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"ESTIMATION OF ASCORBIC ACID IN PHARMACEUTICAL DRUGS/ BEVERAGE/JUICES BY VOLUMETRIC ANALYSIS AND CONFIRMATION OF THE RESULTS BY UV/VIS-SPECTROPHOMETRY TECHNIQUE"

Chemistry

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ABSTRACT

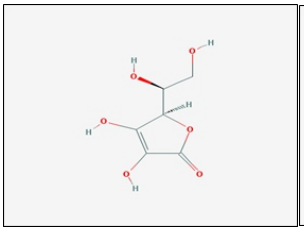
The main aim of this study is to develop a new quantitative assay method for checking the quality and quantity of ascorbic acid from pharmaceutical drug, packed fruit juice, fruit pulp,and vegetableand animal milk products by Volumetric Analysis and UV/Vis-spectrophotometry techniques. This work helped to make better use of pharmaceutical drugs, packed fruit juices, fruits and vegetables as food and a clear understanding of the nutrition content, or doses to be given to maintain a good health and the prevention of risks from diseases caused to a healthy human body.

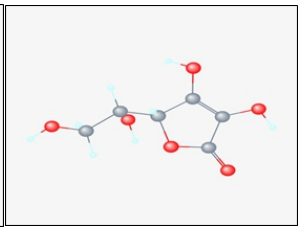
KEYWORDS

Ascorbic acid,Pharmaceutical drug, Volumetric Analysis, UV/Vis-spectrophotometry.

INTRODUCTION

Ascorbic acid is a six carbon compound related to glucose. It is found naturally in citrus fruits and many vegetables. Ascorbic acid is an essential nutrient in human diets, and necessary to maintain connective tissue and bone. Its biologically active form, vitamin, functions as a reducing agent and coenzyme in several metabolic pathways. Vitamin C is considered an antioxidant.





Molecular Formula: $C_6H_8O_6$
Molecular Weight: 176.124 g/mol
IUPAC Name:(2R)-2-[(1S)-1, 2-dihydroxyethyl]-3, 4-dihydroxy-2H-furan-5-one

Vitamin C (ascorbic acid) concentration has been estimated by using two methods, the first - the titration method (redox titration using Iodine Solution and Iodate Solution) and secondly confirmation of the above results by spectrophotometric method.

Five different components (Pharmaceutical drug, packaged fruit juice, fruit, vegetable and animal source) using methods titration with iodine and iodate solutions and these results were confirmed by UV-spectrophotometry. The redox reaction is preferable to an acid base titration because many other components in these can act as acids. This work helped to make better use of pharmaceutical drugs, packed fruit juices, fruits and vegetables as food and a clear understanding of the nutrition content, or doses to be given to maintain a good health and the prevention of risks from diseases caused to a healthy human body.

The main aim of this is to study quantitative assay method for checking the quality and quantity of Ascorbic acid in beverage/juices products by Volumetric analysis and UV/Vis spectrophotometer techniques.

MATERIALS AND METHODS

Collection and sample preparation.

Pharmaceutical drug product (Limcee tablet) was obtained from manufactured company Abbott Healthcare Private Ltd. The 99.0 % pure ascorbic acid drug was obtained from the Merck specialties private limited, Mumbai.

Standards : Ascorbic Acid Tablet contain not less than 95.% and not more than 115.0% of the stated amount of Ascorbic acid, $C_6H_8O_6$.[1]

EXPERIMENTAL SET-UP

Determination of Vitamin C Concentration by Redox Titration Using Iodine Solution

This method determines the vitamin C concentration in a solution by a redox titration using iodine. As the iodine is added during the titration, the ascorbic acid is oxidized to dehydroascorbic acid, while the iodine is reduced to iodide ions.

$C_6H_8O_6 + I_2 \rightarrow 2I^- + C_6H_6O_6$

(Ascorbicacid)
(Dehydroascorbic acid)

Due to this reaction, the iodine formed is immediately reduced to iodide. Once all the ascorbic acid has been oxidized, the excess iodine is free to react with the starch indicator, forms the blue-black starch-iodine complex. This is the endpoint of the titration.

Chemicals Requires

Iodine solution: (0.005 mol L^{-1})
Starch indicator solution: (0.5%)

For vitamin C tablets (LIMCEE): Dissolve a single tablet in 200 mL of distilled water

For packaged fruit juice (ORANGE): Do not dilute. Use directly.

For Fruits (Orange): Strain the juice through cheesecloth to remove seeds and pulp which may block pipettes.

Titration

1. Pipette a 20 mL aliquot of the sample solution into a 250 mL conical flask and add about 150 mL of distilled water and 1 mL of starch indicator solution.
2. Titrate the sample with 0.005 mol L−1 iodine solution. The endpoint of the titration is identified as the first permanent trace of a dark blue-black colour due to the starch-iodine complex.
3. Repeat the titration with further aliquots of sample solution until you obtain concordant results (titres agreeing within 0.1 mL).

Calculations

1. Calculate the average volume of iodine solution used from your concordant titres.
2. Calculate the moles of iodine reacting.
3. Using the equation of the titration (below) determine the number of moles of ascorbic acid reacting.

$C_6H_8O_6 + I_2 \rightarrow 2I^- + C_6H_6O_6$

(Ascorbic acid)
(Dehydroascorbic acid)

4. Calculate the concentration in mol $L^{-1}$of ascorbic acid in the solution obtained from fruit/vegetable/juice. Also, calculate the concentration, in mg/100mL or mg/100g of ascorbic acid, in the sample of

fruit/vegetable/juice.

Statistical Analysis: The results were expressed as mean ± standard error of mean of three determinations.

RESULTS AND DISCUSSION

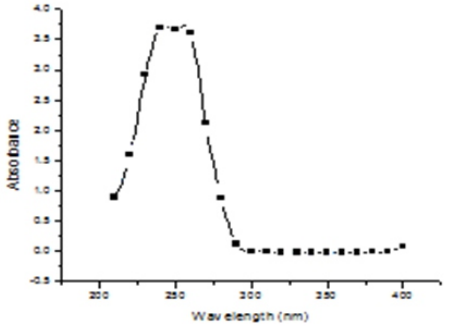
Detection of Wavelength

In the present study, sample solution was then scanned in the UV region of 200-400 nm and the spectrum was recorded to get λ_{max} of analyte in mobile phase. 240nm wavelength was selected for estimation of this combination.

Table 1: Determination of λ_{max} for ascorbic acid by UV/Vis-Spectrophotometry technique using 100 ppm standard solution.

Wavelength/nm	Absorbance
210	0.8849
220	1.5957
230	2.9270
240	**3.6886**
250	3.6607
260	3.6107
270	2.1133
280	0.8746
290	0.1140
300	-0.007
310	-0.008
320	-0.014
330	-0.015
340	-0.015
350	-0.015
360	-0.014
370	-0.014
380	-0.011
390	-0.011
400	0.0812

Graph 1: Plot of absorbance versus wavelength of stock standard solution.



Preparation of calibration curve

A calibration curve was constructed by injecting the different concentration of serial dilutions (standard drug) in range 12.5, 25, 50, 75 and 100 µg/mL in trice replication. The calibration curve was obtained by plotting the average peak areas against these different known concentrations.

Graph 2: Plot of absorbance versus concentration of stock standard solution.

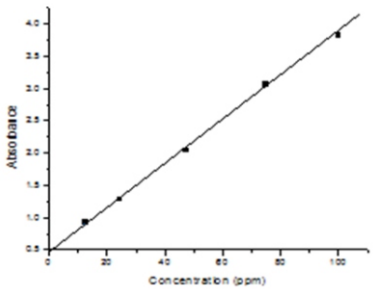


Table 3: Determination of vitamin C using UV-Visible spectrophotometer method: In this work all the drug samples fruits and vegetables are fresh which collected from Pimpri market.

Sr. No	Sample Name	Amount (mg/L)	SD (%)
1.	Vitamin C tablets (LIMCEE)	95.58	± 3.23
2.	Packaged fruit juice (ORANGE)	37.18	± 4.23
3.	Fruit (ORANGE)	17.12	± 3.12

Table 4: Determination of vitamin C using Volumetric analysis: In this work in the second method to determine the value of ascorbic acid was titration method.

Sr. No	Sample Name	Amount (mg/L)	SD (%)
1.	Vitamin C tablets (LIMCEE)	98.00	± 3.23
2.	Packaged fruit juice (ORANGE)	46.20	± 4.02
3.	Fruit (ORANGE)	35.12	± 3.42

CONCLUSIONS AND FUTURE SCOPE

For this work, Volumetric analysis and UV/Vis-Spectrophotometry method were applied and validated for the determination of ascorbic acid from pharmaceutical drug, packed fruit juice, fruit pulp, and vegetable and animal milk products. The experimental conditions in both methods were optimised to get good results. In both methods, standard deviation and recovery study were found within the limits of ± 10% error. Hence, both methods are suitable for the quantitative estimation.

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