Pak. J. Agri. Sa; Vol. 31, *No.* 3, 1994.

EFFECT OF POTASSIUM SORBATE ON THE STABILITY OF KINNOW JUICE CONCENTRATE DURING STORAGE

M.N. Aslam, J.A. Awan & S.M. Nasar-Abbas
Food Technology Section,
Ayub Agricultural Research Institute, Faisalabad
**Department of Food Technology,*
University of Agriculture, Faisalabad

Kinnow juice was concentrated to 46 ◦ Brix under vacuum of 750-760 mm Hg, at 40 to 45◦ C. Potassium sorbate (300 ppm) was added to the concentrate which was then filled in plastic bags and stored at -20, -10, 0 and at +8° C for 90 days. Analysis was conducted for Brix, acidity, pH, reducing sugars, ascorbic acid and sensory characteristics. Results revealed no appreciable change in Brix and pH in all samples. Increase in reducing sugars was found while ascorbic acid and acidity decreased during storage. Concentrate stored at _20° C gave best results followed by samples stored at _100 C. Maximum loss of 89.65% in ascorbic acid occurred in samples stored at +8· C, while at -20· C, it was 34.49%.

INTRODUCTION

In continuation of our work reported earlier on the low temperature storage of Kinnow juice concentrate (Awan *et al.,* 1994), the present investigation describes the effect of potassium sorbate on stability of Kinnow juice concentrate. In previous study (Awan *et al.,* 1994), Kinnow juice of 46· Brix was stored at -20, -10,0 and +8° C and storage behaviour was studied without addition of any chemical. Results showed that storage behaviour in respect of physico-chemical characteristics was equally good at -10 and -20· C.

Sorbates are antifungal agents and primarily used to control yeast and mold growth. They are also effective antinmicrobial agents and are GRAS. Being fatty acid, sorbates are metabolized by the body to CO_2 and H_2O.

Some work on storage of citrus concentrate is reported by EI-Ashwah *et al.* (1982), Marcy *et al.* (1989) and others hut literature on storage of Kinnow concentrate is rather scanty. Sandhu *et al.* (19H5) and Javid (19AA) stored Kinnow juice concentrale of 42· Brix at different temperatures using different doses of chemicals. Ahmadet *al.* (1994) studied the physico-chemical characteristics of Kinnow juice concentrate. The present study was planned to evaluate and determine the suitable/appropriate temperature for short time storage (3-4 months) of Kinnow juice concentrate using potassium sorbate @ 300 ppm contemplate with economic loss of storage of concentrate at subfreezing temperature.

MATERIALS AND METHODS

Kinnow juice after extraction by Mitsulushi Reamer Extractor was concentrated to 46· Brix at 40 to 45 • C under vacuum by employing thin falling film type evaporator.

Potassium sorbate (300 ppm) was added

as preservative. The concentrate was packed into polyethylene bags (400 g capacity) and divided into five lots and stored at -20, -10, 0 and +8· C for 90 days.

Total soluble solids were measured by hand refractometer, acidity by titration against sodium hydroxide, pH with pH meter and reducing sugars by Lane and Eynon method (AOAC, 1984). Brix/acid ratio was calculated from respective Brix and acidity readings. Ascorbic acid was determined by using Spectronic 20 (Ruck, 1964). Sensory evaluation was done by a panel of untrained/trained judges selected from postgraduate students and staff of Department of Food Technology, University of Agriculture, Faisalabad as described by Larmond (1988). Statistical analysis was done to compare the storage temperature and intervals as described by Steel and Torrie (1980) using Randomized Complete Block Design (RCBD).

RESULTS AND DISCUSSION

It is obvious from the study that practically no change occurred in total soluble solids during storage for 90 days, in samples kept at ·20· C (T4) and -10· C (D). However, loss of 6.52 and. 1.09% occurred in samples stored at +8 • C (T!) and O· C (TI) after 75 days of storage. Decrease in acidity and ascorbic acid were observed. Maximum loss of 9.45% in acidity occurred in samples stored at +8· C (T3) while minimum of 4.72% at -10· C. A decrease in acidity was noticed by Palaniswamy and Muthukrishnan (1974) studying the physico-chemical characteristics of lemon juices and squashes during storage. Sandhu *et al.* (1985) observed decrease in acidity in Kinnow juice concentrate of 40· Brix, packed in coming test tubes (25 x 200 mm), heat sealed from top and pasteurized at 80· C for two minutes. Concentrate was stored at 2-5, 10-38 and 37· C for 3 months. The"rate of loss of ascorbic acid was directly proportional to storage temperature and storage period. The initial ascorbic acid content of 145 mg 100 mL-l fell to 15, 30, 80 and 95 mg 100 mL-l in samples stored at +8, 0, -10 and _ 20· C after 90 days of storage. Maximum loss of 89.65% in ascorbic acid was noticed in samples stored at +8· C, while at -20· C, a minimum loss of 34.49% was observed after 90 days. Browning in concentrate was seen after 75 days of storage but was more at +8· C than at -20· C. In an earlier study (Awan *et al.,* 1994), Kinnow juice concentrate was stored without addition of any chemical but browning was less than the present study. Similar trend of loss in ascorbic acid was observed by EI-Ashwah *et al.* (1982) during the storage studies of concentrated orange and lime juices, Pruthi *et al.* (1984) on malta orange concentrate while Javed (1988) on Kinnow juice concentrate.

Buera *et al.* (1986) investigated the effect of potassium sorbate on colour changes in glucose-glycine system of high water activity. Results showed that sorbic acid enhanced browning. Clegg (1964) investigated non-enzymatic browning in lemon juice and found that browning was due to sugar-amine condensation and ascorbic acid was the main precursor. From above, it is clear that potassium sorbate has no role in preserving ascorbic acid but on the other hand, it promotes its losses. The higher losses in ascorbic acid during storage might be due to the use of potassium sorbate as preservative.

Increase in pH, Brix/acid ratio and reducing sugars was noticed during storage studies of Kinnow concentrate. Increase in pH was observed in all the samples stored at all temperatures. Initial value of Brix/acid ratio was 9.62 which reduced to 9.75, 10.25, 9.91 and 10.00 at +8, 0, -10 and -20· C, respectively after 90 days of storage. Re-

Table 1. Physico-chemical changes during storage of Kinnow concentrate at different temperatures

Parameter	Storage period (months)	Storage temperature (0 C) +8	0	-10	-20
Brix	Initial	46.00	46.00	46.00	46.00
	3	43.00 (-6,52)	45,50 (-1,09)	46.00	46.00
Acidity	Initial	4.R7	4.R7	4.R7	4,H7
	3	4,41 (-9,45)	4.44 (-8.82)	4.64 (-4.72)	4.60 (-5,54)
pH	Initial	3.25	3.25	3.25	3.25
	3	3,39 (+4.13)	3,3R (+ 3,H5)	3,39 (+4.13)	3,3X (+ 3.X5)
Brix/acid ratio	Initial	9,45	9,45	9,45	9,45
	3	9.75 (+3.0R)	10.25 (+ 7.RO)	9.91 (+4.(4)	10.00 (+5,51)
Reducing sugars (%)	Initial	17.R5	17.85	17,85	17.R5
	3	21,07 (+ 15.2R)	20.55 (+13.14)	20,40 (+ 12.50)	20,35 (+ 12.29)
Ascorbic acid (mg)	Initial	145.00	145.00	145.00	145.00
	3	15.00 (-89.65)	30.00 (-79.31)	80.00 (-44.83)	95.00 (-34,49)

Figures in parentheses indicate the per cent loss (-) or per cent increase (+).

ducing sugars increased during storage which was faster /pronounced at higher storage temperature. The increase being higher (15.28%) at +8°C while lower at -20°C (12,29%) after 90 days. The increase in reducing sugars might be due to inversion of non-reducing sugars that continues till the inversion was complete. Similar results of increase in reducing sugars have been reported by (EI-Ashwah *et al.,* 1982), while studying the storage stability of orange juice concentrate.

Sensory evaluation carried out after preparing ready-to-serve drinks has shown a gradual decrease in colour appeal throughout the storage period in all the samples kept at all temperatures. However, loss was greater at +8 °C (22.86%) than at -20 ° C (3,57%). Anthocyanins have heenreportcd to be unstable in fruit juices because of the influence of pH, metal complexes, enzymes and other chemical constituents present both in the fruit and under conditions of processing and storage (Peng

Table 2. Changes in sensory characteristics during storage of Kinnow concentrate at different temperatures

Parameter	Storage period (months)	Storage temperature (0C)			
		+8	0	-10	-20
Colour	Initial	7.13	7.13	7.00	7.00
	3	5.50	6.00	6.63	6.75
		(22.86)	(15.85)	(5.29)	(3.57)
Taste	Initial	6.83	7.00	7.00	7.00
	3	4,50	5.12	6.25	6.87
		(32.13)	(26.86)	(10.71)	(1,86)
Flavour	Initial	6.00	5.88	6.00	6.00
	3	5.13	5.25	5,25	5,50
		(14,50)	(10.71)	(9,00)	(8,33)

Figures in paretheses indicate the per cent loss.

and Markakis, 1963). Oxidation of ascorbic acid is reported to cause browning (Nickerson and Ronsivalli, 1982). Such chemical changes appear to result in loss of colour appeal. Gradual decrease in taste score was also noticed during storage. However, the loss was again greater at higher temperature. At +8° C, taste score decreased from 6.83 to 4.50 while increase in non-enzymatic browning with storage time and temperature lead to lower score for the taste of the product. Losses in flavour were also observed throughout the storage period of 90 days. At +8 0C and 0 0C, initial score was 6.00 and 5.88 which fell to 5.13 and 5.25, respectively after 90 days. At -10 and -20° C, loss in flavour was less and score fell from 6.00 to 5.25 and 6.00 to 5,50 after 90 days. Shimodo and Osajima (1981) reported that furfural level was a useful indicator of off-flavour development in Satsuma orange juice. Pruthi *et al.* (1984) analysed four commercial varieties of malta oranges and observed that flavour changes occurred during storage.

It was concluded on the basis of aggregate score obtained keeping in view colour, taste and flavour for ready-to-serve drinks that maximum sensory appeal was recorded for samples stored at -20 0C, followed by -10 0C. On an average, the order of liking among judges decreased during storage. However, samples remained acceptable throughout the storage period except those stored at +8 0C and 0 0C.

REFERENCES

Ahmad, A, J.A Awan, M.I. Siddique and AH. Gilani. 1984. A study of the physico-chemical characteristics of Kinnow juice concentrate. Fruit Processing, 4 (2): 50-52.

AOAC. 1984. Official Methods of Analysis of Association of Analytical Chemists. 14th Ed., Assoc. Analyt. Chemists, Arlington.

Awan, LA; M.N. Aslam and M.I. Siddique. 1994. Low temperature storage of Kinnow juice concentrate. Pak, J. Agri., Sci. 31 (2): 91-97.

Buera, PJ., J. Chirife, S.L. Resnik and R.D. Lozano. 1986. Effect of potassium sorbate on colour changes in glucose-glycine system of high water activity. Lebensmittel-wissenschaft und Technologie, 19 (6): 491-492.

Clegg, K.M. 1964. Non-enzymatic browning of lemon juice. J. Food Sci. Agri.. 15 (2): 878-884.

El-Ashwah, FA., N.M. Abd-EI-Baki, S.K. El-Samahy and M.G. Abd-EI-Fadeel. 1982. Effect of storage on the characteristics of the concentrated orange and lime juices. Agri. Res. Rev. 58 (3): 275-288.

Javed, A. 1988. Manufacture of different flavoured Kinnow juice based drinks. M.Sc. Thesis, Dept. Food Technol., Univ. Agri., Faisalabad.

Larmond, E. 1988. Laboratory Methods for Sensory Evaluation of Food. Canada Dept. Agri. Pub. No. 1637-E.

Marcy, J.E., T.R. Graumlich, P.G. Crandall and M.R. Marshall. 1984. Factors affecting storage of orange concentrate. J. Food Sci. 49 (6): 128-129.

Marcy, J.E., A.P. Hansen and T.R. Graumlich. 1989. Effect of storage temperature on the stability of aseptically packaged concentrated orange juice and concentrated orange drink. J. Food Sci, 54 (1): 227-230.

Nickerson, J.T.R. and L.T. Ronsivalli. 1982. Elementary Food Science. The Avi Pub. Co. Inc., West port..

Palaniswamy, K.P. and CiR, Muthukrishan. 1974. Studies on the physico-chemical characteristics of lemon juice and squashes during storage. Indian Food Packer,28 (4): 37-41.

Peng, CiY. and P. Markakis. 1%3. Effect of phenolase on anthocyan ins, Nature, 199: 597-599.

Pruthi, J.S., J.K. Manan and M.S. Teotia. 1984. Studies on the utilization of Kinnow and malta oranges. J. Food Sci. Technol. 21 (3): 123-127.

Ruck, J.A. 1963. Chemical Methods for Analysis of Fruit and Vegetable Products. Canada Dept. Agri. Pub. No. 1154.

Sandhu, S.K., B.S. Bhatia and F.e. Shukla. 1985. Physico-chemical changes during storage of Kinnow mandarin, orange and pineapple juice concentrate. J. Food Sci. Technol. 22 (5): 342-345.

Steel, R.G.D. and J.H. Torrie. 1980. Principles and Procedures of Statistics. 2nd Ed., McGraw Hill Book Co. Inc., New York.