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Research Article

Storage Effect on Physio-Chemical and Sensory Attributes of Mango Squash Beverage

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Abstract

The total soluble solids, optical density, pH and ascorbic acid of mango based squash beverage increased with increase in the level of sugar ratio at different storage condition. The acidity value of the samples containing mango juice level @ 25% of total extract and sugar @ 350 gm, 450 gm and 550 gm were observed as 1.128, 1.126 and 1.126 respectively, after 90 days of storage at refrigerated condition. The vitamin-C (ascorbic acid) of the mango squash samples were decreased during storage period. It might be due to the oxidation or irreversible conversion of L-ascorbic acid into dehydro ascorbic acid in the presence of enzyme ascorbic acid oxides (ascorbinase) caused by trapped or residual oxygen in the glass bottles. The TSS value of samples after 90 days of storage were observed as 60.5, 61.0 and 62.5 ^{0}Brix at refrigerated condition.

Keywords: Mango, optical density, TSS, squash, storage.

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Introduction

Mango (Mangifera indica L.) which belongs to the family Anacadiacease, is one of the most cultivated fruit in the world [1]. Squash is a type of fruit beverage containing at least 25% fruit juice or pulp and40-50 ^{0}brix total soluble solids commercially; it also contains about 1.0 % acid and is diluted before serving recipes for preparation of squash from various fruits. Mango (*Mangiferaindica L.*) is the most important fruit of India. It's become popular due to Juiciness, sweetness, delicious taste, excellent flavour, attractive fragrance, colour, and abundant source of essential nutrients and vitamins. Antioxidants, vitamins A and C, vitamin B_6 (pyridoxine), folate, other B vitamins and essential nutrients, such as potassium, copper and amino acids are present in mango fruit pulp. The production of mango is 15188.4 thousand MT with productivity of 6.6 MT per hectare. Uttar Pradesh is the largest producer of mango in the country after the state like Andhra [2]. Post harvest losses have been estimated in developed countries ranging from 5-25 %while it is much higher about 20-50% in developing countries depending upon the commodity basis [3]. After maturity there are some post-harvest losses also found in mango.

Oliveira *et al.* [4] investigated degradation kinetics of the sensory attributes of commercial whole mango (cv. Uba) juice, and its sensory acceptability during storage. Samples of the juice were stored in a BOD incubator at 25, 35 and 45 degrees C under 24 h light (650 lux) for 120 days. Adeyemo [5] produced a wine from a mixture of mango juice and pineapple juice and its fermentation (5 days at 28-30 degrees C) and sensory properties were characterized. The total dissolved solid content of the mixed fruit juice decreased with increasing fermentation time from 6.7 to 4.7 degrees Brix. Likewise, the pH value decreased from 5.8 to 3.3, the specific gravity decreased from 1.054 to 1.002 and the sugars content decreased from 69.5 to 49.6 g/l during fermentation. Saito and Takata [6] described a method for preparing mango juice with a rich aroma, which does not cause sedimentation in the mango-juice processed product, or in a beverage containing the product, even after long-term storage, while keeping the natural turbid appearance of mango juice. The method for producing the mango-juice processed product involves: processing, with an enzyme preparation, mango juice having a turbidity of 3700 after being centrifuged for 10 min with a centrifugal effect of 1200 G; and removing pulp from the enzyme-processed product to obtain a mango-juice processed product having a pulp content of 20% (v/v) and a turbidity of 1400 NTU.

Hussain *et al*. [7] carried out comparative study on the effect of cultivars and storage on overall quality of mango squash. Squash were prepared from five different cultivars by mixing pulp, sugar and water in the ratio of 1:1:1. During storage, TSS and reducing sugars and pH significantly increased while ascorbic acid, non-reducing sugar and acidity significantly decreased the score for colour and flavour significantly decreased during storage. Acceptability of the sensory properties of mango juices with or without added green banana pulp was investigated by Taipina *et al.* [8]. Samples were rated using hedonic scales for yellow colour, aroma, flavour, sweetness and mouthfeel. Mouthfeel and flavour of juices differed significantly ($P < 0.05$). Juice containing banana pulp was most accepted, and exhibited the highest score for purchase intent.

Keeping these facts in view, a study was conducted to assess of storage condition effect and quality attributes of mango squash (*MangiferaIndica L.*) in Food Processing laboratory at Sardar Vallabhbhai Patel University of Agriculture and Technology, (U.P.) India.

Materials and Methods

Raw materials

Fresh, fully ripened, uniform sizes mango was procured from the local market of Meerut, then washed, wiped and stored at in the cool chamber.

Juice extraction

Mango juice was extracted using electric juicer (Maharaja White Line India Limited, Kolkata)

Preservative

Within the permissible limit, Potassium Metabisulphite (KMS) was used as a preservative to increase the shelf life of the product.

Packaging materials

Autoclaved glass bottles were used for packaging mango squash beverage leaving a head space of 2.5 to 3.0 cm, then screw caped.

Pasteurization

Beverage pasteurized by dipping the bottle in water bath ($85 – 90^0$C) for 4 to 5 min.

Cooling and storage

After pasteurization the bottles were cooled under the running tap water and stored under room temperature, refrigerator and B.O.D. incubator condition.

Preparation of mango squash beverage

Mango squash beverages consist essentially of an amount of 25 % fruit juice or pulp it is sweeten at least 40-50 ^{o}Brix with a maximum acidity of 1 %. Sample containing different fruit pulp (%) and sugar (gm) ratio viz. 25:350, 25:450 and 25:550 were prepared according to **Figure 1** and evaluated by sensory panel.

Measurement of physico-chemical and sensory properties

TSS

TSS (total soluble solid) of mango squash beverage was measured by hand refractometer of range of 0-32 °Brix.

pH

pH was measured using electronic pH meter (Elico, LI -127).

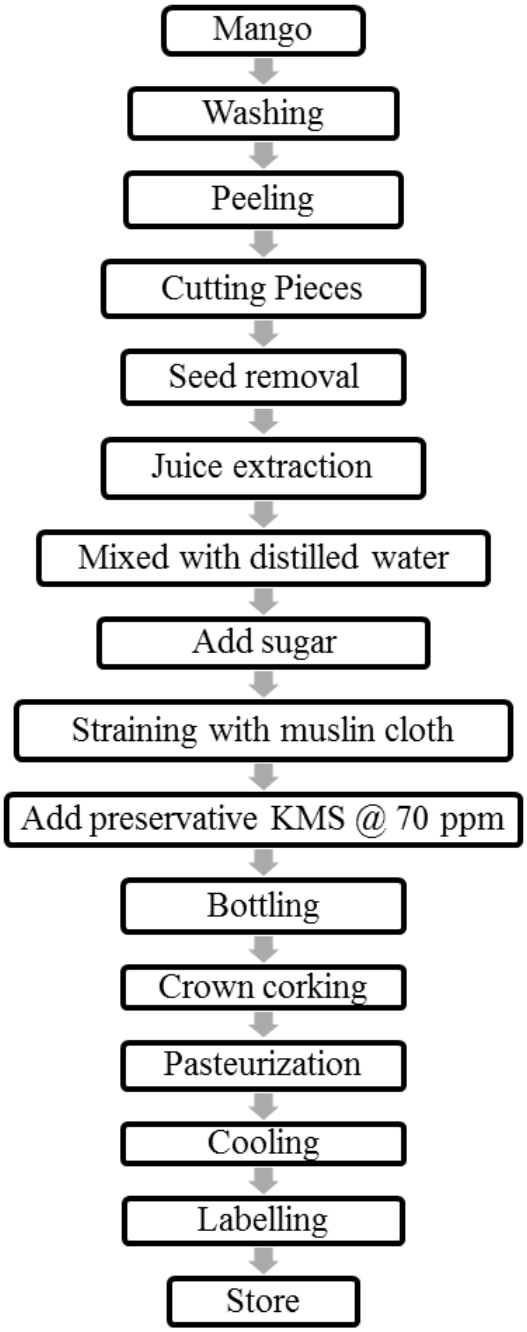

Figure 1 Process flow chart for preparation of mango squash beverage.

Acidity

Acidities of mango squash beverage were determined using method as recommended by Ranganna [9].

Ascorbic Acid (Vitamin C)

Samples of mango squash beverage were analysed for the ascorbic acid content using 2.6- Dichlorophenol indophenol dye titrimetrically as per the modified procedure of AOAC.

Optical Density

Optical density was determined using the method as recommended by Shrivastav and Kumar [10].

Sensory Qualities

Sensory attributes of the samples of mango squash beverage was evaluated as recommended by Ranganna [9] using hedonic rating test method.

Results

Mango squash beverage samples stored at room temperature, B.O.D. and refrigerated conditions assessed for various physico-chemical and sensory parameters after 0, 15, 30, 45, 60, 75 and 90 days.

TSS (^{0}Brix)

The TSS content in mango squash beverage showed an increasing trend under all the treatments with increasing periods of up to 90 days (**Table 1**). The TSS of the samples having mango pulp and sugar ratio M_{25}:S_{350}, M_{25}:S_{450} and M_{25}:S_{550} were measured as 44.0, 44.3 and 45.5 ^{0}Brix, respectively in the fresh samples. TSS increased slightly with increase in sugar ratio as well as with increase in the storage period.

pH

The pH of different samples of mango juice and sugar ratio of M_{25}:S_{350}, M_{25}:S_{450} and M_{25}:S_{550} were measured as 2.8, 2.7 and 2.85 respectively, in the fresh samples. The pH of samples increased during storage (**Table 2**). These results are in agreement with Hussain *et al*. [7].

Table 1 Changes in TSS (^{o}Brix) of mango squash beverage samples at different storage conditions

Storage period (Days)	TSS (^{0}Brix)								
	Room Temperature			Refrigerator			B.O.D.		
	M_{25}:S_{350}	M_{25}:S_{450}	M_{25}:S_{550}	M_{25}:S_{350}	M_{25}:S_{450}	M_{25}:S_{550}	M_{25}:S_{350}	M_{25}:S_{450}	M_{25}:S_{550}
0	44	44.3	45.5	44	44.3	45.5	44	44.3	45.5
15	48.2	48.8	47.5	48.5	49	48.6	48.5	51.2	49.5
30	50	51.2	50.5	50.5	51.6	50.8	51.2	54.5	61.6
45	52.3	53.3	54.6	53	54.2	53.6	53.5	56	44.4
60	55.6	56.6	58.8	55	56.3	56	55.6	59.2	58.3
75	60.6	59.6	62.2	57.6	58.5	58	66	65.5	62.8
90	66.7	64.3	67.2	60.5	61	62.5	68.5	70.5	71.8

Table 2 Changes in pH of mango squash beverage samples at different storage conditions

Storage period (Days)	pH								
	Room Temperature			Refrigerator			B.O.D.		
	M_{25}:S_{350}	M_{25}:S_{450}	M_{25}:S_{550}	M_{25}:S_{350}	M_{25}:S_{450}	M_{25}:S_{550}	M_{25}:S_{350}	M_{25}:S_{450}	M_{25}:S_{550}
0	2.8	2.7	2.85	2.8	2.5	2.85	2.8	2.7	2.85
15	3	2.99	2.92	3	3.02	3.09	3	2.85	2.9
30	3.29	3.15	3.2	3.19	3.2	3.18	3.01	2.99	3.1
45	3.38	3.3	3.38	3.29	3.35	3.4	3.22	3.11	3.19
60	3.48	3.4	3.45	3.39	3.48	3.53	3.34	3.25	3.26
75	3.56	3.55	3.59	3.5	3.58	3.58	3.56	3.64	3.44
90	3.68	3.6	3.66	3.58	3.61	3.63	3.75	3.85	3.68

Acidity (%)

The acidity of mango based squash beverage decreased with decrease in the ratio of mango juice (**Table 3**). Acidity of the samples having mango pulp and sugar ratio M_{25}:S_{350}, M_{25}:S_{450} and M_{25}:S_{550} were measured as 1.165, 1.159 and

1.161 respectively in the fresh samples. The acidity content in mango squash beverage showed decreasing trend under all the treatments with increasing periods of up to 90 days.

Ascorbic acid

Ascorbic acid of the samples of different mango pulp and sugar ratio of M_{25}:S_{350}, M_{25}:S_{450} and M_{25}:S_{550} were measured as 23.00, 23.00 and 26.29 respectively in the fresh samples (**Table 4**). Vitamin-C (ascorbic acid) of the samples were increased during storage period. It might be due to the oxidation or irreversible conversion of L-ascorbic acid into dehydro ascorbic acid in the presence of enzyme ascorbic acid oxidase (ascorbinase) caused by trapped or residual oxygen in the glass bottles.

Table 3 Changes in acidity of mango squash beverage samples at different storage conditions

Storage period (Days)	Acidity (%)								
	Room Temperature			Refrigerator			B.O.D.		
	M_{25}:S_{350}	M_{25}:S_{450}	M_{25}:S_{550}	M_{25}:S_{350}	M_{25}:S_{450}	M_{25}:S_{550}	M_{25}:S_{350}	M_{25}:S_{450}	M_{25}:S_{550}
0	1.165	1.159	1.161	1.165	1.159	1.161	1.165	1.159	1.161
15	1.16	1.153	1.154	1.154	1.155	1.154	1.15	1.158	1.153
30	1.15	1.149	1.147	1.14	1.142	1.149	1.143	1.142	1.144
45	1.14	1.141	1.138	1.136	1.138	1.135	1.138	1.137	1.138
60	1.136	1.137	1.133	1.133	1.135	1.132	1.136	1.134	1.135
75	1.13	1.133	1.128	1.131	1.132	1.129	1.134	1.13	1.129
90	1.128	1.129	1.126	1.128	1.129	1.126	1.128	1.129	1.126

Table 4 Changes in ascorbic acid (mg/100ml) of mango squash beverage samples at different storage conditions

Storage period (Days)	Ascorbic Acid(mg/100ml)								
	Room Temperature			Refrigerator			B.O.D.		
	M_{25}:S_{350}	M_{25}:S_{450}	M_{25}:S_{550}	M_{25}:S_{350}	M_{25}:S_{450}	M_{25}:S_{550}	M_{25}:S_{350}	M_{25}:S_{450}	M_{25}:S_{550}
0	23	24.11	26.29	23	24.11	26.29	23	24.11	26.29
15	24.55	26.33	28	23.55	24.88	27.99	23.35	24.66	27.11
30	25.22	27.44	29.33	23.99	25.33	28.44	23.99	25	28.11
45	26.77	28.37	30.3	24.66	25.99	29.22	24.66	25.88	28.99
60	26.99	28.99	30.99	25	26.44	30.55	25.22	26.44	29.44
75	28.22	29.77	31.34	25.88	27	32.66	26	27.44	30.32
90	30.44	31.44	33.33	26.89	27.55	28.66	27.11	28	32.32

Optical density

Increase in optical density was observed with increase in sugar ratio and storage period (**Table 5**). Optical density of the samples of different pulp and sugar ratio M_{25}:S_{350}, M_{25}:S_{450} and M_{25}:S_{550} were measured as 0.03, 0.302 and 0.305 respectively, in the fresh samples.

Sensory

In general no definite trends of sensory score for individual attributes were observed for fresh samples. Decline in sensory score were observed in samples after 0, 15, 30, 45, 60, 75 and 90 days of storage period (**Table 6**). In few cases increase in score were also observed unexpectedly. This increase in sensory score during storage could not be understood. Sensory evaluation could not be conducted after 90 days of storage due to visible microbial growth in all the stored samples.

Table 5 Changes in optical density of mango squash beverage samples at different storage conditions

Storage period (Days)	Optical Density								
	Room Temperature			Refrigerator			B.O.D.		
	M_{25}:S_{350}	M_{25}:S_{450}	M_{25}:S_{550}	M_{25}:S_{350}	M_{25}:S_{450}	M_{25}:S_{550}	M_{25}:S_{350}	M_{25}:S_{450}	M_{25}:S_{550}
0	0.245	0.247	0.231	0.251	0.247	0.231	0.253	0.245	0.234
15	0.251	0.253	0.243	0.262	0.251	0.245	0.26	0.251	0.245
30	0.265	0.262	0.245	0.265	0.26	0.25	0.265	0.26	0.255
45	0.27	0.27	0.255	0.273	0.265	0.26	0.273	0.267	0.263
60	0.285	0.282	0.267	0.277	0.273	0.265	0.28	0.271	0.273
75	0.295	0.295	0.285	0.281	0.281	0.271	0.285	0.283	0.285
90	0.3	0.302	0.305	0.307	0.309	0.304	0.302	0.306	0.308

Table 6 Changes in overall acceptability of the samples of mango based squash beverage at different storage condition

Storage period (Days)	Overall Acceptability								
	M_{25}:S_{350}			M_{25}:S_{450}			M_{25}:S_{550}		
	Ref.	B.O.D.	R. T.	Ref.	B.O.D.	R. T.	Ref.	B.O.D.	R. T.
0	8.30	7.45	7.575	7.775	7.550	7.425	8.275	7.850	7.55
15	8.075	7.225	7.275	7.575	7.325	7.10	8.025	7.650	7.30
30	7.775	6.95	7.00	7.30	7.05	6.875	7.775	7.325	7.05
45	7.450	6.625	6.70	6.975	6.70	6.575	7.525	6.95	6.70
60	7.20	6.275	6.325	6.70	6.375	6.275	7.20	6.50	6.275
75	6.825	6.05	5.975	6.325	5.850	5.750	6.55	6.05	5.875
90	6.40	5.45	5.60	5.875	5.50	5.250	6.00	5.625	5.375

Where, M_{25}= Mango juice level as 25% of total extract, Ref. = Refrigerator, S_{350} = Sugar level as 350 gm, B.O.D. = B.O.D. incubator, S_{450} = Sugar level as 450 gm, R. T. = Room Temperature, S_{550} = Sugar level as 550 gm.

Conclusion

Increase in optical density was observed with increase in sugar ratio and storage period. In general no definite trends of sensory score for individual attributes were observed for fresh samples. Decline in sensory score were observed in samples after 0, 15, 30, 45, 60, 75 and 90 days of storage period.

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