

Original Research Article

Sensory Evaluation and Microbial Studies of Cashew (*Anacardium occidentale* L.) Apples Juice during Storage

A. V. Bhuwad¹, C. D. Pawar¹, Roshan Varadkar¹, K. P. Vaidya²,
M. M. Kulkarni¹ and P. M. Haldankar³

¹College of Horticulture, ²College of Agriculture,

Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli

³Department of Horticulture, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi
Vidyapeeth, Dapoli-415 712, Dist. - Ratnagiri, M.S., India

*Corresponding author

ABSTRACT

The present investigation entitled “Sensory evaluation and microbial studies of cashew (*Anacardium occidentale* L.) apples juice during storage” in order to various products are available round the year. The experiment was conducted in the Fruit and Vegetable Processing Unit Laboratory, Department of Horticulture, College of Agriculture, Dapoli, Dist-Ratnagiri (M.S.) during 2015-2016 with five different varieties of cashew apple juice was used under this study viz., T₁-Vengurla-1, T₂-Vengurla-4, T₃-Vengurla-6, T₄- Vengurla-7, T₅- Vengurla-8 and two storage conditions viz., S₁-ambient temperature (24-30°C) and S₂- cold storage (12 ± 2°C) with four replication in factorial completely randomized design (FCRD). From the study it was observed that, interaction T₂S₂ (Vengurla-4 at cold storage) recorded lowest bacterial and fungal count at 6 months storage period. As far as sensory evaluation of cashew apple juice was concerned, the same treatment combination T₂S₂ recorded maximum score for colour, flavour and overall acceptability after 6 month storage period.

Keywords

Cashew apple
juice, storage,
Sensory evaluation
and Microbial
study

Introduction

Botanically, cashew apple is the peduncle of the fruit. The juice is astringent due to presence of tannins which has got innumerable medicinal properties as an antidote for cholera. The high tannin content in juice makes it suitable remedy for sore throat and chronic dysentery in Cuba and Brazil (Morton, 1987). Indeed, cashew apple juice is reported to contain 5 times as much vitamin C as in citrus juice (Akinwale, 2000). Also it has anti-mutagenic, anti-bacterial and anti-oxidant properties (Cavalcante *et al.*, 2005).

The wastage of cashew apples is mainly attributed to short shelf life and rapid microbial action. The processors generally use fallen cashew apples under the tree for preparation of processed products. Some processors take freshly harvested cashew apples. However, as the cashew apples are highly perishable in nature, therefore it is necessary to send the fruits in processing center within short period of time. Unlike other fruit juices, the juice extracted from cashew apple cannot be consumed due to its characteristic astringent taste due to tannins, which causes biting sensation of the tongue

and throat. Hence, in order to prepare quality products with less astringency it is necessary to find out varieties suitable for preparing value added products. The quality of juice depends on sensory evaluation and microbial studies during storage hence it is utmost important to make them available round the year. However, very scanty research work has been done on these aspects. Keeping this in to view, five released varieties by DBSKKV, Dapoli viz. Vengurla-1, Vengurla-4, Vengurla-6, Vengurla-7 and Vengurla-8 were selected and investigation entitled “Sensory evaluation and microbial studies of cashew (*Anacardium occidentale* L.) apples juice during storage”.

Materials and Methods

The ripe cashew apples of different varieties selected for study were washed with chlorinated water (100 ppm) and squeezed in basket press for extraction of juice. The extracted juice was further strained through four fold muslin cloth to obtain clear cashew apple juice and it was then pasteurized at 85°C for 10 minutes. Then preservative potassium metabisulphite was added @ 1000 ppm. Before filling juice in bottle, glass bottles were washed with hot plain water, after that they were sterilized by keeping in boiling water for 30 minutes. Then they were dried in air and used for filling hot juice (82°C temperature). After filling and sealing, bottles were pasteurized at 85°C and stored at ambient (27-29°C) temperature and cold storage (12±1°C) and observations were recorded at every 2 months interval up to 6 months to study the sensory evaluation and microbial studies of stored cashew apple juice.

To estimate the bacterial growth in cashew apple juice serial dilution and plate technique was followed using nutrient agar medium (3g-Beef extract, 5g-Peptone, 20g Agar-agar

and 1000 ml distilled water). Likewise to estimate the fungal growth same technique was followed using potato dextrose agar medium (200g potato, 20g Dextrose, 20 g of Agar-agar and 1000 ml of distilled water). Five random observations per plate were recorded and averaged to obtain number of colonies per cm² and then number of colonies per plate was calculated. The data obtained in the present study for statistical analysis as suggested by Panse and Sukhatme (1985).

Results and Discussions

Sensory evaluation

The cashew apple juice was examined for its sensory qualities. The evaluation of sensory qualities in terms of colour and flavour was done at every 2 month interval by a panel of 10 judges with 9 point Hedonic scale. Data regarding the effect of storage conditions, treatments and their interactions on sensory quality are presented in table 1.

Colour

From the table 1, it was observed that, mean score of colour of cashew apple juice decreased with increase in storage period. Decrease in juice colour with increase in storage period may be due to slight oxidative browning, effect of temperature on storage quality of juice. Similar findings have been reported by Bagkar (2013) in jamun juice.

The colour of cashew apple juice differs significantly with respect to different treatments at 4 and 6 months storage. However, juice stored at initial (0 month) and 2 month showed non-significant results. At 4 month storage, highest colour score was recorded by treatment T₂ (7.63) which was at par with T₁, T₃ and T₄ (7.13), irrespective of storage conditions. At 6 months storage, highest colour score was recorded by

treatment T₂ (6.94) which was at par with T₁ (6.69) and T₃ (6.50), irrespective of storage conditions.

It could be seen from the Table 1 that, results were significant throughout the storage period as far as storage condition was concerned, except initial day and 2 month of storage. The treatment S₂ (cold storage) recorded significantly highest score for colour, at 4 (7.35) and 6 months (6.75) storage, irrespective of treatments. The highest score recorded by treatment S₂ (cold storage) may be due to the less deterioration of quality of juice during storage due to effect of low temperature. Similar findings have been reported by Garande (1992) in jamun juice. The interaction of different treatment and storage conditions, the results were non-significant throughout the storage period.

Flavour

The changes in flavour of cashew apple juice during storage were presented in Table 2. From the result it was observed that, mean score of flavour of cashew apple juice decreased with increase in storage period. Decrease in juice flavour with increase in storage period may be due to slight oxidative browning, effect of temperature on storage quality of juice. Similar findings have been reported by Shakoor *et al.*, (2013) in strawberry juice.

The flavour of cashew apple juice differs significantly with respect to different treatments at 4 and 6 months storage. However, juice stored at initial (0 month) and 2 month showed non-significant results.

At 4 month storage, highest flavour score was recorded by treatment T₂ (7.56) which was at par with T₁ (7.19) and T₄ (7.13), irrespective of storage conditions. At 6 months storage, highest flavour score was recorded by treatment T₂ (6.88) which was at par with T₁

(6.63) and T₃ (6.19), irrespective of storage conditions.

It could be seen from the Table 2 that results were significant throughout the storage period as far as storage condition was concerned, except initial day and 2 months of storage. In case of storage conditions S₂ (cold storage) recorded significantly highest score for flavour, irrespective of treatments at 4 (7.50) and 6 months (6.36) storage, irrespective of treatments. The highest score recorded by S₂ (cold storage) may be due to the less deterioration of quality of juice during storage due to effect of low temperature. In case of interaction of different treatments and storage conditions, the results were non-significant throughout the storage period

Overall acceptability

The changes in overall acceptability of cashew apple juice during storage are presented in Table 3. From the table it was observed that, mean score of overall acceptability of cashew apple juice decreased with increase in storage period. Decrease in juice overall acceptability score with increase in storage period may be due to slight oxidative browning and effect of temperature on storage quality of juice.

The overall acceptability of cashew apple juice differs significantly with respect to different treatments at 4 and 6 months storage. However, juice stored at initial (0 month) and 2 month showed non-significant results. At four month storage, highest overall acceptability score was recorded by treatment T₂ (7.59) which was significantly superior over rest of the treatments, irrespective of storage conditions. At six months storage, highest overall acceptability score (6.91) was recorded by treatment T₂ (Vengurla-4) which was at par with T₁ (6.66), irrespective of storage conditions.

The effect of storage on juice of cashew apple was significant throughout the storage period as far as storage condition is concerned, except initial day and two months of storage. In case of storage conditions S_2 (cold storage) recorded significantly highest score for overall acceptability, irrespective of treatments at 4 (7.43) and 6 months (6.69) storage, irrespective of treatments.

The highest score recorded by S_2 (cold storage) may be due to the less deterioration of quality of juice during storage due to effect of low temperature. Whereas, interaction of different treatments and storage conditions, the results were non-significant throughout the storage period.

Microbial studies in cashew apple juice during storage

Bacterial count

The data presented in Table 4 indicate the bacterial count in cashew apple juice and it was observed that bacterial count was increased from 0 month to 6 months of storage, irrespective of treatments and storage conditions. The interaction of treatments and storage conditions had significant effect on bacterial load in cashew apple juice from 2 to 6 months storage period.

At 2 month storage lowest bacterial growth was recorded in interaction T_2S_2 (0.68×10^{-3}) and it was significantly superior over rest of the interactions, whereas highest bacterial growth was recorded in interaction T_5S_1 (2.67×10^{-3}), irrespective of storage conditions and treatments. During 4 month storage lowest bacterial growth was recorded in interaction T_4S_2 (2.35×10^{-3}) and it was at par with T_2S_2 (2.36×10^{-3}). While, highest bacterial growth was recorded in T_5S_1 (5.03×10^{-3}), irrespective of storage conditions and treatments. During 6 month storage,

lowest bacterial growth was recorded in interaction T_2S_2 (3.32×10^{-3}) and was at par with T_4S_2 (3.58×10^{-3}). While, highest bacterial growth was recorded in T_3S_1 (6.47×10^{-3}), irrespective of storage conditions and treatments. Similar findings have been reported by Talasila *et al.*, (2012) in cashew apple juice, Bhardwaj (2013) in kinnow juice, Oladipo *et al.*, (2010) in some Nigerian fruit juices and Hussain *et al.*, (2011) in apple and apricot blended juice.

Fungal count

The data presented in Table 5 showed that the fungal count in cashew apple juice and it was observed that fungal count was increased from 0 month to 6 months of storage, irrespective of treatments and storage conditions. The interaction of treatments and storage conditions had significant effect on fungal load in cashew apple juice from 2 to 6 months storage period.

At 2 month storage lowest fungal count was recorded in interaction T_2S_2 (1.05×10^{-3}) and it was at par with T_4S_2 (1.25×10^{-3}), whereas highest fungal count was recorded in interaction T_5S_1 (2.63×10^{-3}), irrespective of treatments and storage conditions. During 4 month storage lowest fungal count was recorded in interaction T_5S_2 (2.38×10^{-3}) and it was at par with T_2S_2 (2.63×10^{-3}). While, highest fungal count was recorded in T_5S_1 (5.13×10^{-3}), irrespective of treatments and storage conditions. During 6 month storage lowest fungal count was recorded in interaction T_2S_2 (4.20×10^{-3}) and it was at par with T_4S_2 (4.50×10^{-3}). While, highest fungal count was recorded in T_5S_1 (8.63×10^{-3}), irrespective of treatments and storage conditions. Similar findings have been reported by, Emamifar (2010) in orange juice and Bagkar (2013) in jamun juice.

Table.1 Changes in colour score of cashew apple juice under ambient temperature (27-29°C) and cold (12 ±1°C) storage

Treatments	0 month			2 months			4 months			6 months		
	S ₁	S ₂	Mean	S ₁	S ₂	Mean	S ₁	S ₂	Mean	S ₁	S ₂	Mean
T ₁	7.88	8.25	8.06	7.63	8.00	7.81	6.63	7.63	7.13	6.38	7.00	6.69
T ₂	8.13	8.50	8.31	7.88	8.25	8.06	7.50	7.75	7.63	6.63	7.25	6.94
T ₃	7.88	8.25	8.06	7.63	7.88	7.75	7.00	7.25	7.13	6.25	6.75	6.50
T ₄	8.13	8.13	8.13	7.63	7.88	7.75	7.00	7.25	7.13	5.75	6.50	6.13
T ₅	7.88	8.25	8.06	7.25	7.63	7.44	6.25	6.88	6.56	5.88	6.25	6.06
Mean	7.98	8.28	8.13	7.60	7.93	7.76	6.88	7.35	7.11	6.18	6.75	6.46
	S.Em.±		C.D. @ 1%	S.Em.±		C.D. at 1%	S.Em.±		C.D. @ 1%	S.Em.±		C.D. @ 1%
Treatment (T)	0.14		NS	0.15		NS	0.17		0.64	0.19		0.70
Storage (S)	0.09		NS	0.09		NS	0.11		0.41	0.11		0.44
Interaction (TxS)	0.19		NS	0.21		NS	0.23		NS	0.26		NS

T₁ - Vengurla - 1

T₂ - Vengurla - 4

T₃ - Vengurla - 6

T₄ - Vengurla - 7

T₅ - Vengurla - 8

S₁ - Ambient temperature

S₂ - Cold storage

NS - Non-significant

Table.2 Changes in flavour score of cashew apple juice under ambient temperature (27-29°C) and cold (12 ±1°C) storage

Treatments	0 month			2 months			4 months			6 months		
	S ₁	S ₂	Mean	S ₁	S ₂	Mean	S ₁	S ₂	Mean	S ₁	S ₂	Mean
T ₁	8.13	8.13	8.13	7.50	8.13	7.81	6.63	7.75	7.19	6.50	6.75	6.63
T ₂	8.25	8.25	8.25	8.00	8.25	8.13	7.13	8.00	7.56	6.75	7.00	6.88
T ₃	7.75	8.13	7.94	7.75	7.88	7.81	6.88	7.25	7.06	5.75	6.63	6.19
T ₄	8.00	8.38	8.19	7.63	7.88	7.75	7.00	7.25	7.13	5.63	6.63	6.13
T ₅	7.50	8.13	7.81	7.25	7.75	7.50	6.38	7.25	6.81	5.88	6.13	6.00
Mean	7.93	8.20	8.06	7.63	7.98	7.80	6.80	7.50	7.15	6.10	6.63	6.36
	S.Em.±		C.D. @ 1%	S.Em.±		C.D. @ 1%	S.Em.±		C.D. @ 1%	S.Em.±		C.D. @ 1%
Treatment (T)	0.12		NS	0.15		NS	0.12		0.45	0.18		0.70
Storage (S)	0.07		NS	0.09		NS	0.07		0.29	0.11		0.44
Interaction (TxS)	0.16		NS	0.21		NS	0.17		NS	0.25		NS

T₁ - Vengurla - 1

T₂ - Vengurla - 4

T₃ - Vengurla - 6

T₄ - Vengurla - 7

T₅ - Vengurla - 8

S₁ - Ambient temperature

S₂ - Cold storage

NS - Non-significant

Table.3 Changes in overall acceptability of cashew apple juice under ambient temperature (27-29°C) and cold (12 ±1°C) storage

Treatments	0 month			2 months			4 months			6 months		
	S ₁	S ₂	Mean	S ₁	S ₂	Mean	S ₁	S ₂	Mean	S ₁	S ₂	Mean
T ₁	8.00	8.19	8.09	7.56	8.06	7.81	6.63	7.69	7.16	6.44	6.88	6.66
T ₂	8.19	8.38	8.28	7.94	8.25	8.09	7.31	7.88	7.59	6.69	7.13	6.91
T ₃	7.81	8.19	8.00	7.69	7.88	7.78	6.94	7.25	7.09	6.00	6.69	6.34
T ₄	8.06	8.25	8.16	7.63	7.88	7.75	7.00	7.25	7.13	5.69	6.56	6.13
T ₅	7.69	8.19	7.94	7.25	7.69	7.47	6.31	7.06	6.69	5.88	6.19	6.03
Mean	7.95	8.24	8.09	7.61	7.95	7.78	6.84	7.43	7.13	6.138	6.69	6.41
	S.Em.±		C.D. @ 1%	S.Em.±		C.D. @ 1%	S.Em.±		C.D. @ 1%	S.Em.±		C.D. @ 1%
Treatment (T)	0.09		NS	0.113		NS	0.11		0.42	0.14		0.54
Storage (S)	0.06		NS	0.071		NS	0.07		0.26	0.09		0.34
Interaction (TxS)	0.13		NS	0.159		NS	0.15		NS	0.20		NS

T₁ - Vengurla - 1

T₂ - Vengurla - 4

T₃ - Vengurla - 6

T₄ - Vengurla - 7

T₅ - Vengurla - 8

S₁ - Ambient temperature

S₂ - Cold storage

NS - Non-significant

Table.4 Changes in bacterial count (colony count $\times 10^{-3}$ /ml) of cashew apple juice under ambient (27-29°C) and cold (12 \pm 1°C) temperature

Treatments	0 month			2 months			4 months			6 months		
	S ₁	S ₂	Mean	S ₁	S ₂	Mean	S ₁	S ₂	Mean	S ₁	S ₂	Mean
T ₁	0.00	0.00	0.00	2.17	1.31	1.74	4.65	2.98	3.81	6.17	4.04	5.10
T ₂	0.00	0.00	0.00	1.39	0.68	1.04	3.59	2.36	2.98	5.13	3.32	4.22
T ₃	0.00	0.00	0.00	2.65	1.33	1.99	4.75	3.00	3.88	6.47	4.00	5.23
T ₄	0.00	0.00	0.00	1.99	1.22	1.60	4.30	2.35	3.33	5.84	3.58	4.71
T ₅	0.00	0.00	0.00	2.67	1.35	2.01	5.03	3.03	4.03	6.13	4.13	5.13
Mean	0.00	0.00	0.00	2.17	1.18	1.68	4.47	2.74	3.60	5.95	3.81	4.88
	S.Em.±		C.D. @ 1%	S.Em.±		C.D. @ 1%	S.Em.±		C.D. @ 1%	S.Em.±		C.D. @ 1%
Treatment (T)	0.00		0.00	0.07		0.26	0.05		0.18	0.05		0.30
Storage (S)	0.00		0.00	0.04		0.17	0.03		0.11	0.03		0.13
Interaction (TxS)	0.00		0.00	0.09		0.37	0.06		0.25	0.08		0.30

T₁ - Vengurla - 1

T₂ - Vengurla - 4

T₃ - Vengurla - 6

T₄ - Vengurla - 7

T₅ - Vengurla - 8

S₁ - Ambient temperature

S₂ - Cold storage

NS - Non-significant

Table.5 Changes in fungal count (colony count $\times 10^{-3}$ /ml) of cashew apple juice under ambient (27-29°C) and cold (12 \pm 1°C) temperature

Treatments	0 month			2 months			4 months			6 months		
	S ₁	S ₂	Mean	S ₁	S ₂	Mean	S ₁	S ₂	Mean	S ₁	S ₂	Mean
T ₁	0.00	0.00	0.000	2.38	1.50	1.94	4.88	3.25	4.06	8.38	5.40	6.89
T ₂	0.00	0.00	0.000	1.73	1.05	1.39	4.50	2.63	3.56	8.00	4.20	6.10
T ₃	0.00	0.00	0.000	2.40	1.65	2.03	5.00	3.25	4.13	8.50	5.58	7.04
T ₄	0.00	0.00	0.000	1.58	1.25	1.41	4.75	3.25	4.00	8.25	4.50	6.38
T ₅	0.00	0.00	0.000	2.63	1.50	2.06	5.13	2.38	3.75	8.63	5.25	6.94
Mean	0.00	0.00	0.000	2.14	1.39	1.77	4.85	2.95	3.90	8.35	4.99	6.67
	S.Em.±		C.D. @ 1%	S.Em.±		C.D. @ 1%	S.Em.±		C.D. @ 1%	S.Em.±		C.D. @ 1%
Treatment (T)	-		-	0.06		0.24	0.11		0.41	0.10		0.38
Storage (S)	-		-	0.04		0.15	0.07		0.26	0.06		0.24
Interaction (TxS)	-		-	0.09		0.33	0.15		0.58	0.14		0.54

T₁ - Vengurla - 1
S₁ – Ambient temperature

T₂ - Vengurla - 4

T₃ - Vengurla – 6
S₂ – Cold storage

T₄ - Vengurla -7
NS – Non-significant

T₅ – Vengurla - 8

From the present study it was concluded that, on the basis of sensory evaluation score (Colour, Flavour and Overall acceptability) and microbial study (Bacterial and Fungal) of cashew apple juice interaction T₂S₂ (Vengurla-4 at cold storage) was found best after 6 month storage period.

References

- Akinwale, T. D. (2000). Cashew apple juice. "It's uses in fortifying the nutritional quality of some tropical fruits". *European Food Research Technology*, 211: 205 – 207.
- Bagkar, P.P. (2013). Storage studies of jamun (*Syzygium cumini* Linn.) juice. A M. Sc. (Agri.) thesis submitted to Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli, Dist- Ratnagiri (M.S).
- Bhardwaj, R. (2013). Physico-chemical, sensory and microbiological quality of kinnow juice stored in refrigerated storage condition. *Asian J. Dairy and Food Res.*, 32(3): 203-213.
- Cavalcante, A.A.M. B. Rubensam, Erdtmann, M. Brendel and J.A.P. Henriques (2005). Cashew (*Anacardium occidentale* L.) apple juice lowers mutagenicity of aflatoxin B1 in *S. typhimurium* TA102 *Gen. Mol. Biol.*, 28: 328-333.
- Emamifar, A. (2010). Evaluation of nanocomposite packaging containing Ag and ZnO on shelf life of fresh orange juice. *Innovative Food Science and Emerging Technologies*, 11:742-748.
- Garande, V. K. (1992). Studies on maturity indices, storage and processing of jamun (*Syzygium cumini* skeels) fruits. A M.Sc. (Agri.) thesis Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra State.
- Hussain, I. A. Zeb and M. Ayub (2011). Evaluation of apple and apricot blend juice preserved with sodium benzoate at refrigeration temperature. *World J. of Agric. Sci.*, 7(2): 136-142.
- Oladipo I.C., D. T. Adeleke and A.O. Adebisi (2010). The effect of pH and chemical preservatives on the growth of bacterial isolates from some Nigerian packaged fruit juices. *Pakistan Journal of Biological Sciences*, 13:16-21.
- Panase, V.G and P.V. Sukhatme (1985). *Statistical methods for agricultural workers*, I.C.A.R New Delhi.
- Shakoor, W., Javid Ullah, Alam Zeb and Z. Muhammad (2013). Effect of refrigeration temperature, sugar concentrations and different chemicals preservatives on the storage stability of strawberry juice. *International Journal of Engineering and Technology*, 13 (3):1-2.
- Talasila, U., R. R. Vechalapu and K. B. Shaik (2012). Storage stability of cashew apple juice- use of chemical preservatives. *Journal of Food Technology*, 10 (4):117-123.