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Determination of percentage of citric acid in fruit juices

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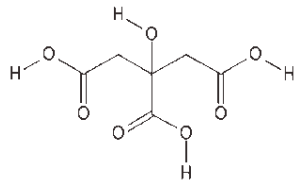
Citric acid is a weak organic acid found in all citrus fruits such as lemons limes, galgals and oranges. Citric acid act as good natural preservative and is also used to add acidic taste to food and soft drinks as it is non–toxic. Citrate is the most abundant organic ion found in the urine. In biochemistry it acts as an important intermediate in the citric acid cycle in the metabolism of living beings. Citric acid has an important component of co-enzyme A which has many metabolic roles, particularly in conversion of pyruvic acid into acetyl co-enzyme A and helps in the degradation of fatty acids. Knowledge of the citric acid content of beverages may be useful in nutrition therapy for calcium urolithiasisl, epically among patients with hypocitraturia. Citrate is a naturally occurring inhibitor of urinary crystallization and achieving therapeutic urinary citrate concentration is one clinical target in the medical management of calcium urolithiasisl. Citrate retards stones formation by inhibiting the calcium oxalate nucleation process and the growth of both calcium oxalate and calcium phosphate stones largely by its ability to bind with urinary calcium and reduces the free calcium contraction, thereby reducing the supersaturation of urine and other crystals and may enhance urinary citrate excretion . Medical interventions to increase urinary citrate are a primary focus in the medical managements of urolithiasis. Its deficiency obviously retards general and mental growth and induces, fatigue, reproductivdebility, fatty liver, graying of hair etc. In various citrus juices, citric acid content can be quantitatively measured. The procedure commonly used to do this take advantage of the known reactivity of citric acid with sodium hydroxide known as titration. We can calculate comparative accounts of the percentage of citric acid in various citrus fruits. Recently its has been shown that certain strains of Candida (a yeast) can produce citric acid from n- alkanes derived from petroleum. This method, when developed will revolutionize the citric acid industry.

Key words: *Pyruvic acid, Co-Enzyme A, Candia, Urolithiasis, Hypocitraturia, Urinary Citrate.*

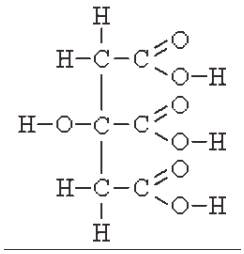
Introduction :

Citric acid exists in a variety of fruits and vegetables, but it is most concentrated in lemons and limes (Muller M, et al., 1996), where it can comprise as much as 8% of dry weight of the fruit (Seltzer MA, et al., 1996).



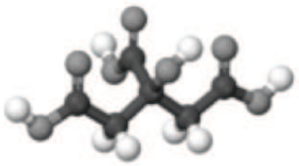
It occurs in citrus fruits such as lemons, limes, galgals and oranges. Lemon juice contains 7-10% citric acid (Release 19). Citric acid is a weak organic acid found in citrus fruits. It is a good, natural preservative and is also used to give an acidic taste to food and soft drinks. It also serves as an environmentally benign cleaning agent and acts as an antioxidant.

Citric acid's chemical formula is $C_6H_8O_7$.Its structure is reflected in its IUPAC name 2-hydroxypropane-1,2,3-tricarboxylic.



Citric acid contains three carboxylic acid functional groups so it gives three series of salts and esters. Citric

acid forms the monoacetyl derivative with acetyl chloride and hence contains one alcoholic OHgroup.



Objective :

To get a comparative account of the percentage of citric acid in various citrus fruits.

Principle of Experiment :

The citrus fruits contain citric acid in large amounts which gives its acidity. The acids are extracted or diluted with distilled water and determined by titrating with standard solution of NaOH.

$$R(COOH)_3 + 3NaOH = R(COONa)_3 + 3H_2O$$

Sodium citrate

Identification test :

1. When an aqueous solution of the citric acid is treated with a few drops of silver nitrate solution, a white crystalline precipitate is obtained which is soluble in ammonium hydroxide.
2. When aqueous solution of citric acid is treated with a solution of beta-napthol in concentrated H_2SO_4, a blue colors solution is obtained. It indicates the presence of citric acid.

Procedure :

1. Dilute solution of fruit juices was prepared in a measuring flask.
2. 10gm of NaOH was weighed and diluted with distilled water in a measuring flask and shaken thoroughly.
3. Diluted juice solution was titrated with the NaOH solution using 1 drop of phenolphthalein as indicator with constant swirling until permanent pink colour appears. The pink colour indicates the end point i.e. the solution is neutralized.

Observation :

SAMPLE NO. 1
LEMON JUICE

Obs. No.	Volume of juice Taken	Burette Reading in ml			Concurrent Reading	Indicator
		Initial	Final	Difference		
1	10ml	9.5	27.9	18.3	18.3	Phenolphthalein
2	10ml	28	46.3	18.3		
3	10ml	1.0	19.3	18.3		
4	10ml	19.6	37.9	18.3		
5	10ml	1.6	20.0	18.3		

Calculation :

Strength of lemon juice can be calculated by the following formula:

$$N_1V_1 = N_2V_2$$

N_2 = Normality of the citric acid solution = ?
V_2 = Volume of the citric acid solution taken = 10ml
N_2 = Normality of the standard NaOH = 1/10
V_2 = Volume of the standard NaOH used =18.3ml

$$N_1V_1 = N_2V_2$$
$$N_1 = 18.3/100$$
$$= 0.183$$

% of citric acid = 6.4 * normality
= 6.4 * 0.183
= 1.1712
= 1.1 %

Similarly the % of citric acid was found out in all other citrus fruits taken for analysis. The observation and results are tabulated in the following table:

Sl. No.	Sample Name	Volume of Juice Taken(Ml)	Vol. of Naoh Used	% of Citric Acid
1.	Lemon	10 ml	18.3	1.1
2.	Amla	10 ml	8.2	0.52
3.	Grape	10 ml	3.0	0.03
4.	Orange	10 ml	2.0	0.12
5.	Lime	10 ml	1.4	0.08
6.	Pine Apple	10 ml	1.2	0.076
7.	Pears	10 ml	1.0	0.064

Conculsion:

1. Maximum amount of citric acid is present in Sample no. 1(lemon juice)
2. Minimum amount of citric acid is present in sample no. 7 (pears juice)
3. Percentage of citric acid present in given fruits juices is as follows:

(a)	Lemon	–	1.1%
(b)	Amla	–	0.52%
(c)	Grapes	–	0.19%
(d)	Orange	–	0.12%
(e)	Lime	–	0.08%
(f)	Pine Apple	–	0.076%
(g)	Pears	–	0.64%

Suggestion :

- Contact with dry citric acid or with concentrated solution can result in skin and eye irritation, so protective clothing should be worn when handling these materials.
- Excessive consumption is capable of eroding the tooth enamel.
- Contact to the eyes can cause a burning sensation, and may cause blindness with prolonged exposure in extremely high concentration.
- Sometimes a high concentration of citric acid can damage hair and bleach it.

Disscusion :

- Citrus fruit are rich in citric acid. Citric acid is water soluble and is also fats soluble.
- The recommended daily allowance of citric acid for an adult is 60mg a day (Penniston KL. et. al., 2007).
- Amla fruit extract has shown significant decrease of the blood glucose levels.
- Lemon juice may also be used as lighten hair colors.
- When you buy sour candies, you may note many of then are covered with a fine white powder. This is citric acids, which adds an exterior coating to candies and provides quite a bit of sour taste.
- A halved lemon dipped in salt or baking powder can be used as an eco-friendly cleaning agent to brighten copper cookware.
- Citric acid is used as a flavoring and preservative in food and beverages, especially soft drinks.

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