate in ripened guava extract

= 1.39 /100 x 44g / litre of diluted extract

$= 0.612 g L^{-1}$

Result

The Normality of oxalate ion

Fresh guava solution is = 1.32 N

Semi - ripen guava solution is = 1.37 N

Ripened guava solution is = 1.39 N

The strength of oxalate ion

Fresh guava solution is $= 0.58 gL^{-1}$

Semi - ripen guava solution is $= 0.60 gL^{-1}$

Ripened guava solution is $= 0.61 gL^{-1}$

Conclusion

- The content of oxalate ion in guava was found to be 59.67 percent, which is close to the literature value of 60 percent.
- It was also noticed that the content of oxalate ion grows with ripening of guava.

bibliography

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- Wikipedia
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