AN ADVANCE CHEMICAL ANALYSIS TECHNIQUE FOR DETERMINATION & KINETIC STUDY OF ASCORBIC ACID IN VARIOUS SAMPLES.

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Abstract: Ascorbic Acid is a powerful antioxidant naturally present in many foods especially in 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. Ascorbic Acid is one of the important water soluble vitamins. Simple Indirect Spectrophotometric methods for determination of L-Ascorbic Acid in Various samples. Utilizing a Spectrophotometric method, Beer's Law is obeyed and also to study the Kinetics of Ascorbic Acid in various Samples.

Keywords: Ascorbic Acid, Fruits, , Spectrophotometer, Kinetic Study.

I. Introduction

The best understood function of ascorbic acid is its role in synthesizing the protein collagen. Ascorbic acid is extremely important for the formation of intracellular material. It also influences the formation of hemoglobin and the maturation of erythrocytes. It is very important for wound healing. Ascorbic acid increases the cross-connections between amino acids in collagen, greatly strengthening the tissues it helps form. It enhances iron absorption by keeping iron in its most absorbable form. It is vital for the function of the immune system, especially for the activity of certain cells in the immune system. Finally it is also necessary for the synthesis of a number of hormones, neurotransmitters, and other compounds, such as bile acids and DNA. Vitamin C is an essential nutrient for our organism. It is necessary for our body's development. Humans, as well as other primates and other species, cannot synthesize this nutrient due to the absence of the enzyme L-gulonolactone oxidase in their organisms. This enzyme is capable of catalyzing the conversion of glucose in vitamin C (without enzymatic action). Therefore, it is extremely important to maintain the intake of vitamin C in order to develop a healthy organism. Our so objective in this investigation is to study the degradation of vitamin C in various samples .We will determine the order of reaction followed by our samples and we will calculate the reaction rate constant *k* based on the results of the experiments on this basis half life period can also be calculated.

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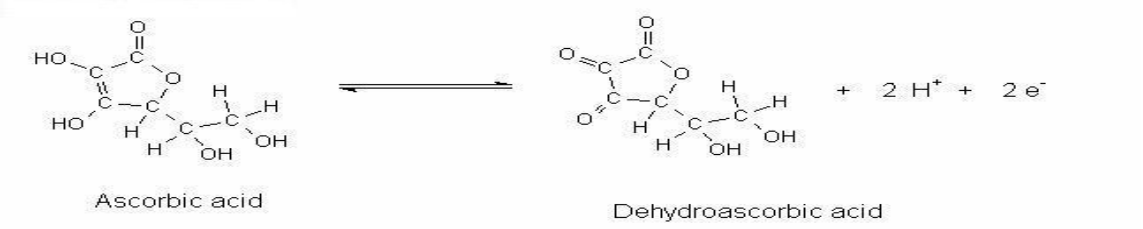

II. Experimental Method

A) Chemicals used

a) Auramine O = 0.01% b) Sodium acetate = 2.0 mol l^{-1} c) Oxalic acid = 0.2 mol l^{-1} d) Sodium salt of EDTA = 5% e) Potassium iodide = 0.1 mol l^{-1} f) Potassium iodate = 0.2 mol l^{-1} g) HCl = 0.02 mol l^{-1}

B) Methodology

a) Stock Solution

1) Double distilled deionized water was used.

2) For ascorbic acid, a stock solution was prepared by dissolving 100mg of Ascorbic Acid in 100ml in water.

3) Working solutions were freshly prepared by appropriate dilution of stock solutions with water.

4) Potassium iodide -potassium iodate (KI-KIA) Mixture was prepared by mixing 0.1 mol l^{-1} potassium iodide and 0.2 mol l^{-1} potassium iodate in 5:1 ratio. This solution was prepared daily and kept in amber colored bottle.

5) A UV-Visible spectrophotometer SL-210 double beam was used for all spectral measurements.

6) pH measurements were done.

7) A centrifugal having a maximum centrifugal force of 1850 g with fixed swing out rotors was used for centrifugation.

C) Determination of Ascorbic Acid in fruit juices and Vegetables:

1) Fruit samples were weighed; juice was separated from fruits with a mechanical press and centrifuged.

2) A 1.0 ml aliquot of juice was diluted to 100ml with 0.2 mol l^{-1} oxalic acid to avoid losses of Ascorbic Acid due to air oxidation, to this mixture 5% EDTA (1 ml) was added and the solution was centrifuged for 5min.

3) Supernatant liquid was further diluted to a suitable volume with deionized water on the basis of Ascorbic Acid concentration in fruits.

4) In aliquot, auramine o dye (2 ml) was added, followed by sodium hydroxide (2 ml) and then analyzed.

5) Various samples of vegetables were cut into small pieces and 4-5 g were homogenized with 100-150ml of 0.2 mol l^{-1} oxalic acid as soon as possible to avoid any oxidation of Ascorbic Acid.

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6) To this, added 1 ml of 5% EDTA and centrifuged. Supernatant liquid was diluted to a suitable volume and 1 ml aliquot was analyzed

D) Determination of Ascorbic Acid in pharmaceuticals and Biological samples:

1) All drug samples tested were fresh and purchased from local pharmacy.

2) An Ascorbic Acid tablet or content of a capsule was weighed, ground to a fine powder and stirred for 2-3 min with 50ml of deionized water. Then 5% EDTA (1 ml) was added and filtered through filter paper.

3) Insoluble mass was washed with three successive 5 ml portions of water and filtrate plus washings were diluted to 250 ml calibrated flask.

4) A known volume was further diluted depending on Ascorbic Acid content and color of the sample.

5) Aliquot (1 ml) was analyzed.

6) Since presence of Ascorbic Acid has been reported in samples.

7) Prior to determination of Ascorbic Acid 5% EDTA (1 ml) and 1% TCA (Tricholoacetic acid) (2 ml) were added, centrifuged, diluted to a suitable volume and aliquot (1 ml) was analyzed.

E) Kinetic study

Loss of Ascorbic Acid in Various samples concentrates was calculated by using the Standard equation for first order reaction given below.

First –Order Reaction is given by:

$\ln C = \ln C_o - kt$ or $\ln(C/Co) = - kt$

Where, C= concentration at time t, Co= concentration at time zero, K= first –order rate constant, t= time

Temperature Dependence of Ascorbic Acid was determined by using Arrhenius Equation

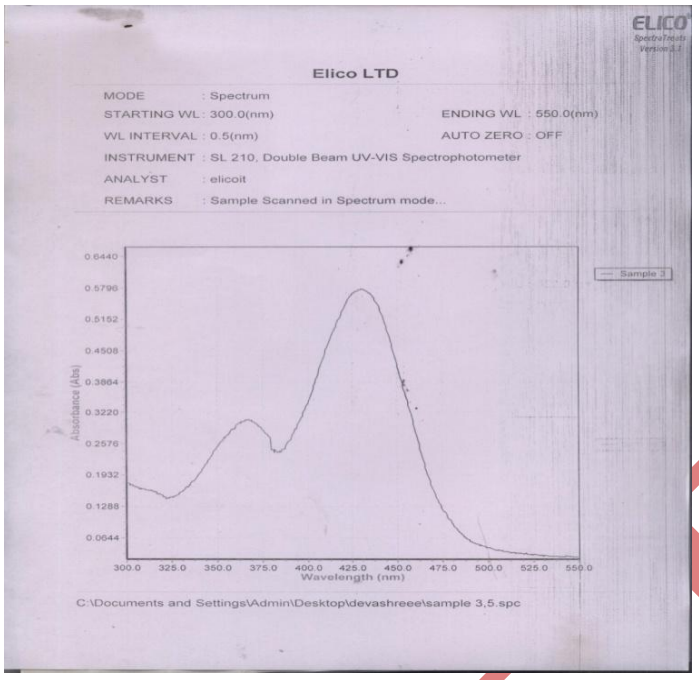
$K=Ko\ e^{-EA/RT}$

Where, K= rate constant ,K_o= pre-exponential factor, Ea= activation energy(K mol l^{-1}) R= gas constant ,T= absolute temperature in K

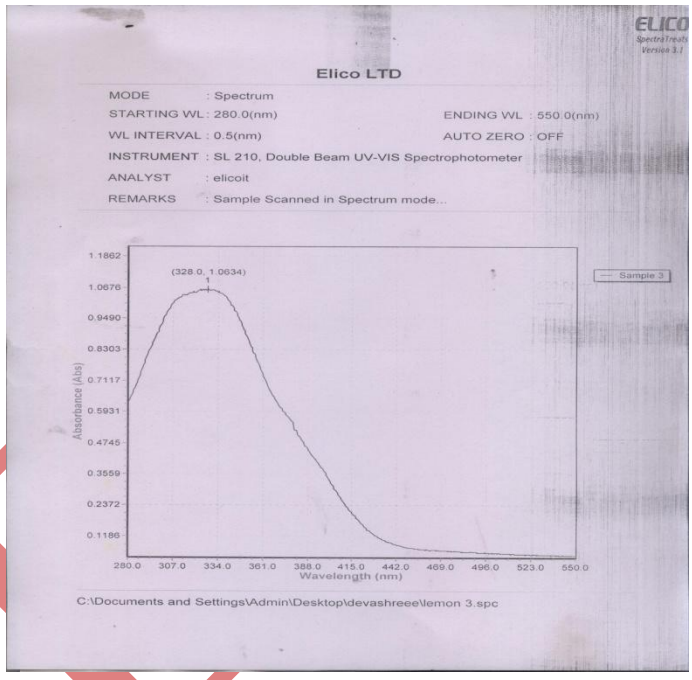
III .Results and Discussion

A) Analysis Report

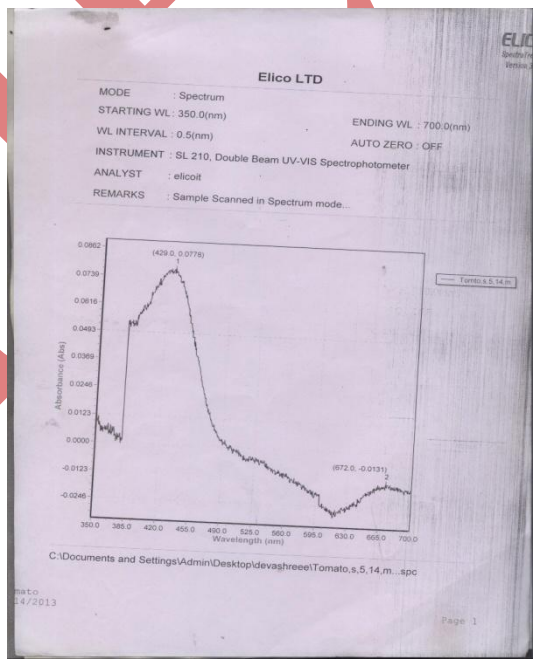
1) Analysis for Ascorbic Acid



2) Analysis for Lemon

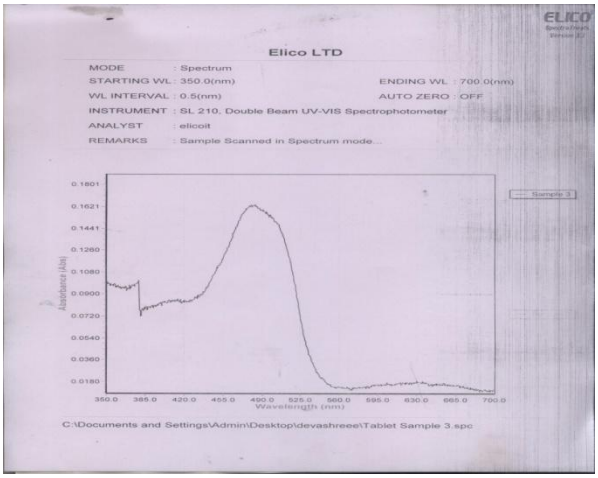


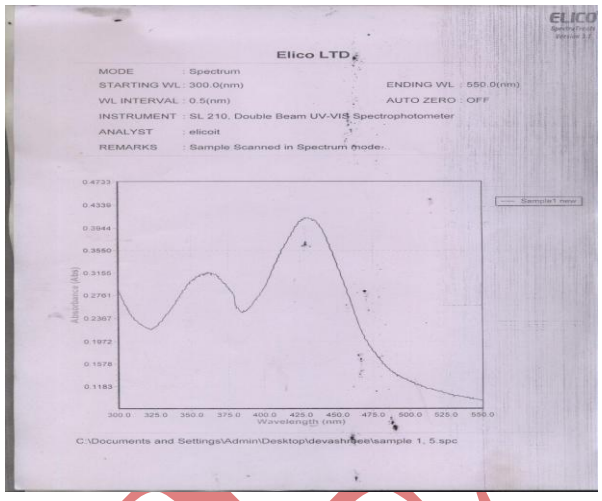
3) Analysis for Tomato



4) Analysis for Tablet

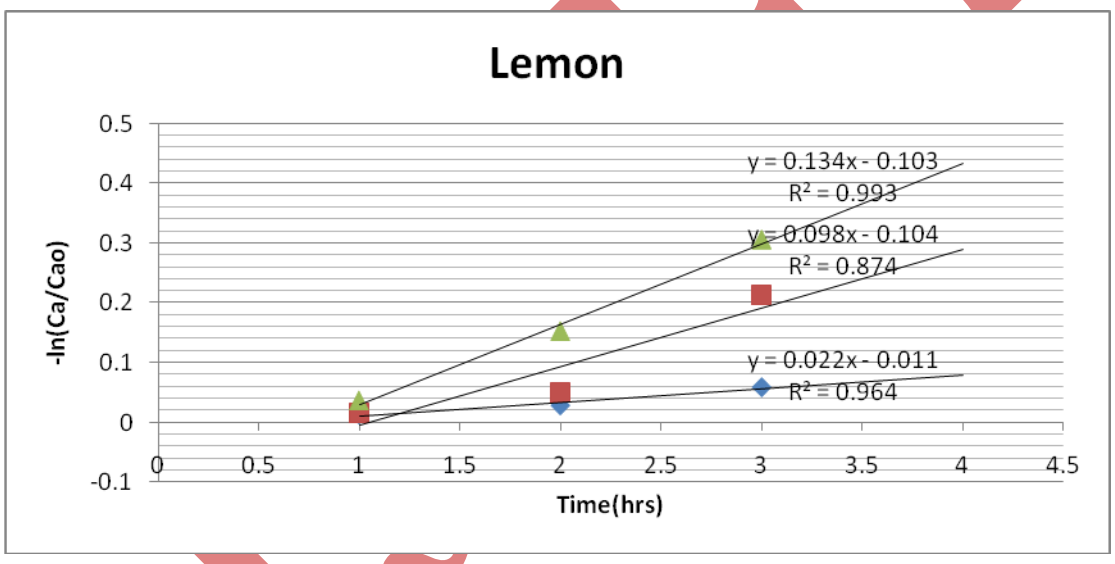
5) Analysis for Milk





B) Kinetic Study for Lemon & Tomato

a) First-order Reaction

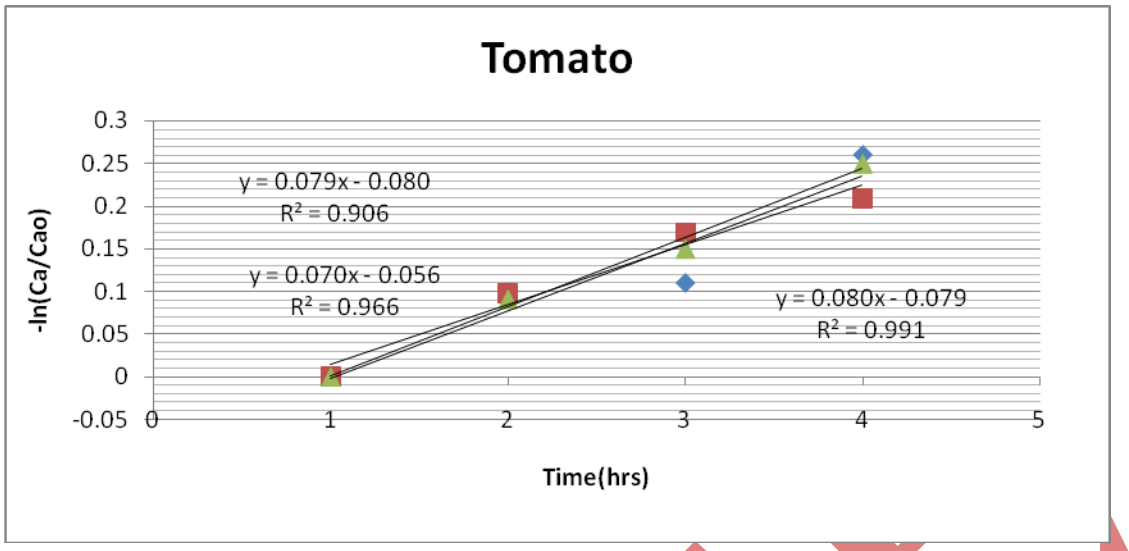


slope = - (E/R)

E = 3000 ×8.314

= 24942 J/mol.K

E = 24.942 kJ/mol.K

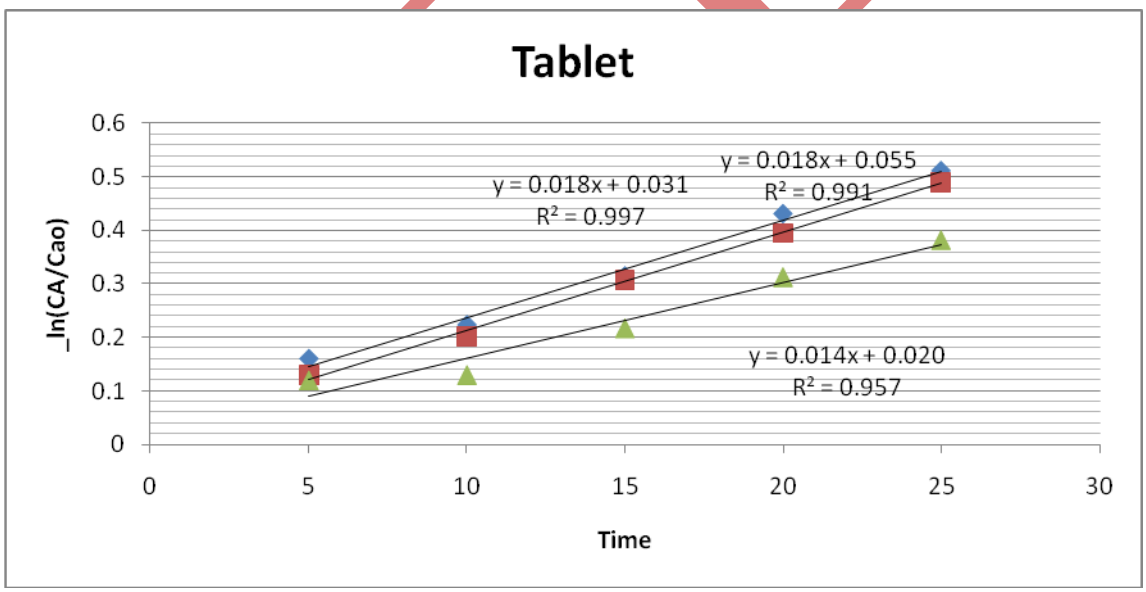


slope = - (E/R)

E = 1920 × 8.314

= 15962.88 J/mol.K

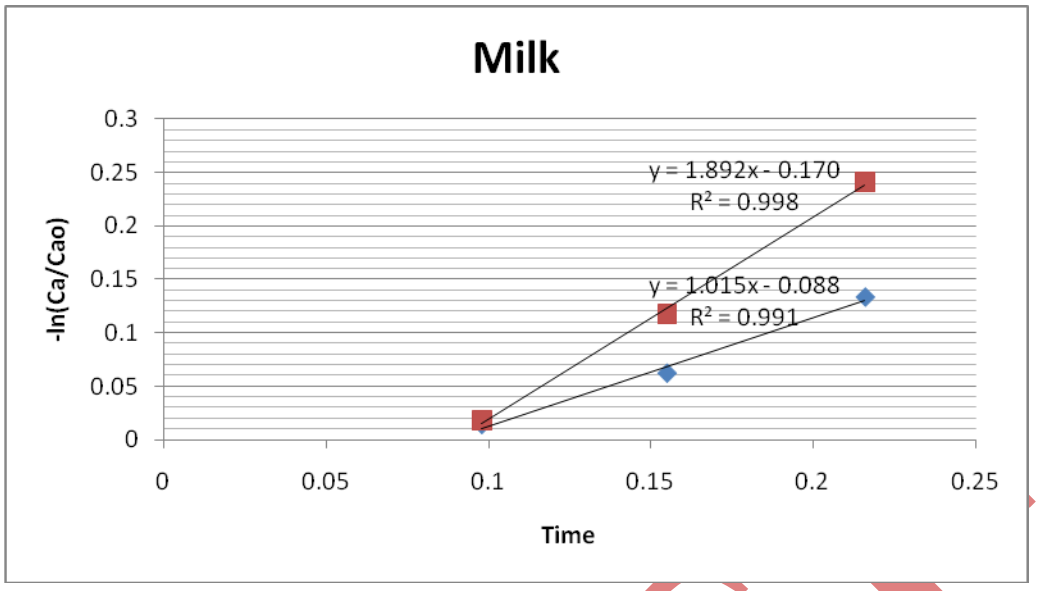
E = 15.96288 kJ/mol.K



slope = - (E/R)

E = 19596.0 J/mol.K

E = 19.5960 kJ/mol.K



slope = - (E/R)

E = 143416.5 J/mol.K

E = 14.34165 kJ/mol.K

IV) Conclusion

- Since presence of Ascorbic Acid has been reported in samples.
- This study provided a new ,simple and highly sensitive method for determination of Ascorbic Acid in Various samples.
- The stability of formed Auramine O dye is an added advantage of the method.
- The proposed mathematical models permit a simulation of the vitamin C degradation Rate in Samples & also the Activation energy.

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