RETENTION OF ASCORBIC ACID IN FORTIFIED ORANGE JUICE POWDERS DURING STORAGE

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ABSTRACT

Both *Coorg* and *Sathgudi* orange juice powders are good carriers for added ascorbic acid during prolonged storage at ordinary temperatures. There is not much difference between nitrogen and air packs as regards retention of ascorbic acid during storage. Nitrogen pack, however, helps to keep the powder in a better free-flowing condition.

Introduction

In the course of an investigation of the possibility of preparing powders from *Coorg* and *Sathgudi* orange juices adopting the method standardised in these laboratories[1] it was of interest to study the retention of ascorbic acid added to it, for fortifying it. Since orange juice and its products are primarily valued for their ascorbic acid content, their suitability as vehicles for fortification with ascorbic acid is of much significance. Miller[2], who has studied a large number of preserved fruit and vegetable products for their suitability for fortification with ascorbic acid, has observed that orange juice concentrates and powders are fairly good as carriers for ascorbic acid. Pritchett, Stevens and Baier[3] have reported a retention of 98·8 percent of ascorbic acid in dehydrated orangeade and satisfactory retention during storage at 37°C (98·6°F) for several months. Mylne and Seamans[4] have studied the changes during storage in ascorbic acid content and other constituents in stabilised orange juice powder. The results of a similar investigation in the case of two orange juice powders, packed in air and in nitrogen, are presented in this paper.

Material and Methods

Coorg and *Sathgudi* orange juice powders, prepared according to the standard method by vacuum-shelf drying, were employed for storage studies. Citric acid (1 5 per cent) and ascorbic acid (50,100 and 150 mg. per cent.) were the two additives used singly or in combination. These were powdered finely and mixed well with an aliquot of the orange juice powder, and this premix was mixed again with the bulk of the powder to secure their fairly uniform distribution. The blended powders were packed in 8 oz. capacity glass jars fitted with metallic screw caps. One lot was packed as such in air, while the other set was packed in nitrogen gas under a positive pressure of 4-5 lbs., after preliminary evacuation of the jars and flushing out any residual air inside by means of nitrogen gas. The closed jars were made air-tight by dipping the lids in paraffin wax. The different lots were stored at room temperature and at 37°C for further analysis.

True ascorbic acid was determined by the formaldehyde-xylene method of Robinson and Stotz[5]. The retention of ascorbic acid was expressed as a percentage of that present in the same at start. Moisture, ash and acidity in the powder were determined according to standard A.O.A.C. methods. Reducing as well as total sugars were determined by the methylene blue titration method of Lane and Eynon[6].

Results and Discussion

Since only fairly small quantities of citric and ascorbic acid powders were blended with the orange juice powders,—a process in which it is rather difficult to attain uniformity of distribution—it was necessary to find out to what extent the technique adopted could be relied upon to give a uniform distribution. An analysis, using six replicates of two typical fortified lots, gave the following results for the average values with their standard errors of the mean:—

	Lot 1	Lot 2
Acidity per cent	2·68±0·05	2·37±0·02
Ascorbic acid mg. per cent	115·1 ±4·0	44·6± 3·0

The comparatively low standard errors of the mean indicated that the technique adopted for mixing the additives and drawing samples for analysis was satisfactory.

The proximate composition of the two bulk samples of orange juice powders employed for fortification is shown in Table I. Data regarding retention of ascorbic acid in fortified lots stored at room temperature (24—30°C) and 37°C are shown in Tables II and III respectively.

It will be observed that the retention of ascorbic acid during a period of 9 months storage at ordinary room temperature is as high as 66 to 82% in the case of *Sathgudi* orange juice powder and 74 to 91% in the case of *Coorg* orange juice powder. When the period of storage is prolonged to two years, the retention decreases, the retention still ranging from 35 to 68 percent and 64 to 77% in the case of the two powders, respectively. The retention percentages in the case of air-packing and nitrogen-packing are almost the same. In the case of the nitrogen-packed powders, however, during prolonged storage, there was less browning and caking than in the case of the air-packed powders. In both cases, browning and caking were only very slight, if not negligible.

In the case of powders as such packed in air and stored at 37°C, the retention of ascorbic acid upto a storage period of 4 months was quite high (48 to 72 per cent in the case of *Sathgudi* orange juice powder and 72 to 86 per cent in the case of *Coorg* orange juice powder). At the end of one year's storage, however, the retention was reduced considerably to 0 to 41 per cent in the case of *Sathgudi* orange powder and only slightly to 66 per cent in the case of the *Coorg* orange powder. The addition of citric acid to the powders did not have any marked effect on the retention of ascorbic acid during storage.

Conclusion

Both *Sathgudi* and *Coorg* orange juice powders are good carriers for added ascorbic acid, there being only a small loss of it even during prolonged storage at 24 –30°C. The retention, however, decreases considerably when they are stored at 37°C beyond a period of about 4 months. This occurs in spite of the low moisture content of the powders, which is about one per cent. Although there is no marked difference between air and nitrogen-packed powders, as regards percentage retention of ascorbic acid, nitrogen-packed powders have less tendency to brown or cake during prolonged storage.

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TABEL I

Proximate Composition of Orange Juice Powders

Particulars	*Sathgudi* orange juice powder	*Coorg* orange juice powder
	%	%
Moisture	0·77	1·13
Ash	1·05	0·74
Acidity as anhydrous citric Acid	1·05	1·31
Reducing sugars, as invert sugar	8·1	10·6
Total sugars, as invert sugar	95·6	95·6
Ascorbic acid (mg.)	10·2	5·0
Remarks	Light yellow powder	yellow powder

TABLE III

Retention of ascorbic acid in orange juice powders during storage at room temperature (24—30°C)

Treatment	Product	Packed in	Ascorbic acid content at start mg. %	Ascorbic acid retention per cent at the end of (months)		
				4	9	24
	I. Sathgudi orange juice powder					
1	+50 mg. % ascorbic acid	Air	60·2	80·4	82·4	34·7
2	Do.	Nitrogen	60·2	82·7	65·8	45·2
3	+50 mg. % ascorbic acid+ 1·5% citric acid	Air	60·0	72·3	65·7	55·3
4	Do.	Nitrogen	60·0	86·0	80·8	56·8
5	+100 mg. % ascorbic acid	Air	110·2	82·8	74·7	64·2
6	Do.	Nitrogen	110·2	79·3	78·7	67·1
7	+100 mg. % ascorbic acid+ 1·5 % citric acid	Air	110·0	89·5	76·3	67·8
8	Do.	Nitrogen	110·0	91·3	69·5	59·2
	II. Coorg orange juice powder					
1	+150 mg. % ascorbic acid	Air	155·0	88·4	84·8	63·7
2	Do.	Nitrogen	155·0	91·6	90·6	77·4
3	+150 mg.+ ascorbic acid + 1·5 % citric acid	Air	154·9	81·8	75·7	74·3
4	Do.	Nitrogen	154·9	74·3	74·3	70·8

TABLE III

Retention of ascorbic acid in orange juice powders during storage at 37°C

Treatment	Product	Ascorbic acid content at start mg. %	Ascorbic acid retention per cent at the end of			
			2 days	1 month	4 months	12 months
	I. Sathgudi orange juice powder					
1	+50 mg. per cent ascorbic acid	60·2	90·5	70·3	68·9	0·0
2	+50 mg. % ascorbic acid+1·5 per-cent citric acid	60·0	90·7	61·7	47·6	14·7
3	+100 mg. psr cent ascorbic acid	110·2	73·4	69·2	67·2	40.8
4	+100 mg. per cent ascorbic acid+ 1·5 per cent citric acid	110·0	84·5	68·3	72·0	29·3
	II. Coorg orange juice powder					
1	+150 mg. per cent ascorbic acid	155·0	91·0	85·9	85·9	66·1
2	+150 mg. per cent ascorbic acid+ 1·5 per cent citric acid	154·9	88·6	80·4	72·2	..

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