Determination of Vitamin C (Ascorbic acid) concentration in some of Commercial Products, by Redox Titration

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Abstract

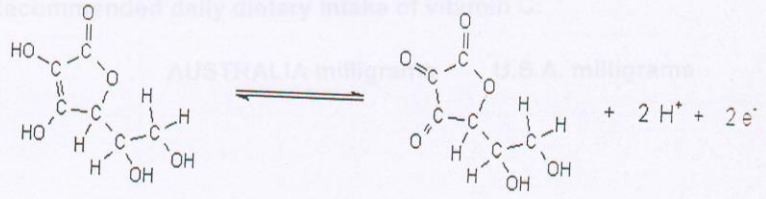
The goal of this search is to determine the concentration of vitamin C (Ascorbic acid) in some of a Commercial Products, Vegetables and Fruit Juices by Redox Titration. A redox titration, involving an Iodometric method, has been used to do the analysis. The samples classified by their Vitamin C content.

الخلاصة

الهدف من البحث لتحديد تركيز فيتامينC (حامض الاسكوربيك)في عدد من المنتجات التجارية والخضروات وعصائر الفواكه بواسطة التسحيح الاختزالي.التسحيح الاختزالي يتضمن طريقة اليودو ميتريا باستخدام التحليل.النماذج مصنفة حسب احتوائها لفيتامينC.

Introduction

Vitamins are a group of small molecular compounds that are essential nutrients in many multi-cellular organisms, and humans in particular. L-Ascorbic acid was first isolated as a pure substance by Albert Azent-Gyorgi and Charles Kingin 1928 [Paulling ,1970] , an anti-oxidant and free radical scavenger, is found ubiquitously in fruit and vegetables such as citrus fruits (oranges, lemons, limes, tangerines etc.), melons, tomatoes, peppers, broccoli, green leafy vegetables such as spinach, potatoes and turnips, its quantitative determination is especially important in the production of wine, beer, milk, soft drinks and fruit juices, where it can be a quality indicator [Gerrior & Zizza,1994] .Given the essential role played in the human diet and necessary to growth and repair of tissues in all parts of human body .It is necessary to form collagen an important skin proteins ,scar tissue ,tendons, ligaments, and blood vessels. vitamin C is essential for the healing of wounds, and for the repair and maintenance of cartilage, bones and teeth [Mcevoy ,1993] . Since vitamin C is easily oxidized, storage and cooking in air leads to the eventual oxidation of vitamin C by oxygen in the atmosphere. In addition, ascorbic acid is water-solubility vitamin means that a significant amount of vitamin C present in a food can be lost by boiling and then discarding the cooking water [Mcevoy ,1993]. The formula for ascorbic acid is $C_6H_8O_6$, It occurs as a white or slightly yellow crystal or powder with a slight acidic test , Ascorbic Acid is freely soluble in water; sparingly soluble in alcohol; insoluble in chloroform, ether, and benzene [Moffat,1986]. The structures for the reduced (ascorbic acid) form and for the oxidized form (dehydroascorbic acid) are shown below:



Ascorbic acid

Dehydroascorbic acid

The amount of ascorbic acid can be determined by a redox titration with a standardized solution of iodine. The iodine is reduced by the ascorbic acid to form iodide. As shown in the other half of this redox equation.

The titration end point is reached when a slight excess of iodine is added to the ascorbic acid solution [Bailey ,1974;Brody,1994;Pauling ,1976;Kalluer,1986]. Vitamin C deficiency leads to scurvy, a disease characterized by weakness, small hemorrhages throughout the body that cause gums and skin to bleed, and loosening of the teeth. Vitamin C can not synthesized through body cells, nor does it store it. It is therefore important to include plenty of vitamin C-containing foods in daily diet. vitamin C toxicity is very rare, because the body can not store the vitamin however ,amounts greater than 2000 mg/day are not recommended because such high doses can lead to stomach up set and diarrhea. The minimum daily requirement is 30 mg. Well-balanced diets provide adequate amounts of the vitamin as measured by the Recommended Daily Allowance (RDA) of about 75 mg per day for adults (aged 15 or older), less for children, and more for pregnant and lactating women. The National Academy of Sciences recommends the consumption of 60 mg of ascorbic acid per day. . the Federal Food and Drug Administration has adopted the recommended dietary allowance (RDA) of 60 mg/day A very small daily intake of vitamin C (10-15 mg/day for an adult) is required to avoid deficiency and stave off scurvy. However, there has been, and continues to be, vigorous debate on what the optimum daily intake of vitamin C is. Some have argued that 200 mg/day is an optimal daily intake for adult humans. Others have suggested 1-2 g/day is best, this despite studies that show that the blood is saturated with vitamin C at 100 mg/day, and any excess is excreted in the urine [RDA,1995; RDA,1987; Browne.,1993; FAO/WHO,2002; Levine *et al.*,1999; Levine *et al.*,1995;Teoh ,1975].

Recommended daily dietary intake of vitamin C:

	AUSTRALIA milligrams	U.S.A. milligrams
Infants:	30	35
Children:	30-50	45
Adult men:	30	60
Adult women:	30	60
Pregnancy (2nd and 3rd trimesters)	60	80
Lactation:	60	100

I2 is not standard solution ,so it may be standardized with thiosulphate solution .

Experimental Procedure for determination of [Bailey ,1974; Brody, 1994; Pauling,1976; Kalluer,1986].

1. Preparation of 0.005 mol L^{-1} iodine solution: Accurately weight two gm of KI and 1.3g of I2 , dissolved to aless amount of water , shake until dissolving . Transfer iodine solution to a 1L volumetric flask , making sure to rinse all traces of solution in to the volumetric flask using distilled water , completed the volume up to the mark.

2. Preparation of 0.5% starch indicator solution: Soluble starch (0.25gm) to a 100 mL conical flask or beaker and 50 mL of distilled water was added . Solution heated with stirring at 79 ^{0}C for 5 minutes , careful must be taken not to exceed the stated temperature. Allow solution to cool to room temperature.

3. Preparation of food/drink sample:

- Industrial Packaged fruit juices {Orange , Pineapple, Lemon ,Tmrhend and Apple (Miso), Pepsi (khaleek kadha), Red grapes(Niktar), Seven up (Kufa), Pomegranate (Linda) , Tmrhend (Toti), Orange (Dalia), and Granules peach (Rani) } may also need to be strained through cheese cloth if it contains a lot of pulp or seeds.
- For analysis of vitamin C powders (Tanc lemon , Tanc orange and livans powders) dissolved 1 gm in 100mL of distilled water (in a volumetric flask).
- For analysis of vitamin C tablets (Kruger and joiure tablets), dissolved a single tablet in 200 mL of distilled water (in a volumetric flask).
- Juice squeezed from fresh fruit (Diala orange , Hilla orange, Egypt orange ,allalinki ,pomegranate and apple Juices) should be strained through cheese cloth in order to remove seeds and pulp which may block pipettes.
- Juice squeezed from fresh vegetables (Tomato ,Onion ,Celery ,Option ,Potato and Lettuce juices) should be strained through cheese cloth in order to remove seeds and pulp which may block pipettes.

•Sample of fruit or vegetable (100gm) blended in a food processor together with 50 mL of distilled water. After blending, strain the pulp through cheese cloth, washing it 0mL in a volumetric flask.

4. Aliquot of the sample (20 ml) solution prepared above transfrred into a 250 mL conical flask , about 150 mL of distilled water and 1 mL of starch indicator solution.
5. Sample were titrated with 0.005 mol L^{-1} iodine solution. The endpoint of the titration is identified as the first distinct trace of a dark blue-black colour due to the starch-iodine complex.
6. Titration were repeated with further aliquots of sample solution until concordant results (titres agreeing within 0.1 mL) were obtained.

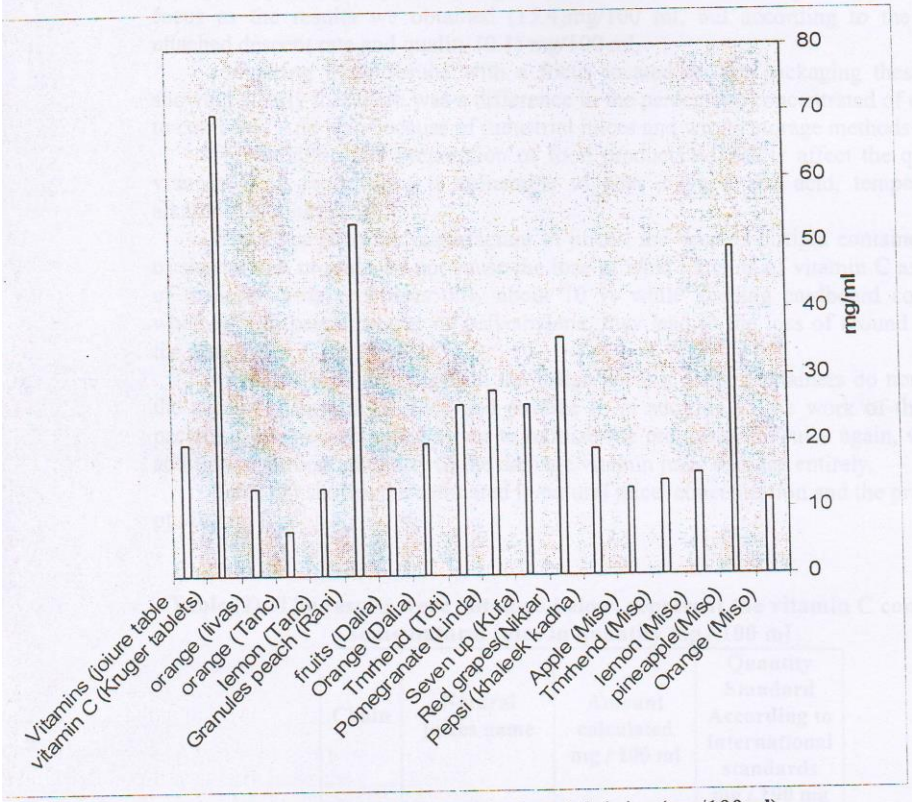
Results and discussion:-

In this research estimating vitamin C in industrial juices (Orange , Pineapple, Lemon, Tmrhend and Apple (Miso), Pepsi (khaleek kadha), Red grapes (Niktar), Seven up (Kufa), Pomegranate (Linda) , Tmrhend (Toti), Orange (Dalia), fruits (Dalia) and Granules peach (Rani)), Kruger and joiure tablets, and Tanc lemon , Tanc orange and livans powders, and natural juices for fresh fruits (Diala orange , Hilla orange, Egypt orange ,mandarin ,pomegranate and apple Juices) and fresh vegetables (Tomato , Onion ,Celery ,cucumber ,Potato and Lettuce juices).It was calibrated using redox way by iodine calibration using starch as indicator , iodine was an adequate oxidizer used for this purpose.

Table (1) show the in industrial juices estimated concentration and the proportion of vitamin C.

Table (1):The results were obtained below, represent the vitamin C content in some industrial juice in quantity mg / 100 ml and percentage %.

Chain	Industrial product name	Amount calculated mg / 100 ml
1	Orange (Miso)	11.49
2	pineapple(Miso)	49.4
3	lemon (Miso)	15.4
4	Tmrhend (Miso)	14.2
5	Apple (Miso)	13
6	Pepsi (khaleek kadha)	19
7	Red grapes(Niktar)	35.7
8	Seven up (Kufa)	25.88
9	Pomegranate (Linda)	28
10	Tmrhend (Toti)	25.77
11	Orange (Dalia)	19..995
12	fruits (Dalia)	13.33
13	Granules peach (Rani)	53.32
14	lemon (Tanc)	13.33
15	orange (Tanc)	6.665
16	orange (livas)	13..33
17	vitamin C (Kruger tablets)	69..95
18	Vitamins (joiure tablets)	19..995



Scheme (1) . Vitamin C content in some industrial juice (mg/100ml) .

The result in table (1) and scheme (1) showed the highest concentration of vitamin C in industrial juices found in granules peach juice where concentration is (53.32) mg / 100 ml and lowest in orange juice (Miso),hitting (11.49) mg /100 ml ,either powder Limon Tanc, the presence of vitamin C according to bulletin declared on the product is 100 %,but the results show that we have reached 89.9 % and its concentration was (3.33) mg/100 ml, where results appeared supposed to be the weight of vitamin C (667) mg of origin (45) mg ,results show that this weight (599.85) mg of origin (45) mg . While orange Tanc powder result of vitamin C amount to 44.96 % with the amount according to bulletin declared as the products of 100 %,where it should the weight of vitamin C (667) mg of origin (45) mg ,results show that this weight (299.9) mg of origin (45) mg . Vitamin C tablets – type Krueger according to bulletin declared only that all (1) gm contains (45) mg of vitamin C, but the results we obtained the concentration is (69.95) mg in (1) gm ,an increase of about (25) mg. Either vitamins fruits tablets – type junior according to bulletin declared only that all (1) gm contains (8.8) mg of vitamin C but we have received is (19.995) mg in (1) gm, an increase of more than double.

Where the study showed that the Tmrhend juice (Miso) was vitamin C focus as the results we obtained (25.77) mg/100 ml ,but according to the bulletin attached

descent rate and quality (1.68) mg/100) ml ,either alimonadah juice (Miso) was its focus as the results we obtained (15.4)mg/100 ml, but according to the bulletin attached descent rate and quality (0.1) mg/100 ml.

comparing these results with a focus located on the packaging these juices. showing clearly that there was a difference in the percentage concentrated of company to company, And also because of industrial juices and wrong storage methods.

The handling and preparation of food products adversely affect the quality of vitamin C in food. since it vulnerable to heat ,oxygen and acid, temperate and alkalinity mediums.

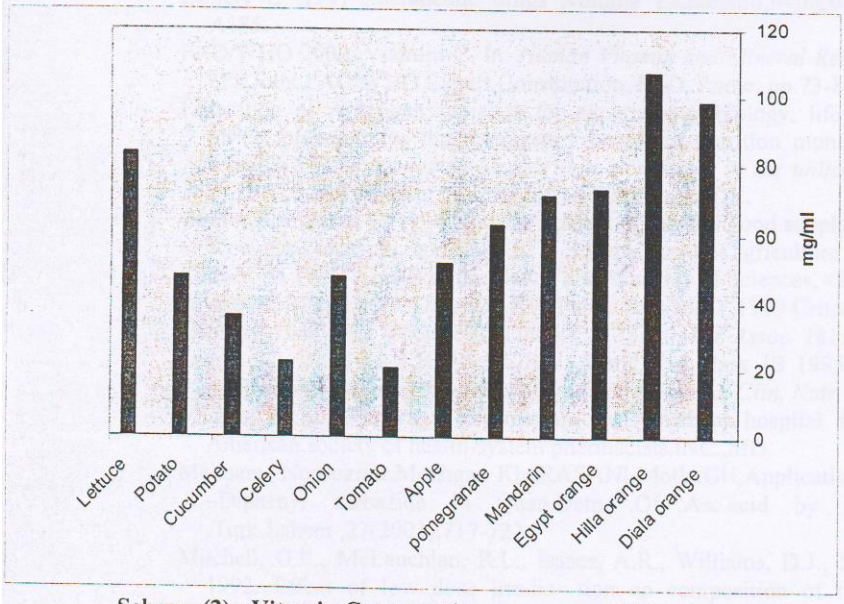
With regards to the manufacture of juices, the keepers airtight containers made of sheet metal or glass do not cause the lose of what remains of vitamin C as a result of manufacturing processes only about 10 % while keeping cardboard containers. whether with paraffin layer or polyethylene, they lead to the loss of around 75 % of the past three

weeks, even if keeping it in the fridge because these containers do not prevent the access of oxygen to juice and oxidize it, in addition to the work of the upper-packaged juice or occupied by air to oxidize the proportion of juice again, while the addition of carbon alkalinity of the damage vitamin juice damage entirely.

Table (2) shows the estimated in natural juice concentration and the proportion of vitamin C .

Table (2) :The results were obtained below, represent the vitamin C content in some natural juice in quantity mg / 100 ml .

Chain	Natural juices name	Amount calculated mg / 100 ml	Quantity Standard According to international standards mg / 100 mg
1	Diala orange	98.64	42-50
2	Hilla orange	107.1	42-50
3	Egypt	73.315	42-50
4	orange	71.4	37.7
5	Mandarin	63	52.8 – 72
6	pomegranate	51.5	6
7	Apple	20.6	13.6 – 17
8	Tomato	47.6	50
9	Onion	22.1	14
10	Celery	35.7	27
11	Cucumber	47.6	11 – 20
12	Potato	83.3	75
	Lettuce		



Scheme (2) : Vitamin C content in some natural juices .

In table (2) and scheme (2) the results showed the highest concentration of tamin C found in orange juice, hitting (107.1) mg /100ml of juice ,the lowest level as found in tomato juice, when it reached (20.6)mg /100 ml of juice.

Results showed also the presence of vitamin C concentration (107.1) mg 00ml in naturally orange juice (Hilla),98.64 mg / 100 ml (Diala) and 73.315 mg /)0 ml (Egyptian) ,while the concentration of vitamin C in Hilla orange highest from iala orange which highest more than the Egyptian orange. Results appeared that the cus of vitamin C in natural juices models is considered much higher as the focus of ternational standards[Dennis Pittenger,1983;Mitchell G.E.etal.,1992;Vanderslice T.,1990;Romero M.A.,1992;Sidibe M.,1996;Brand Miller,etal.,1993].

vitamin C exist in the form of drugs as swallow tablets, chewing tablets, vallow capsules, solvents and injection, Americans experts certain can be access to e handling of the recommended amount of vitamin C easily through alternative edicine but the damage will be limited in the short term if they are to stop dealing se, therefore preferred experts dealt vitamins by natural eating and drinking, and t to rely on synthetic substitutes [Dollery C.,1991].

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