

In this article are discussed the effect which different methods of Preservation & other factors have on

THE KEEPING QUALITY

of

CITRUS JUICES DURING STORAGE

By

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INTRODUCTION

THE maintenance of the original quality of citrus juices during storage is one of the difficult problems that confront the citrus fruit juice Industry to-day. Quality consists in taste, flavour and general appearance of the product. It is the taste and flavour that influence the acceptability of nearly every thing that passes the lips whether it be food or beverage. Good flavour in a particular food is in itself an automatic insurance of the fact that people will consume it not only to maintain their health, but also to reach the desirable target of normal or optimum Nutrition. Flavour is of great importance especially to those of poor or capricious appetite, who may not consume enough food unless the flavour is attractive. From commercial point of view, too, a more pleasant product is liable to be sold in greater quantities than a competitor's similar product with less of pleasant flavour, although the price for both the products may be the same and the advertising appeal equal.

The chemical aspect of flavour must also be given due consideration, specially, with respect to natural flavour present in citrus juices. Flavour in citrus juices is due to the flavouring agents & particularly due to the essential oils (Odoriferous Volatil oils) present in them. These essential oils are the important sources of aroma and flavour & hence are of great importance for the Food Technologists.

Attention must also be given to the effect of other factors like, (1) the method of treatment etc. before packing, (2) oxygen present in the head-space of the container and that dissolved or adsorbed on the juice particles, (3) the type of container, and (4) storage conditions, specially when they are to be preserved for long periods. Such considerations will primarily be guardian over the natural flavours, as far as possible, and also over their retention in the final product. Keeping the above points in view, an investigation was undertaken on the Preservation of pure citrus juices, a brief report of which with regard to the keeping quality of citrus juices during storage, is given in this article.

MATERIALS & METHODS

Juices from 7 different citrus fruits namely Orange (Mosambi), Grape-fruit, Sweet lime, Galgal, Nagpuri Sangtra, Lime and Khatta were extracted and packed as (i) control, (ii) sweetened with the addition of cane sugar @ 5% (iii) deaerated, and finally, under each treatment, they were separately preserved by (1) Ordinary Pasteurization at 175°F for $\frac{1}{2}$ hour (both in 12 oz plain tin cans as well as 8 oz bottles) (2) Overflow pasteurization (bottles) (3) Potassium - Meta - bisulphite @ 700 p. p. m. of SO₂ (4) Sodium Benzoate @ 1000 p.p.m. (5) Flash pasteurization at 190°F for one minute both in 8 oz bottles and 12 oz. plain tin cans. All the sets

thus prepared were stored at (1) room temperature (2) in a refrigerator (3) in an incubator (37°C).

QUANTITATIVE ORGANOLEPTIC ANALYSIS

The perception of flavour involves several senses, particularly the sense of tongue-taste, the sense of smell, and the sense of feeling. The tongue-taste encompasses very well the flavour of such substances as citric acid, sugar etc. Odour, on the other hand, can be detected effectively from within the mouth quite as well as through actual smelling, for there is a convenient and effective back entry from the mouth to the smelling area in the head by way of throat. Some of the scented air is pumped up to the smelling area each time one swallows. The warmth and moisture of the mouth make odour perception even more delicate and discriminating than it is through ordinary smelling. A considerable reproducibility with respect to quality of citrus juices may be obtained through organoleptic analysis. The figures given in the table below are taken from typical data devoted, entirely to the appraisal of Squashes prepared from preserved citrus juices. The values given therein represent the general tasting practice followed and demonstrate the degree of accuracy which may be obtained by such type of routine organoleptic work.

Scoring was done on a 100 point scale as detailed in the table i.e. 20 marks for taste, 50 for flavour and 30 for general appearance, which includes clarity as well as colour of the product. The samples, which procured about 80 marks or above, were considered as excellent, those which obtained between 70-80 as good and between 60-70 as fair.

Tasting was done in an established manner, without swallowing, in $\frac{1}{2}$ -1 oz. sips, after each of which the mouth was rinsed with water. All the findings of the different technical tasters were written down by them secretly and scored to the nearest whole point. Then score-sheet were turned over to the author for tabulating and averaging. The table referred to above embodies typical data

obtained with regard to the keeping quality of Lime Juice and Sangtra juice packed under different treatments and methods of preservations and stored under different conditions.

DISCUSSION

The general keeping quality of juices is affected by a number of factors, both from within and without and every change that occurs in them is likely to influence flavour. The factors from within include the life process of raw fruit or the nature of the fruit & fruit juice, Enzyme actions, and various chemical changes such as sugar protein reaction etc. The factors from without are those of the environment. They include the oxygen present in the Head space, or dissolved or adsorbed on the juice particles, the substance of the container, the method of preparation & extraction, the method of packing or preservation of juices & storage conditions etc.

Thus, Sweet Lime juice, immediately after extraction got intensely bitter, taste being almost equal to that of Quinine; this may be ascribed to the presence of various glucosides, which offer great obstacle in the successful preservation of Sweet Lime juice. An investigation is, therefore, necessary with regard to finding the composition of the juice in respect particularly of the substance which is responsible for the bitterness and the mechanism involved in these changes as also for developing a manufacturing technique by which this bitterness can be overcome.

Similarly, Grape-fruit juice is also somewhat bitter, because of the presence of bitter principle-naringin-a lemon yellow crystalline glucoside-found in great abundance in the albedo and in the carpellary membranes. The presence of even one part of it in 8000 parts of juice renders it extremely bitter (Tressler et al, 1939). California Grape-Fruit, according to Poor, (1934), was found to contain 0.06 % of naringin in juice, 0.15% in rag, 0.90% in the peel and 1.49% in albedo; further it is more in unripe than in fully ripe fruit.

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Thus the selection of the right type of fruit for juice and also the method of extraction is bound to influence the taste and flavour of a particular juice, as slight maceration of the albedo portion or of the carpellary membranes may result in a bitter and highly unpalatable juice.

Juices of Lime, Galgal and Khatta, because of their high acid content, could not be tasted as such and hence it was not possible to evaluate them as such. Anyhow, the squashes prepared from these were tasted and the remarks are given on the next page.

In Lime juice the retention of original flavour and aroma was much better than either in Galgal or Khatta juice and in fact there was no comparison between them. In Galgal and Khatta juices there was found some peculiar odour, giving a bad after-taste. In Lime Juice, on the whole, the retention of flavour was fairly good even after 10 months' storage at room temperature, while Khatta and Galgal juices became unpalatable. Moreover, too much discoloration had set in in these two juices, which gave a poor impression about the product. On the other hand, browning was noticed much less in Lime juice even after 10 months' storage.

In Orange juice almost similar phenomenon was observed.

Comparing the different treatments, in general, deaerated samples were found to be superior to both control and sweetened ones. Sweetened samples, however, showed an early tendency towards darkening. Total darkening, as compared with either control or deaerated samples, was more as stated earlier, and lost all appeal to the eye of the consumer.

A word to the relative values of the various methods of preservation with regard to the keeping quality of citrus juices:

Flash pasteurization, in general, gave the best results irrespective of the different

tereatments and other factors. Next in order of merit were SO₂, over-flow pasteurization, ordinary pasteurization and the worst Sodium Benzoate. In benzoated samples, after prolonged storage, there was a peculiar throatcatching, chemical after-taste which was disliked by every taster.

Processing by heat does a variety of things to the flavour. Plain boiling tends to drive off the volatile flavour & hence dearomatize the juice. Thus, in over-flow pasteurized samples, because of the thermal treatment done, there developed a slight cooked taste. In ordinary pasteurization samples, cooked taste was even more pronounced.

With regard to the relative effect of the containers on the retention of original taste and flavour, it was observed, that after processing, the glass-packed pasteurized juice, in general, had slightly cooked taste as compared with similarly treated canned juice. This may be attributed to the slower cooling of the bottled juice. In flash pasteurized samples, however, no such cooked taste was noticeable.

In general, tinny flavour was observed in all juices packed in tin during storage. There was much corrosion specially near and above the surface of the liquid in the container, in case of highly acid fruit juices viz., Lime, Khatta & Galgal etc. Slight feathering was noticeable even after one month's storage; at low temperature storage very little corrosion was found after 4-5 months' storage.

Corrosion was much less in less acid juices, particularly in Sweet Lime juice, Orange Juice and Sangtra juice. Corrosion was found to be roughly proportional to acid content of the juice. Of course, where head-space was greater, enhanced corrosion was observed.

Generally speaking, at low temperature storage, irrespective of the type of container, the juices retained maximum of their original flavour and aroma, even at the end of 6 months' storage.

TABLE

Organoleptic Analysis of Deaerated Lime Juice and Nagpuri Sangtra Juice preserved by different methods of preservation and stored at Room temp.

(Score-card Method)

Fruit Juice	Methods of Preservation	Taste					Clarity	Total Marks	Remarks.
		Aroma	Intensity	Trueness	Colour				
		20	10	20	20	20	10	100	
Lime Juice (After 10 months storage)	Ord. Pasteurization								
	(a) Bottles.	15	4	11	11	14	7	62	Slightly cooked taste.
	(b) Cans.	16	5	12	12	15	7	67	Fairly fresh, slight tinny flavour.
	Over-flow pasteuriz.	16	5	12	12	15	7	67	Fairly fresh.
	Sodium Benzoate @0.1 %	14	4	11	11	13	6	59	Off chemical after taste.
	SO ₂ @ 700 p.p.m.	16	5	13	12	15	7	68	Fresh.
	Flash past. (Bot.)	16	6	14	14	15	7	72	Fresh.
Flash past. (Cans).	16	6	13	13	15	7	70	Fresh, slight tinny flavour.	
Sangtra Juice (Nagpuri).	Ord. Past. (Bottles)	14	4	11	11	13	6	59	Cooked and slightly better taste.
	Ord. Past. (Cans).	15	5	12	12	14	7	65	Tinny flavour.
	Over-flow past.	15	5	11	12	14	7	64	Slightly cooked and bitter taste.
	Sodium Benz.	13	4	11	11	10	6	55	Off-chemical after taste.
	SO ₂ @ 700 p.p.m.	15	5	12	12	15	7	66	Fairly fresh, slightly bitter taste.
	Flash past (Bot)	16	5	13	13	15	7	69	Fairly fresh.
	Flash past (Cans).	16	5	12	13	15	7	68	Fresh but slight tinny flavour-