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Ascorbic Acid Study in Citrus Juice: Effect of Preservative

MUZZAFFAR KHAN[1], IMTIAZ AHMAD[1], AND MOHAMMAD QAISER[2]
[1]Department of Chemistry, University of Peshawar, Peshawar, Pakistan
[2]PCSIR, Laboratories, off University, Jamrud Road, Peshawar, Pakistan.

Abstract

This paper reports the effect of preservative on ascorbic acid extracted from freshly plucked oranges. Colorimetric method was used for the determination of ascorbic acid. Determination of some inorganic elements like sodium, potassium and lithium were also determined by flame photometry. The preservative was found to have a beneficial effect on the retention of ascorbic acid, particularly when used in high concentration. Metal content, particularly potassium did not alter significantly during preservation for duration of one month.

Keywords: Citrus juice, Oxidation, Preservation, Metal Content.

Introduction

Ascorbic acid as a component of many fruits represents a major source of vitamin C in human food stuff. It ranges from 14.8-69.8 mM/L in plasma of a fasting person [1]. It protects against chronic diseases. A drinking generous amount of a mixture of various juices maintain the level of ascorbic acid and improves the blood lipid profile, reduces oxidative stress, prevents atherogenic modifications of LDL cholesterol and platelet aggregation. Deficiency of ascorbic acid in some population particularly elderly people may lead to sever health problems [2-5]. Supplementation of ascorbic acid (ascorbate) is essential to avoid health problems in them. It may act as pharmacological base [6] and protect from the consequences of some diseases like cardiovascular diseases [7, 8]. Ascorbic acid is widely distributed in plants; the richest natural sources are orange juices, citrus extracts [9, 10] and grape fruit juice.

The primary causes of loss of ascorbic acid is the oxidation under processing and storage conditions, vacuum de-aeration of juices is very important in controlling this loss, the type of material used for construction of juice processing equipment is critical. Contamination by iron and copper ion will also increase ascorbic oxidation. There is a need to avoid oxidation of juices during processing as well as storage for quality assurance.

The present study was undertaken to investigate the use of a preservative and the time of storage as well as inorganic elements on the percent retention of ascorbic acid determined in the extracts obtained from freshly plucked citrus fruits.

Material and Methods

Sample collection

Freshly plucked source oranges from plants grown in the vicinity of Department of Chemistry, University of Peshawar, were taken. The fruits were thoroughly rinsed with water to remove dust and other particles. The fruits were cut and squeezed to extract the juice. The juice was filtered, clarified and centrifuged to remove the solid colored particles.

Preparation of reagents

1M sulphuric acid, 0.1M sodium thiosulphate and iodine solution were prepared. Sodium thiosulphate was standardized with potassium iodide, while iodine solution was standardized with sodium thiosulphate solution using the well established method [11]. Starch

solution was prepared by dissolving 1g in small amount of water to form a paste. The paste was poured in to100ml of boiling water and boiled for one minute. The solution was allowed to cool and then 1g of potassium iodide was added. The solution was stoppered and stored.

Determination of Ascorbic Acid

Iodometric titration was used for the determination of ascorbic acid in the source organs.

Procedure.-10ml of centrifuged fruit juice was taken. To this solution, 10ml of 1M H_2SO_4 and 2ml of starch solution were added and titrated against standard iodine solution till the appearance of purple color at the end point, the amount of ascorbic acid was calculated from the amount of iodine utilized by the following relation:

1ml of 0.05M iodine =0.0088g of ascorbic acid

Preparation of stock solution of preservatives

1 g of potassium metabisulphide and 0.1g of benzoic acid was dissolved in 100ml distilled water. Different quantities of preservative were added to 50ml of juice and preserved in dark for three months.

Determination on sodium, potassium and lithium in fruit juice by the flame photometry

Analar grade salts were used for the preparation of stock solutions. 1000 ppm solution of Na, K and Li were prepared by dissolving 0.525 g, 0.191 g and 0.6 g of the respective salts in 100ml of distilled water used as standard stock solutions.

Results and Discussion

To maintain the dietary importance, as well as freshness, flavor, & color up to the satisfaction of the consumer, vegetables & fruits are usually preserved to be healthful. Quality of fruit juices is deteriorated due to many factors, oxidation is mainly responsible. Both oxides and peroxides may cause direct oxidation. Indirect oxidation may result from the formation of highly reactive quinines produced during the action of phenolases of phenolic substrates.

The effect of some preservatives on the retention of ascorbic acid was studied. The data is compiled in Table 1. It is evident from the data that there is a marked effect of preservatives on the % retention of the ascorbic acid. The % retention in case of 0.01w/w of the preservative caused 48 % retention of ascorbic acid. Upon increasing the concentration of the preservative, the % retention was increased and attained the highest value at 0.05 w/w of the preservative where the retention was found to be 84 %.

Table 2 provides data of ascorbic acid as function of time in days. It is evident from the data that the retention on day I was found to be 44.00 %, day 10 the was 45.00 %, day 20 th was 51 %, day 30 th was 57 % and day5 0 th was 42 % respectively. This increase in the retention can be seen with the higest at day 30 th. This is due to the formation of flavonoids or polyphenols. Poly phenols have been reported as good anti oxidants [12, 13]. There are two theories about the mode of action of flavonoids. The first is that the flavonoids can form metals complexes [14] (data of metals determined is given in Table 2). It has been pointed out that flavonoids of citrus fruits do not posses chemical configurations like 3-hydroxy-4-carboxy group in the pyrone ring or 3.4-dihydroxy group in the β-ring which is necessary for these compounds to complex with metal ions. The second theory is that the oxidation of ascorbic acid is a chain reaction and that the flavonoid interrupt the reaction by acting as a free radical acceptors/scavengers.

Citrus fruits have been found to be high in potassium and low in sodium. The potassium to sodium ratio is important in regulating blood pressure. The effect of preservation time on the metal contents was also studied. The data is compiled in Table 2. It can be observed that the sodium content of the sample preserved for 30 days is very low and the potassium content is still satisfactory. Thus it is inferred from the results that the desired metal contents are not affected so much during preservation for prolonged periods. The preserved juices can be used with the same results as the whole one.

Conclusion

From the current study it can be concluded that preservation is an effective way to retain ascorbic acid content in fruits.

Table – 1. Effect of Preservative on the stability of ascorbic acid in orange juice

Amount of preservative (%W)	Volume (mL)	Ascorbic acid (mg/100mL)	% retention of A.A	organoleptic test	
				Color	taste
0.01	1.0	16.0	48.0	B	G
0.02	2.0	18.0	54.0	A	E
0.03	3.0	18.0	54.0	B	G
0.04	4.0	18.5	56.0	B	G
0.05	5.0	28.0	84.0	**A**	**E**
0.1	10.0	27.0	81.0	**A**	**E**
0.15	15.0	23.0	69.0	**A**	**B**

Level of ascorbic acid before the addition of preservative=33.0mg/100ml
Taste: E=excellent: G=good: B=changed.
Color: A=original; B=changed

Table - 2. Ascorbic acid and mineral content determined at different interval of time

Days	Ascorbic acid (mg/100mL)	Na^+ (ppm)	%age	K^+ (ppm)	%age	Li^+ (ppm)	%age
1	44.00	1.7	0.0034	83.0	0.166	7.0	0.014
10	45.00	0.8	0.0018	83.0	0.166	7.5	0.015
20	51.25	1.2	0.0024	64.0	0.128	6.2	0.012
30	57.50	0.2	0.0004	66.0	0.132	3.5	0.007
40	42.55	0.8	0.0016	59.5	0.119	4.0	0.008

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