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RESEARCH PAPER

Preparation of aonla RTS beverage from drained syrup

■ K. CHANDAN, A.K. ROKHADE AND G.B. SRINIVASULU

SUMMARY : An investigation was conducted to prepare RTS beverage from drained aonla syrup without wasting it. The RTS prepared using drained aonla syrup adjusted to 20^0 Brix containing two per cent lime juice + one per cent ginger juice was found to be acceptable with lower microbial population and highest oganoleptic scores (out of 5.00) of 4.07 for colour and appearance, 4.32 for taste, 4.53 for flavour and 4.28 for overall acceptability.

KEY **W**ORDS : Drained aonla syrup, TSS, Lime juice, Ginger juice

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Aonla (*Emblica officinalis* Gaerth.),an important minor fruit and a crop of commercial significance. The fruit is highly nutritive and one of the richest sources of vitamin C. Fresh aonla fruits are sour and astringent in taste. Hence, cannot be consumed as a table fruit. Even though many processed products of aonla are available in the market, dehydrated product has always an upper hand in the consumer preference. Therefore, an investigation was conducted to prepare sweetened aonla slices. During osmotic dehydration of aonla slices, sugar syrup drained was found to contain a portion of juice due to osmosis between the syrup and aonla slices (Keshatti, 2003). Aonla syrup can be used to prepare aonla RTS with lime juice, ginger juice (Gajanana, 2002). Although little work has been done in this regard, but no attention has been given to utilise the drained aonla syrup obtained as a by-product during osmo-dehydration process. Therefore, in the present investigation, an attempt was made to prepare aonla RTS from drained syrup without wasting it.

MEMBERS OF THE RESEARCH FORUM

Author for Correspondence :
K. CHANDAN, College of Horticulture, Sirsi, UTTAR KANNADA (KARNATAKA) INDIA
Email : chandu_hort@rediffmail.com

Coopted Authors:
A.K. ROKHADE, Division of Horticulture, University of Agricultural Sciences, DHARWAD (KARNATAKA) INDIA

G.B. SRINIVASULU, College of Horticulture, Sirsi, UTTAR KANNADA (KARNATAKA) INDIA
Email : seenugb@rediffmail.com

EXPERIMENTAL METHODS

Fresh aonla fruits cv. Sureban (local variety) procured from Lingadhal village, Belgaum district (Karnataka) were used to present investigation. The drained aonla syrup was obtained by the following treatments followed for preparing dehydrated aonla slices.

T_1 – Blanching + 2% salt for 1 hour + 50^0B sugar syrup for 24 hours
T_2 – Blanching + 2% salt for 2 hour + 50^0B sugar syrup for 24 hours
T_3 – Blanching + 2% salt for 3 hour + 50^0B sugar syrup for 24 hours
T_4 – Blanching + 2% salt for 1 hour + 60^0B sugar syrup for 24 hours
T_5 – Blanching + 2% salt for 2 hour + 60^0B sugar syrup for 24 hours
T_6 – Blanching + 2% salt for 3 hour + 60^0B sugar syrup for 24 hours
T_7 – Blanching + 2% salt for 1 hour + 70^0B sugar syrup for 24 hours
T_8 – Blanching + 2% salt for 2 hour + 70^0B sugar syrup for 24 hours
T_9 – Blanching + 2% salt for 3 hour + 70^0B sugar syrup for 24 hours
T_{10} – Lye blanching + 60^0B sugar syrup for 24 hours

T_{11} – Lye blanching + 70^{0}B sugar syrup for 24 hours

The drained sugar syrups obtained by above treatments were preserved by boiling the syrup for 15 minutes and filled in to clean, sterile bottle and sealed with crown caps and stored under ambient conditions.

The bottled aonla syrup was adjusted to 15^{0}B and subjected to organoleptic evaluation. Based on these results the drained syrup obtained from treatment T_5 and T_8 were used for the preparation of RTS beverage.

Preparation of aonla RTS from drained syrup :

The experiment was laid out in Completely Randomised Design with three replications. There were ten treatments. The details of treatments are as follows:

R_1 : Aonla syrup from T_5 + 1% lime juice + 0.5% ginger juice, TSS 15^{0}B

R_2 : Aonla syrup from T_5 + 2% lime juice + 0.5% ginger juice, TSS 15^{0}B

R_3 : Aonla syrup from T_5 + 1% lime juice + 0.5% ginger juice, TSS 20^{0}B

R_4 : Aonla syrup from T_5 + 2% lime juice + 1.0% ginger juice, TSS 20^{0}B

R_5 : Aonla syrup from T_5 + 3% lime juice + 1.5% ginger juice, TSS 20^{0}B

R_6 : Aonla syrup from T_8 + 1% lime juice + 0.5% ginger juice, TSS 15^{0}B

R_7 : Aonla syrup from T_8 + 2% lime juice + 1.0% ginger juice, TSS 15^{0}B

R_8 : Aonla syrup from T_8 + 1% lime juice + 0.5% ginger juice, TSS 20^{0}B

R_9 : Aonla syrup from T_8 + 2% lime juice + 1.0% ginger juice, TSS 20^{0}B

R_{10} : Aonla syrup from T_8 + 3% lime juice + 1.5% ginger juice, TSS 20^{0}B

The bottled aonla syrup of T_5 and T_8 were adjusted to 15^{0}B and 20^{0}B. The lime juice and ginger juice were extracted and added to syrup as per the treatments and mixed well. RTS was filtered through muslin cloth and filled in sterilised bottles. The bottled RTS was subjected to organoleptic evaluation on the same day.

The drained syrup and aonla RTS were analysed for chemical parameters. Ascorbic acid was estimated as per AOAC method (Anonymous,1984). Acidity was estimated by titrating it against 0.1 N sodium hydroxide solution using phenolphthalein as indicator and reported in terms of citric acid. Reducing sugar, non-reducing and total sugar were estimated as per the standard methods. The data were analysed statistically and reported at per cent significance level (Panse and Sukhatme,1985.)

The microbial load was counted and the total count was expressed by multiplying the number of colonies with dilution factor and expressed as CFU per millilitre in aonla RTS.

EXPERIMENTAL FINDINGS AND ANALYSIS

The results obtained from the present investigation are summarized in Table 1, 2, 3, 4 and 5.

Chemical parameters of drained aonla syrup :

Significant differences with respect to TSS (^{0}Brix) were observed among the treatments and storage period (Table 1). The mean TSS in different treatments irrespective of storage period was found significantly highest (44.17^{0}B) in T_{11} followed by T_{10} (43.33^{0}B), whereas the lowest TSS (31.16^{0}B) was observed in T_2. The mean TSS irrespective of treatments was found to increase from 35.24 to 37^{0}B after six months after storage (MAS). Increase in TSS may be due to conversion of polysaccharides into sugars during hydrolysis process and also due to heat treatment given to syrup before hot filling in to bottles. Similar findings were reported by Garande *et.al.*(1995) in jamun products and Srivastava and Kumar (1998) in aonla products.

The mean reducing sugar in different treatments irrespective of storage period was found significantly highest (15.94%) in T_8, which was at par with T_9 (15.93%), whereas the lowest reducing sugars (13.79%) was observed in treatments T_1 and T_2. The mean reducing sugars irrespective of treatments was found to increase marginally from initial level 14.47 per cent to 15.52 per cent at six MAS.

The mean non-reducing sugar in different treatments irrespective of storage period was found significantly highest (31.97%) in T_9, which was at par with T_8 (31.57%), whereas the lowest non-reducing sugars (27.56%) was observed in treatments T_1. The mean non-reducing sugars irrespective of treatments were found to increase marginally from initial level 27.74 per cent to 32.03 per cent at six MAS.

The mean total sugar in different treatments irrespective of storage period was found significantly highest (49.58%) in T_9, which was at par with T_8 (49.17%), whereas the lowest total reducing sugars (42.82%) was observed in treatments T_1. The mean total sugars irrespective of treatments were found to increase marginally from 43.59 per cent to 49.23 per cent at six MAS. The increase might be due to conversion of starch and other carbohydrates in to sugars. Similar results were observed by Saini *et al.* (1996) in thermally processed mango RTS and Krishnaveni *et al.* (2001) in jackfruit RTS storage.

The mean total titratable acidity in different treatments irrespective of storage period was found significantly highest (0.47%) in treatments T_{10} and T_{11}, whereas the lowest acidity (0.38%) was observed in T_9. The mean acidity irrespective of treatments was found to increase from 0.40 per cent to 0.47 per cent after six MAS. Pectic substances have been reported to increase the acidity in fruit products. Hence, degradation of pectic substances of pulp in to soluable solids might have contributed towards an increase in acidity of drained aonla

Table 1: Effect of treatments and storage period on composition of drained aonla syrup

Treatments	TSS (°Brix)			Reducing sugar (%)			Non-reducing sugar (%)			Total sugar (%)			Titratable acidity (%)			Sugar:acid ratio			Ascorbic acid (mg/100ml)		
	A	B	Mean	A	B	Mean	A	B	Mean	A	B	Mean	A	B	Mean	A	B	Mean	A	B	Mean
T_1	30.67	32.67	31.67	13.34	14.24	13.79	25.49	29.63	27.56	40.20	45.44	42.82	0.43	0.50	0.46	94.49	91.85	93.17	41.83	17.30	29.57
T_2	30.00	32.33	31.16	13.25	14.33	13.79	26.01	30.02	28.01	40.27	45.93	43.10	0.39	0.46	0.43	102.76	100.29	101.53	41.00	16.99	28.99
T_3	26.67	28.67	27.67	13.50	14.57	14.03	25.46	29.51	27.49	40.30	45.63	42.97	0.39	0.45	0.42	103.92	101.91	102.92	43.00	17.63	30.48
T_4	34.67	36.33	35.50	14.43	15.42	14.93	28.15	32.60	30.38	44.07	49.73	46.90	0.39	0.45	0.42	112.45	110.04	111.24	46.00	18.90	32.45
T_5	36.00	38.00	37.00	14.35	15.40	14.88	28.28	32.65	30.46	44.10	49.77	46.93	0.41	0.48	0.44	108.65	104.98	106.82	49.83	20.04	34.94
T_6	34.33	35.67	35.00	14.60	15.67	15.13	28.52	32.92	30.72	46.10	50.32	47.21	0.38	0.41	0.39	117.52	115.80	116.66	37.33	21.83	29.58
T_7	36.67	38.67	37.67	15.35	16.40	15.88	29.17	32.92	31.04	46.05	51.05	48.55	0.38	0.44	0.41	122.84	117.55	120.20	60.17	23.50	41.83
T_8	35.67	37.67	36.67	15.37	16.52	15.94	29.42	33.71	31.57	46.33	52.00	49.17	0.36	0.42	0.39	128.70	121.96	125.33	60.50	24.73	42.62
T_9	36.67	38.33	37.50	15.40	16.45	15.93	29.62	34.32	31.97	46.58	52.58	49.58	0.34	0.41	0.38	136.37	130.00	133.19	51.50	23.03	37.26
T_{10}	42.67	44.00	43.33	14.22	15.32	14.77	29.71	31.51	29.11	42.33	48.48	45.41	0.44	0.50	0.47	95.78	160.81	101.30	47.22	26.43	36.83
T_{11}	43.67	44.67	44.17	15.30	16.37	15.83	28.31	32.56	30.43	45.10	50.63	47.87	0.43	0.50	0.47	104.30	99.88	102.88	48.93	26.40	37.67
Mean	35.24	37.00	36.12	14.47	15.52	14.99	27.74	32.03	29.89	43.59	49.23	46.41	0.40	0.47	0.43	111.62	109.19	110.40	47.97	21.53	34.75
For comparing means of																					
	S.E.±	C.D.@ 1%		S.E.±	C.D.@ 1%		S.E.±	C.D.@ 1%		S.E.±	C.D.@ 1%		S.E.±	C.D.@ 1%		S.E.±	C.D.@ 1%		S.E.±	C.D.@ 1%	
T	0.286	1.079		0.090	0.339		0.189	0.714		0.172	0.649		0.013	0.049		3.400	12.840		1.303	4.919	
S	0.123	0.464		0.038	0.143		0.081	0.306		0.073	0.276		0.006	0.023		1.450	NS		0.681	2.582	
TxS	0.405	NS		0.128	NS		0.267	NS		0.243	NS		0.018	NS		4.81	NS		1.843	6.958	

A – Initial, B- 6 Months after storage, NS – Non-significant

syrup. An increase in acidity with the storage period has also been observed in jamun juice and nectar by Khurdiya and Roy (1985).

Significantly highest sugar: acid ratio was observed in T_9 (133.19), whereas the lowest sugar: acid ratio (93.17) was observed in T_1.

The mean ascorbic acid in different treatments irrespective of storage period was found significantly highest (42.62 mg/100ml) in T_8, which was at par with T_7 (41.83mg/100ml), whereas the lowest ascorbic acid was recorded in T_2 (28.99 mg/100ml). The mean ascorbic acid irrespective of treatments was found to decrease significantly during the storage period of six months to about 50 per cent of its initial *i.e.*, 47.97 mg per 100 ml at the beginning of storage to 21.53 mg per 100 ml at six MAS. The interaction effect between treatments and storage period also found to be significant. Significantly highest ascorbic acid was recorded in T_9 (51.50 mg per 100 ml) in the initial period of storage, whereas the lowest (16.99 mg per 100 ml) was observed in T_2 at six MAS. The decrease in ascorbic acid could be attributed to the oxidation by trapped oxygen in the glass bottles, which resulted in formation of dehydro-ascorbic acid. The findings are in accordance with the results reported by Sonawane (2000) in

Table 2: Organoleptic evaluation of drained aonla syrup (TSS 15^{0}B) as influenced by treatments (Scores out of 5.00)

Treatments	Colour and appearance	Taste	Flavour	Overall acceptability
T_1	3.05	3.03	3.13	3.03
T_2	3.15	3.28	3.03	3.03
T_3	3.15	3.28	3.03	3.03
T_4	3.15	3.53	3.13	3.78
T_5	3.28	4.03	3.13	4.03
T_6	3.15	3.78	3.08	3.93
T_7	3.15	3.63	3.03	3.83
T_8	3.15	3.78	3.08	4.03
T_9	3.05	3.63	2.88	3.97
T_{10}	3.05	2.68	2.93	3.50
T_{11}	3.05	2.63	2.93	3.28
Mean	3.13	3.39	3.04	3.58
For comparing means of				
S.E.±	0.049	0.033	0.033	0.069
C.D@ 1%	NS	0.132	0.132	0.275

NS – Non-significant

Table 3: Organoleptic evaluation of aonla RTS as influenced by treatments (Scores out of 5.00)

Treatments	Colour and appearance	Taste	Flavour	Overall acceptability
R_1	3.82	3.57	3.53	3.53
R_2	3.82	3.82	3.53	3.78
R_3	4.07	4.32	4.03	4.03
R_4	4.07	4.32	4.53	4.28
R_5	3.82	3.82	3.55	3.48
R_6	4.17	4.32	4.13	4.18
R_7	4.07	3.82	4.03	4.03
R_8	4.07	3.82	4.03	3.78
R_9	4.32	4.57	4.53	4.53
R_{10}	4.07	4.07	4.13	4.03
Mean	4.03	4.04	3.99	3.97
For comparing means of				
S.E.±	0.067	0.067	0.035	0.033
C.D.@ 1%	0.261	0.261	0.136	0.129

tamarind pulp and Shere (2003) in aonla RTS storage.

Organoleptic evaluation of drained aonla syrup :

The results indicated that, there were significant difference between the treatments with respect to taste, flavour and overall acceptability except color and appearance (Table 2).

Significant highest score for taste was observed in drained syrup obtained by T_1 (4.03) followed by T_2 (3.78) and the least score was recorded in T_{11}(2.63). Significantly highest score for flavour was observed in T_1, T_4 and T_5 (3.13) followed by T_6 and T_8 (3.08) and the least score was recorded in T_9 (2.88). Significantly highest score for overall acceptability was observed in T_5 and T_8 (4.03) followed by T_9 (3.97) and the least was recorded in T_1, T_2, and T_3 (3.03).

Based on these results the drained syrup obtained from treatment T_5 and T_8 were used for the preparation of RTS beverage.

Preparation of aonla RTS from drained syrup :

Organoleptic evaluation of aonla RTS :

The results indicated that, there was a significant difference between the treatments with respect to colour and appearance, taste, flavour and overall acceptability (Table 3). Significantly highest score for colour and appearance was observed in R_9 (4.32) followed by R_6 (4.17), whereas least score was recorded in R_1, R_2 and R_5 (3.82). Significantly highest score for taste was recorded in R_9 (4.57) followed by R_4 and R_6 (4.32), whereas least score was recorded in R_1 (3.57). Significantly highest score for flavour was observed in R_4 and R_9 (4.53) followed by R_6 and R_{10} (4.13), whereas the least score was recorded in R_1 and R_2 (3.53). Significantly highest score for overall acceptability aonla RTS was observed in R_9 (4.53) followed by R_4 (4.28) and R_6 (4.18), whereas the least score was recorded in R_1 (3.53).

Table 4: Chemical composition of aonla RTS as influenced by treatments

Treatments	Ascorbic acid (mg/100g)	Reducing sugars (%)	Non-reducing sugars (%)	Total sugars (%)	Titratable acidity (%)	Sugar: acid ratio
R_1	4.10	2.53	8.58	11.57	0.21	56.08
R_2	4.10	2.47	8.65	11.57	0.22	52.58
R_3	7.13	2.92	11.07	14.57	0.24	59.89
R_4	7.13	2.93	11.02	14.53	0.25	57.39
R_5	7.13	2.90	11.09	14.57	0.26	56.02
R_6	5.35	2.55	8.60	11.60	0.18	64.44
R_7	5.33	2.55	8.63	11.63	0.19	61.23
R_8	8.58	2.97	11.07	14.60	0.20	73.00
R_9	8.39	2.87	11.18	14.63	0.23	64.67
R_{10}	8.49	2.90	11.09	14.57	0.26	56.02
Mean	6.57	2.76	10.10	13.38	0.22	60.13
For comparing means of						
S.E.±	0.120	0.040	0.045	0.037	0.005	0.908
C.D.@ 1%	0.483	0.160	0.181	0.149	0.020	3.652

Table 5: Quantitative estimation of micro-organisms of fresh aonla RTS prepared from drained aonla syrup stored for six months

Treatments	Bacteria	Fungi	Yeast
	No. X 10^5 (CFU/ml)	No. X 10^3 (CFU/ml)	No. X 10^3 (CFU/ml)
R_1	4.00	1.50	2.30
R_2	3.50	1.30	1.90
R_3	4.40	1.20	1.40
R_4	2.70	0.90	1.20
R_5	4.80	0.80	1.50
R_6	3.10	1.60	1.90
R_7	4.00	1.50	2.20
R_8	3.10	1.20	2.10
R_9	2.50	0.80	1.10
R_{10}	2.70	0.90	1.60

Chemical parameters of aonla RTS :

Significantly highest ascorbic acid (mg/100g) was observed in R_8 (8.58 mg/100g), which was at par with R_{10} (8.49 mg /100g), whereas the lowest value was observed in R_1 and R_2 (4.10 mg/100g) (Table 4).

Significantly maximum reducing sugar was observed in R_8 (2.97%), which was at par with R_4 (2.93%), whereas minimum was recorded in R_1 (2.53%). Significantly maximum non-reducing sugar was observed in R_9 (11.18%), which was at par with R_5 and R_{10} (11.09%), whereas minimum was observed in R_1 (8.58%). Significantly maximum total sugar was observed in R_9 (14.63%). Significantly maximum total titratable acidity was observed in R_5 and R_{10} (0.26%), which was at par with R_4 (0.25%), whereas minimum value was observed in R_6 (0.18%). Significantly maximum sugar:acid ratio was observed in R_8 (73.00), whereas minimum ratio was observed in R_2 (52.58%).

Microbial load on aonla RTS :

The bacterial population of fresh aonla RTS was found minimum in R_9 (2.5×10^5 CFU/ml) followed by treatments R_4 nd R_{10} (2.7×10^5 CFU/ml), whereas maximum bacterial population was observed in R_5 (4.8×10^5 CFU/ml). The fungal population was observed minimum in treatments R_5 and R_9 (0.80×10^3 CFU/ml) followed by treatments R_4 and R_{10} (0.90×10^3 CFU/ml), whereas maximum fungal population was observed in R_6 (1.60×10^3 CFU/ml). The minimum yeast population was observed in R_9 (1.10×10^3 CFU/ml) followed by R_4 (1.20×10^3 CFU/ml), whereas maximum yeast population was observed in R_1 (2.30×10^3 CFU/ml).

Conclusion :

The RTS prepared using drained aonla syrup adjusted to 20^0 Brix containing two per cent lime juice + one per cent ginger juice was found to be acceptable with lower microbial population and highest organoleptic scores.

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