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Study on preparation, packaging and storage of passion fruit (*Passiflora edulis* flavicarpa Deg.) Nectar beverages

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Abstract

Passion fruit (*Passiflora edulis* flavicarpa Deg.) is the fruit of exotic passion flower. Passion fruit grown commercially all around the world. The fruit is valued for its powerful medicinal property and high antioxidant activity. The juice exhibits pronounced flavour and aroma which help in producing high quality beverages and also in flavouring several other products. It is quite delicious, nutritious and liked for its excellent blending property. Even though passion fruit is having many such advantages, its utilization is limited in processing sector mainly due to the short shelf life, minimum juice recovery and intense acidity. Hence, to overcome these limitations, a study on “preparation, packaging and storage of passion fruit (*Passiflora edulis* flavicarpa Deg.) Nectar beverages” was carried out in the Department of Post-Harvest Technology, College of Horticulture, Junagadh Agricultural University, Junagadh-362 001 (Gujarat) during 2024-25 with two main objectives viz., to study the quality parameters of passion fruit nectar in different packaging materials during storage period & to study the shelf life of passion fruit nectar of local passion fruit variety. Treatment viz Factor A: Nectar (N₁ Nectar 13 °Brix, N₂ Nectar 15 °Brix, N₃ Nectar 17 °Brix). Factor B: Packaging material (P₁ PET bottle P₂ PVC bottle) & Factor C: Storage condition (S₁ Ambient temperature, S₁ Low temperature (5-7 °C) with three replication in Completely Randomized Design with Factorial concept. Treatment combinations were T₁- Nectar (13 °Brix) +PET bottle+Ambient temperature, T₂- Nectar (13 °Brix)+ PET bottle + Low temperature(5-7 °C) , T₃- Nectar (13 °Brix) +PVC bottle + Ambient temperature, T₄- Nectar (13 °Brix) + PVC bottle + Low temperature(5-7 °C) , T₅- Nectar (15 °Brix) + PET bottle + Ambient temperature, T₆- Nectar (15 °Brix)+ PET bottle + Low temperature(5-7 °C), T₇- Nectar (15 °Brix) + PVC bottle + Ambient temperature, T₈- Nectar (15 °Brix)+ PVC bottle + Low temperature(5-7 °C), T₉- Nectar (17 °Brix) + PET bottle + Ambient temperature, T₁₀- Nectar (17 °Brix)+ PET bottle + Low temperature(5-7 °C), T₁₁- Nectar (17 °Brix) + PVC bottle + Ambient temperature & T₁₂- Nectar (17 °Brix)+ PVC bottle + Low temperature (5-7 °C). Bio-chemical characteristics viz Ascorbic acid (mg/100g pulp), Total sugar (%), Reducing sugar (%) & Non-reducing sugar (%), Organoleptic evaluation viz color, taste, flavor & overall acceptability were observed in the treatment T₁₁(N₃ Nectar 17 °Brix + P₂ PVC bottle+ S₁ Ambient temperature). It may be concluded that storage of passion fruit nectar (17 °Brix) at ambient temperature by filling in PVC bottle which can be kept safely up to one month along with organoleptically acceptable good quality.

Keywords: Passion fruit, nectar packaging, storage

Introduction

Passion fruit (*Passiflora edulis* Sims.) is a perennial, climbing, woody vine which produces round or ovoid fruits having a tough, smooth, waxy dark purple/yellow coloured rind with faint, fine white specks. It contains orange coloured pulpy juice with large number of small, hard, dark brown to black pitted seeds. The juice is delicious with good flavour, intense aroma and sweet-acid taste and is well known for its excellent blending quality. As people are more concerned about their health, demand for passion fruit juice is increasing not only because of its exotic flavour but also for its high nutritional and medicinal properties. There is a lot of evidence that the passion fruit could be a powerful medicinal source. The juice contains very good proportion of acids, sugars, Vitamin-A, fibre, phenolic compounds, ascorbic acid (Ramaiya *et al.*, 2012) [6] and minerals such as sodium, magnesium, sulphur, chlorides, etc. (Rao *et al.*, 2014) [8]. The juice of yellow type is more acidic and its recovery is comparatively less (25-30%) than the purple type (35-38%) (Rao *et al.*, 2014) [8].

Even though the high acidity of passion fruit limits its utilisation for table purpose, its intense flavour offers ample scope for processing into numerous value added products like fruit beverages, concentrate, etc. Fruit nectars are unfermented beverages that occupy a prominent place in the processed food sector. By far the greatest benefit of passion fruit to humankind is fruit and the delicious juice. Passion fruit juice is highly acidic due to predominance of citric and malic acid. The strong and intense flavour of passion fruit offers ample scope for processing in to a refreshing fruit nectar. In India, limited work has been done on the post harvest technology of passion fruit. So, the intervention on this aspect has better scope in processing the juice of passion fruit in to a refreshing beverage.

Methodology

Passion fruit nectar was prepared from local variety of passion fruit by sorting grading, cutting, extraction and straining of pulp. 20% fruit pulp was used for preparation of nectar. Adjustment of acidity and TSS (13°Brix, 15°Brix, 17°Brix, and 0.3% acidity). pasteurization of juice, addition of preservative (Sodium Benzoate 0.1%). bottling in PET (Poly Ethylene Terephthalate + PVC(Poly Vinyl Chloride) bottle. Again heating process was done to bottles. Bottles were stored at ambient and low temperature (5-7°C). Organoleptic quality of passion fruit nectar developed from juice in different formulations of TSS and juice content revealed that passion fruit nectar containing 20% juice and 17°Brix was more acceptable. The change in quality of nectar was evaluated during storage at monthly intervals. Ascorbic acid, was estimated as per the procedure suggested by AOAC (1998), reducing, non-reducing and total sugars were determined as per the procedure suggested by Ranganna (1997) [7]. Total soluble solids (TSS) were determined by using hand refractometer. Quality of passion fruit nectar was judged by a panel of judges having different age groups for colour, flavour, taste, and overall acceptability, based on a 9 point hedonic scale rating (Amerine *et al.*, 1965) [11].

Analytical Tools

All parameters were statistically analyzed by using analysis of variance technique for Factorial Completely Randomized Design as described by Panse and Sukhatme (1985) for significance by “F” test. Standard error of mean and critical differences was worked out at 5 % level of significance. The statistical analysis was carried out in Department of Agricultural Statistics, College of Agriculture, Junagadh Agricultural University, Junagadh.

Results and Discussion

Total soluble solids (TSS) of passion fruit nectar increased throughout the storage period, irrespective of storage conditions (Table 1). Nectar stored under ambient temperature showed higher rate of increase compared to

those stored under refrigerated condition. Significant increase in TSS content of passion fruit nectar was not observed after first and second month of storage. Increase in TSS could be due to solubilisation of passion fruit pulp constituents during storage and degradation of complex starch into simple sugars due to hydrolysis of polysaccharides (Jawanda *et al.*, 1978) [14]. Ascorbic acid in passion fruit nectar decreased throughout the storage period irrespective of storage conditions (Table 1). Nectar stored under ambient temperature showed higher rate of decrease compared to low temperature. The reason behind decrease in ascorbic acid could be due to oxidation of vitamin-C to furfural and hydroxyl methyl furfural (Aruna *et al.*, 1997) [9]. Reducing, non reducing and total sugars of passion fruit nectar increased during storage irrespective of storage conditions (Table 1). However significant difference between the treatments was observed after one & two months of storage. Increase in sugar content may be due to breakdown of complex starch into simple glucose and sucrose (Selvaraj *et al.* 1989) [9].

Data on mean sensory scores of passion fruit nectar during first and second month of storage are presented in (Table 2). Sensory scores of passion fruit nectar declined during storage in all the treatments. The rate of decrease was faster in nectar stored under ambient condition as compared to refrigerated condition. After two months of storage, nectar developed from the juice of purple fruit stored under refrigerated condition recorded maximum sensory score while the minimum was seen in the samples from the passion fruit nectar stored under ambient condition. These results are in accordance with those reported by Ladaniya *et al.* (2004) [5] where in the organoleptic scores for body, taste, colour and aroma of sweetened ‘Nagpur’ Mandarin orange juice decreased with increase in storage period irrespective of storage conditions. However, scores for overall acceptability topped in refrigerated condition as compared to ambient temperature. Nectar stored at ambient temperature had higher microbial load than those stored at low temperature. Bacteria were not detected up to one months of storage and yeast did not survive up to one month of storage, in any treatments. Even though, fungi were not detected initially, it was found one month after storage. However, the microbial load in all the samples was within the acceptable limits (FSSAI). According to Tchango-Tchango *et al.* (1994) [10] the acidity in processed passion fruit juice inhibited the growth and multiplication of pathogenic microorganisms like *Escherichia coli*, *Streptococcus* or *Staphylococcus*, but might contain non-pathogenic fungi, yeasts or lactic acid bacteria. Sandi *et al.* (2004) also reported that the passion fruit juice pasteurized at 75°C for 60 sec showed complete inhibition of microbial population, and also the juice stored under ambient condition remained microbiologically safe up to one month of storage period.

Table 1: Effect of different concentration of passion fruit nectar, packaging material and storage methods on TSS (°Brix), Total sugar(%), Reducing sugar(%), Non reducing sugar (%) & Ascorbic acid (mg/100g) of passion fruit nectar

Treatment	TSS (°Brix)		Total sugar (%)		Reducing sugar (%)		Non reducing sugar (%)		Ascorbic acid (mg/100g)	
	After one month of storage	After two months of storage	After one month of storage	After two months of storage	After one month of storage	After two months of storage	After one month of storage	After two months of storage	After one month of storage	After two months of storage
N ₁ P ₁ S ₁	14.55	15.17	4.49	5.13	1.46	1.90	3.03	3.23	60.36	30.39

N ₁ P ₁ S ₂	14.18	15.05	4.11	4.85	1.44	1.67	2.67	3.18	59.40	28.41
N ₁ P ₂ S ₁	14.40	15.55	6.69	7.98	1.42	1.0	8.27	6.34	47.31	13.16
N ₁ P ₂ S ₂	13.95	14.75	6.28	7.35	1.37	1.75	4.91	5.65	43.22	20.17
N ₂ P ₁ S ₁	16.55	17.10	7.35	8.28	1.58	2.19	5.78	6.25	40.18	18.14
N ₂ P ₁ S ₂	16.10	16.85	6.57	7.55	1.54	1.91	5.03	5.61	36.01	14.19
N ₂ P ₂ S ₁	15.60	16.50	8.07	9.17	1.66	2.30	6.41	6.83	32.07	13.25
N ₂ P ₂ S ₂	15.15	16.15	7.46	8.77	1.62	2.02	5.84	6.74	27.71	11.38
N ₃ P ₁ S ₁	18.90	19.93	10.99	11.63	1.54	2.60	9.36	9.05	19.35	8.30
N ₃ P ₁ S ₂	18.45	19.60	10.35	11.21	1.70	2.13	8.65	9.08	26.80	8.71
N ₃ P ₂ S ₁	18.15	19.40	12.95	13.32	2.05	2.66	10.90	10.61	24.51	8.16
N ₃ P ₂ S ₂	17.45	18.80	12.56	12.82	1.85	2.21	10.72	10.62	22.20	7.09
S. Em. _±	0.071	0.138	0.026	0.052	0.061	0.055	0.048	0.082	0.097	0.037
C. D. at 5%	0.20	NS	NS	0.15	NS	NS	0.14	0.23	NS	0.10

Table 2: Effect of different concentration of passion fruit nectar, packaging material and storage methods on taste, colour, flavour and overall acceptability of passion fruit nectar

Treatment	Taste		Colour		Flavour		Overall acceptability	
	After one month of storage	After two months of storage	After one month of storage	After two months of storage	After one month of storage	After two months of storage	After one month of storage	After two months of storage
N ₁ P ₁ S ₁	6.25	4.92	6.00	4.00	6.00	3.98	6.07	4.30
N ₁ P ₁ S ₂	7.05	6.03	6.80	5.25	6.55	5.05	6.79	5.45
N ₁ P ₂ S ₁	6.50	5.10	6.30	4.45	6.30	4.10	6.37	4.55
N ₁ P ₂ S ₂	7.30	6.22	7.11	5.73	7.05	5.30	7.15	5.98
N ₂ P ₁ S ₁	6.45	4.73	6.03	4.15	6.40	4.30	6.29	4.40
N ₂ P ₁ S ₂	7.40	6.35	7.02	6.45	7.15	6.45	7.19	6.42
N ₂ P ₂ S ₁	6.95	6.20	6.45	5.15	6.95	4.90	6.78	5.42
N ₂ P ₂ S ₂	7.85	6.75	7.30	6.60	7.35	6.25	7.50	6.53
N ₃ P ₁ S ₁	7.03	5.00	6.30	5.25	6.65	4.65	6.66	4.97
N ₃ P ₁ S ₂	8.05	6.95	7.03	6.95	7.60	6.65	7.57	6.85
N ₃ P ₂ S ₁	7.65	5.15	6.85	5.45	7.35	5.20	7.28	5.27
N ₃ P ₂ S ₂	8.45	7.40	7.73	7.50	8.00	7.35	8.06	7.40
S. Em. _±	0.080	0.066	0.080	0.191	0.071	0.082	0.174	0.241
C. D. at 5%	NS	0.19	NS	NS	NS	NS	NS	NS

Table 3: Effect of different concentrations of passion fruit nectar, packaging material and storage methods on total fungal count (cfu/ml) & Total bacterial count (cfu/ml)

Treatment	Total fungal count (cfu/ml)		Total bacterial count (cfu/ml)	
	After one month of storage	After two months of storage	After one month of storage	After two months of storage
N ₁ P ₁ S ₁	0.15 x 10 ²	1.18 x 10 ²	1.47X 10 ²	1.48 x 10 ³
N ₁ P ₁ S ₂	ND	0.58 x 10 ²	ND	98
N ₁ P ₂ S ₁	0.13 x 10 ²	1.2 x 10 ²	1.22X 10 ²	1.62 x 10 ³
N ₁ P ₂ S ₂	ND	0.42 x 10 ²	ND	76
N ₂ P ₁ S ₁	0.12 x 10 ²	1.2 x 10 ²	1.14 X 10 ²	1.27 x 10 ³
N ₂ P ₁ S ₂	ND	0.40 x 10 ²	ND	73
N ₂ P ₂ S ₁	0.10 x 10 ²	2.5 x 10 ²	1.06X 10 ²	2.22 x 10 ³
N ₂ P ₂ S ₂	ND	0.37 x 10 ²	ND	66
N ₃ P ₁ S ₁	0.8 x 10 ²	1.5 x 10 ²	1.05X 10 ²	1.37 x 10 ³
N ₃ P ₁ S ₂	ND	0.23 x 10 ²	ND	62
N ₃ P ₂ S ₁	0.8 x 10 ²	1.6 x 10 ²	1.04X 10 ²	1.44 X 10 ³
N ₃ P ₂ S ₂	ND	0.19 x 10 ²	ND	47
FSSAI Standard	1X 10 ²	1X 10 ²	1X 10 ³	1X 10 ³

Conclusions

The storage of passion fruit nectar (17 °Brix) at ambient temperature by filling in PVC bottle which can be kept safely up to one month along with organoleptically acceptable good quality.

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