

**RESEARCH ARTICLE :**

# Development of fermented beverage from aonla (*Emblica officinalis* Gaertn.) blends

■ **M. CHIRAG REDDY, K.N. SREENIVAS, M. KARAN, G.S. MANJULA AND H. MOHAMAD TAYEEB ULLA**

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**SUMMARY :** Blended beverage was prepared by using different fruit combination of aonla, sapota, pineapple and grapes, where the TSS (14 °B) was maintained by using raisin juice. Fermentation was carried out for 72 hours using *Saccharomyces cerevisiae* var. *ellipsoideus* (MTCC 552). Later, the fermentate was transferred to pre sterilized bottles and pasteurized and then left for ageing. Among all the parameters alcohol per cent and titratable acidity increased and the TSS, pH, ascorbic acid content decreased during storage time. Treatment T<sub>7</sub> [Grated aonla (50 %) with Grape must (50 %)] was found to be best as suggested by sensory panel when compared to other treatment with respect to TSS (8.70°B), pH (4.29), acidity (0.65 %), ascorbic acid (45.00 mg 100<sup>-1</sup>) and alcohol content (3.29 %) followed by Treatment T<sub>5</sub> [Grated Aonla (50 %) with pineapple pulp (50 %)].

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**KEY WORDS :**

Aonla, Blended beverage, TSS, pH, Acidity, Ascorbic acid

## **BACKGROUND AND OBJECTIVES**

Aonla (*Emblica officinalis* Gaertn.) is a subtropical fruit belonging to family Euphorbiaceae. Aonla is a rich source of ascorbic acid (600 mg/100g) and also contains moisture (81.2 %), protein (0.5 %), carbohydrate (14 %), fibre (3.4 %), iron (1.2 %), mineral matter (0.7 %), Vitamin B<sub>1</sub> (13 mg per 100g). It is extensively used in Ayurveda for its medicinal properties, since time immemorial. Direct consumption of aonla is less preferred because of its high acidity and astringent taste. Thermal processing makes the fruits lose vital phytochemicals such as ascorbic acid, polyphenols,

antioxidants etc. An alternative method of processing like fermentation is boon in this regard. Further, to ward off misconception regarding drinking alcohol beverages, developments of products which are having less than 5 per cent alcohol using natural source of sugar, which is similar to many Ayurveda products, helps in better acceptance of the prepared products for enhanced health benefits. Therefore, blending of two or more fruit juices and their beverages are thought to be a convenient alternative for its utilization in order to have some value added fruit drinks which are of high quality in respect of sensory and nutritional aspects. So the preparation of blended beverage from grated aonla using

Author for correspondence :

**M. CHIRAG REDDY**  
College of Horticulture,  
BENGALURU  
(KARNATAKA) INDIA  
Email : [mchiragreddy@gmail.com](mailto:mchiragreddy@gmail.com)

See end of the article for authors' affiliations

raisin paste as the present technology of manufacturing wine from grapes is available. Keeping in view of the above, the current study was formulated to develop nutritional yet sensory acceptable fermented beverage from nutraceutical rich aonla with studying other fruits.

## RESOURCES AND METHODS

Fully matured, disease free, aonla fruits, Pineapple, Sapota and Grapes (Bangalore Blue) were obtained from the market for the experiment. Fruits were washed thoroughly in clean water and aonla were grated into small pieces in aonla grater machine. The selected sapota and pineapple fruits were weighed individually and were peeled using stainless steel knife. The edible fruit portion was cut into small rectangular slices after removing the core by using fruit corer in case of pineapple. Grapes were mashed by hands and then used for the experiment. Fruits were blended into different combination *viz.*,

T<sub>1</sub> = Grated aonla (100 % : Control);

T<sub>2</sub> = Grated aonla (60 %) with sapota pulp (40 %);

T<sub>3</sub> = Grated aonla (50 %) with sapota pulp (50 %);

T<sub>4</sub> = Grated aonla (60 %) with pineapple pulp (40 %);

T<sub>5</sub> = Grated aonla (50 %) with pineapple pulp (50 %);

T<sub>6</sub> = Grated aonla (60 %) with grape must (40 %);

T<sub>7</sub> = Grated aonla (50 %) with grape must (50 %);

In all the treatments, TSS of must was maintained at 14 °B for all treatments using raisin juice. These treatments were evaluated for their bio-chemical composition during storage period and sensory qualities after three months of storage. The experiment was carried out with seven different treatments and five replications, using Completely Randomized Design.

Aonla blended beverage was analyzed for pH, TSS, acidity, ascorbic acid and alcohol content during three months of storage. Various physico-chemical characteristics of the blended beverage were analyzed as per the standard methods.

### pH :

The pH of the aonla blended beverage was measured by using digital pH meter. The pH was measured using I Trans Bench top pH meter, after standardization with buffers of pH 4 and 9.

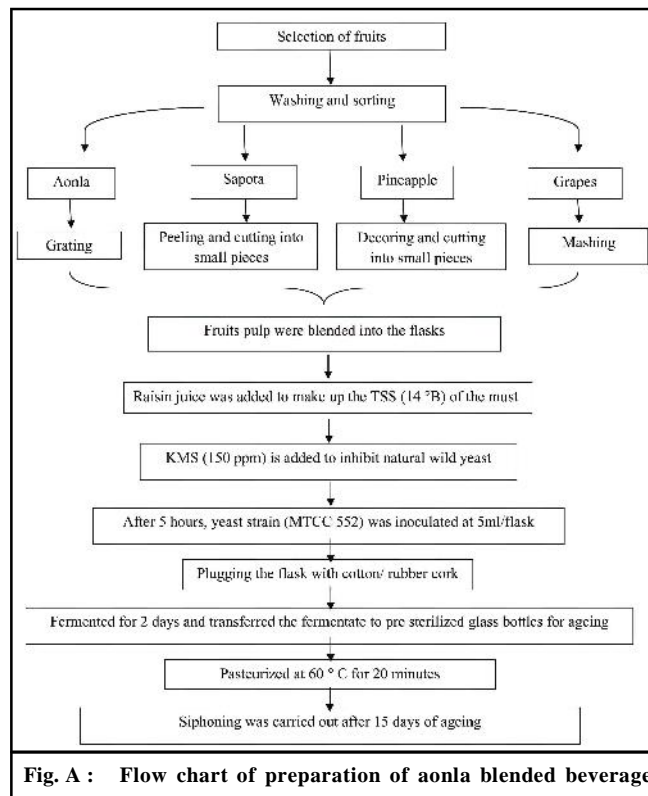


Fig. A : Flow chart of preparation of aonla blended beverage

### Total soluble solids (TSS °B) :

The content of total soluble solids (TSS) in the aonla blended beverage was determined with the help of digital hand refractometer ATAGO pocket refractometer and expressed as degree Brix (°B).

### Titrateable acidity (%) :

The total titrateable acidity of aonla blended beverage was determined by visual titration method (Ranganna, 1986).

### Preparation of sample:

Two ml of aonla blended beverage was taken and the volume was made upto 25 ml with distilled water and the aliquot was used for analysis.

### Procedure:

Ten ml of filtrate was taken in a conical flask and titrated against 0.1N NaOH solution using 1 or 2 drops of phenolphthalein indicator. Formation of pink colour was recorded as the end point of titration. Then, the acidity was calculated as follows :

$$\text{Acidity (\%)} = \frac{\text{Titre value} \times 0.1 \text{N NaOH} \times \text{Vol. made up} \times \text{Equi. wt of citric acid}}{\text{Vol. of sample taken for titration} \times \text{Wt. of sample} \times 1000} \times 100$$

### Ascorbic acid (mg 100 g<sup>-1</sup>) :

Ascorbic acid content of aonla blended beverage was determined by 2, 6-dichlorophenol indophenols visual titration method described by Ranganna (1986).

### Standardization of dye :

Five ml of standard ascorbic acid solution and five ml of 3 per cent metaphosphoric acid was taken in a conical flask and titrated against the dye solution. The end point was light pink colour which persisted for at least 10 seconds. The dye factor was calculated as,

$$\text{Dye factor} = \frac{0.5}{\text{Titre value}}$$

### Preparation of sample :

Two ml of aonla blended beverage was taken in a beaker and the volume was then made upto 100 ml with 3 per cent metaphosphoric acid.

### Procedure :

Five ml of sample was taken in a conical flask and titrated against the standard dye solution. The end point was light pink colour, which persisted for 10 seconds.

### Calculation :

$$\text{Vitamin C (mg 100 g}^{-1}\text{)} = \frac{\text{Titre value} \times \text{dye factor} \times \text{volume made up}}{\text{Volume of sample taken for titration} \times \text{Wt. of the sample}} \times 100$$

Ethanol content was determined by

spectrophotometric method (Caputi *et al.*, 1968) using potassium dichromate. The absorbance was taken at 600 nm in a spectrophotometer. The standard curve was prepared using pure ethanol in concentrations ranging from 0 to 8 per cent and the amount of ethanol in the experimental sample were determined and expressed as per cent.

## OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well as discussions have been summarized under following heads:

### Total soluble solids (TSS °B) :

Blended beverages of grated aonla (50 %) with grape must (50 %) - T<sub>7</sub> was found best and significant with higher TSS (8.70) whereas the lowest TSS (7.50) was observed in T<sub>1</sub> - grated aonla (100 % - Control). TSS was decreased as the storage period advanced in all the treatments; this was due to conversion of sugars to alcohol by yeasts during fermentation and also consumption of sugars by yeast. Similar results were reported in grapes by Patil (1994) and Taskar (2007), the TSS content were decreased sharply from 23.0 to 8.20 °Brix during fermentation. Later the rate of fermentation was decreased but it continued at a much slower rate upto 8 days during which a decrease of 12.9 per cent TSS was noted. The increased TSS may be attributed to less alcohol content and decreased TSS during storage period this might be due to concentration of the nutrient resulted in higher alcohol yield and thus less TSS (Table 1).

### pH:

A decreased in pH was observed in aonla blended

**Table 1 : Effect of different fruit pulp ratio on TSS (°B) content of blended beverages during storage period**

Treatments	0 Days	15 Days	30 Days	45 Days	60 Days	75 Days	90 Days
T <sub>1</sub> = Grated Aonla (100 %) - (Control)	8.14	7.76	7.84	7.78	7.66	7.62	7.50
T <sub>2</sub> = Grated Aonla (60 %) with Sapota Pulp (40 %)	8.40	8.32	8.26	8.08	7.98	7.86	7.76
T <sub>3</sub> = Grated Aonla (50 %) with Sapota Pulp (50 %)	8.68	8.44	8.24	8.10	7.94	7.84	7.74
T <sub>4</sub> = Grated Aonla (60 %) with Pineapple Pulp (40 %)	9.08	8.86	8.64	8.52	8.40	8.32	8.22
T <sub>5</sub> = Grated Aonla (50 %) with Pineapple Pulp (50 %)	9.36	8.82	8.88	8.72	8.62	8.56	8.44
T <sub>6</sub> = Grated Aonla (60 %) with Grape Must (40 %)	8.80	8.58	8.40	8.22	8.14	8.02	7.90
T <sub>7</sub> = Grated Aonla (50 %) with Grape Must (50 %)	9.56	9.38	9.14	9.06	8.98	8.82	8.70
C.D. (P=0.05)	0.648	0.601	0.454	0.279	0.276	0.392	0.188
S.E. ±	0.166	0.154	0.116	0.071	0.071	0.100	0.048
F test	**	**	**	**	**	**	**

\*\* indicates significance of value at P=0.01

NS = Non-significant

beverages as the storage period increased. Treatment 7 {Grated Aonla (50 %) with Grape Must (50 %)} recorded higher pH (4.29), whereas, the lowest pH (4.20) was recorded in grated aonla (100 %), which was due to production of acid by yeast during the fermentation process. The results were in concurrence with the findings of Olasupo and Obayori (2003). These results were on par with the results of Bravo-Abad and Inigo-Leal (1989) that increased acidity would have resulted in decrease in pH at lower concentrations of sugar. Adsule *et al.* (1995) opined that the production of malic, lactic, citric, and tartaric acid resulted in decreasing the pH (Table 2).

### Titrateable acidity (%) :

An increased acidity was observed in the blended beverages as the storage time increased in all the treatments. The higher acidity content (0.97) was observed in T<sub>1</sub> - Grated Aonla (100 % - Control) which would be due to the utilization of sugars in the must by yeasts leading to higher acidity in blended beverages.

The lowest acidity (0.65) was observed in Grated Aonla (50 %) with Grape Must (50 %) *i.e.*, T<sub>7</sub>. Similar results were reported by Sapna *et al.* (2002), in fermentation of different herbs and reported more titrateable acidity was observed in thyme wine (1.39 %) followed by French basil (1.24 %) and whereas the lower titrateable acidity was observed in Melissa wine (0.80 %) after nine weeks of storage. The increase in titrateable acidity during fermentation could be due to production of certain organic acids by yeast cells. Also similar results were reported by Laminkanra (1997), in the experiment on the changes in organic acid composition during fermentation and ageing of Noble muscadine wine and formation of succinic acid appeared to be responsible for the characteristic increase in total acidity during seven months of storage. The results are on par with the findings of Olasupo and Obayori (2003) the initial per cent acidity was 0.42 which increased to 0.83 (Table 3).

### Ascorbic acid (mg/100 ml) :

The decrease in the ascorbic acid content was

**Table 2 : Effect of different fruit pulp ratio on pH of blended beverages during storage period**

Treatments	0 Days	15 Days	30 Days	45 Days	60 Days	75 Days	90 Days
T <sub>1</sub> = Grated Aonla (100 %) - (Control)	4.20	4.05	3.99	3.93	3.88	3.84	3.77
T <sub>2</sub> = Grated Aonla (60 %) with Sapota Pulp (40 %)	4.36	4.28	4.21	4.16	4.13	4.05	4.00
T <sub>3</sub> = Grated Aonla (50 %) with Sapota Pulp (50 %)	4.37	4.33	4.24	4.19	4.15	4.12	4.03
T <sub>4</sub> = Grated Aonla (60 %) with Pineapple Pulp (40 %)	4.41	4.35	4.29	4.24	4.20	4.17	4.11
T <sub>5</sub> = Grated Aonla (50 %) with Pineapple Pulp (50 %)	4.55	4.49	4.35	4.37	4.33	4.26	4.21
T <sub>6</sub> = Grated Aonla (60 %) with Grape Must (40 %)	4.47	4.38	4.33	4.26	4.24	4.18	4.12
T <sub>7</sub> = Grated Aonla (50 %) with Grape Must (50 %)	4.59	4.54	4.47	4.39	4.35	4.32	4.29
C.D. (P=0.05)	0.040	0.038	0.134	0.043	0.044	0.041	0.052
S.E ±	0.010	0.010	0.034	0.011	0.011	0.010	0.013
F test	**	**	**	**	**	**	**

\*\* indicates significance of value at P=0.01

NS = Non-significant

**Table 3 : Effect of different fruit pulp ratio on acidity (%) content of blended beverages during storage period**

Treatments	0 Days	15 Days	30 Days	45 Days	60 Days	75 Days	90 Days
T <sub>1</sub> = Grated Aonla (100 %) - (Control)	0.44	0.50	0.64	0.75	0.86	0.92	0.97
T <sub>2</sub> = Grated Aonla (60 %) with Sapota Pulp (40 %)	0.42	0.54	0.63	0.68	0.75	0.82	0.85
T <sub>3</sub> = Grated Aonla (50 %) with Sapota Pulp (50 %)	0.39	0.48	0.50	0.66	0.71	0.79	0.84
T <sub>4</sub> = Grated Aonla (60 %) with Pineapple Pulp (40 %)	0.36	0.40	0.46	0.53	0.59	0.67	0.73
T <sub>5</sub> = Grated Aonla (50 %) with Pineapple Pulp (50 %)	0.33	0.37	0.42	0.49	0.57	0.65	0.67
T <sub>6</sub> = Grated Aonla (60 %) with Grape Must (40 %)	0.41	0.46	0.50	0.57	0.63	0.70	0.78
T <sub>7</sub> = Grated Aonla (50 %) with Grape Must (50 %)	0.28	0.32	0.39	0.45	0.53	0.60	0.65
C.D. (P=0.05)	0.030	0.029	0.029	0.030	0.080	0.031	0.027
S.E. ±	0.008	0.008	0.007	0.008	0.020	0.008	0.007
F test	**	**	**	**	**	**	**

\*\*indicate significance of value at P=0.01

NS =Non-significant

observed in blended beverages in all treatments. The higher ascorbic acid content (90.90) was observed in T<sub>1</sub> - Grated Aonla (100 % - Control), whereas, the lowest ascorbic acid content (45.00) was recorded in T<sub>7</sub> {Grated Aonla (50 %) with Grape Must (50 %)}. Decrease in ascorbic acid is due to increase in the temperature and as the pH goes towards acidic and depletes the ascorbic acid content. Decrease in TSS and ascorbic acid in storage of mango and guava juice was reported by Kalra and Tandon (1984). A study conducted by Brock *et al.* (1998) revealed that, ascorbic acid is very sensitive to thermal and pressure temperatures (Table 4).

#### Alcohol (%) :

The increasing trend in the alcohol content was observed in storage time. There was significant difference between the treatments with respect to alcohol content in blended beverages. The alcohol content (4.16) was found to be significantly highest in the treatment T<sub>1</sub> - Grated Aonla (100 % - Control). The lowest alcohol

percentage (3.29) was observed in the treatment T<sub>7</sub> - Grated Aonla (50 %) with Grape Must (50 %). Similar results was reported by Chikkasubbanna *et al.* (1990), that the alcohol per cent of the grape wine increased due to decrease in total soluble sugars due to the activity of yeast during fermentation. Adusule *et al.* (1992) estimated the alcohol content in pomegranate wine and reported that upon incubation alcohol content (6.6 %) was increased and Sapna *et al.* (2002) obtained an alcohol content of 6.57 to 6.75 per cent in Japanese wine, coriander wine had 7.05 to 7.37 per cent in the third and after ninth weeks of storage. The increase in alcohol content was due to the complete conversion of sugars to alcohol. The variation in alcohol production by yeast strains may be due to the variation in the rate of sugar utilization during fermentation and alcohol tolerance limits. The reduction in the sugar level indicated that some sugar content has been consumed by the yeast as a substrate to grow and converted to ethanol (Singh, 2009) (Table 5).

**Table 4 : Effect of different fruit pulp ratio on ascorbic acid (mg 100ml<sup>-1</sup>) content of blended beverages during storage period**

Treatments	0 Days	15 Days	30 Days	45 Days	60 Days	75 Days	90 Days
T <sub>1</sub> = Grated Aonla (100 %) - (Control)	143.10	126.00	114.30	102.60	99.90	96.30	90.90
T <sub>2</sub> = Grated Aonla (60 %) with Sapota Pulp (40 %)	116.10	96.30	91.80	83.70	72.90	67.50	59.40
T <sub>3</sub> = Grated Aonla (50 %) with Sapota Pulp (50 %)	109.80	88.20	80.10	72.00	63.90	55.80	46.80
T <sub>4</sub> = Grated Aonla (60 %) with Pineapple Pulp (40 %)	114.30	94.50	83.70	77.40	68.40	58.50	49.50
T <sub>5</sub> = Grated Aonla (50 %) with Pineapple Pulp (50 %)	110.70	90.90	81.90	74.70	67.50	59.40	51.30
T <sub>6</sub> = Grated Aonla (60 %) with Grape Must (40 %)	113.40	93.60	85.50	79.20	72.90	64.80	57.60
T <sub>7</sub> = Grated Aonla (50 %) with Grape Must (50 %)	101.70	86.40	79.20	71.10	62.10	54.00	45.00
C.D. (P=0.05)	12.183	11.589	6.019	6.647	7.401	8.194	7.976
S.E. ±	3.118	2.966	1.540	1.701	1.894	2.097	2.041
F test	**	**	**	**	**	**	**

\*\*indicates significance of value at P=0.01

NS=Non-significant

**Table 5 : Effect of different fruit pulp ratio on alcohol (%) content of blended beverages during storage period**

Treatments	0 Days	15 Days	30 Days	45 Days	60 Days	75 Days	90 Days
T <sub>1</sub> = Grated Aonla (100 %) - (Control)	3.90	3.96	4.01	4.05	4.09	4.12	4.16
T <sub>2</sub> = Grated Aonla (60 %) with Sapota Pulp (40 %)	3.71	3.79	3.86	3.92	3.95	4.00	4.02
T <sub>3</sub> = Grated Aonla (50 %) with Sapota Pulp (50 %)	3.85	3.91	3.95	3.99	4.02	4.06	4.09
T <sub>4</sub> = Grated Aonla (60 %) with Pineapple Pulp (40 %)	3.79	3.85	3.92	3.96	3.99	4.03	4.06
T <sub>5</sub> = Grated Aonla (50 %) with Pineapple Pulp (50 %)	3.59	3.66	3.73	3.80	3.87	3.93	3.98
T <sub>6</sub> = Grated Aonla (60 %) with Grape Must (40 %)	3.37	3.48	3.55	3.63	3.69	3.72	3.76
T <sub>7</sub> = Grated Aonla (50 %) with Grape Must (50 %)	2.95	3.03	3.09	3.15	3.22	3.26	3.29
C.D. (P=0.05)	0.039	0.039	0.025	0.021	0.025	0.024	0.016
S.E. ±	0.010	0.010	0.006	0.005	0.006	0.006	0.004
F test	**	**	**	**	**	**	**

\*\*indicates significance of value at P=0.01

NS=Non-significant

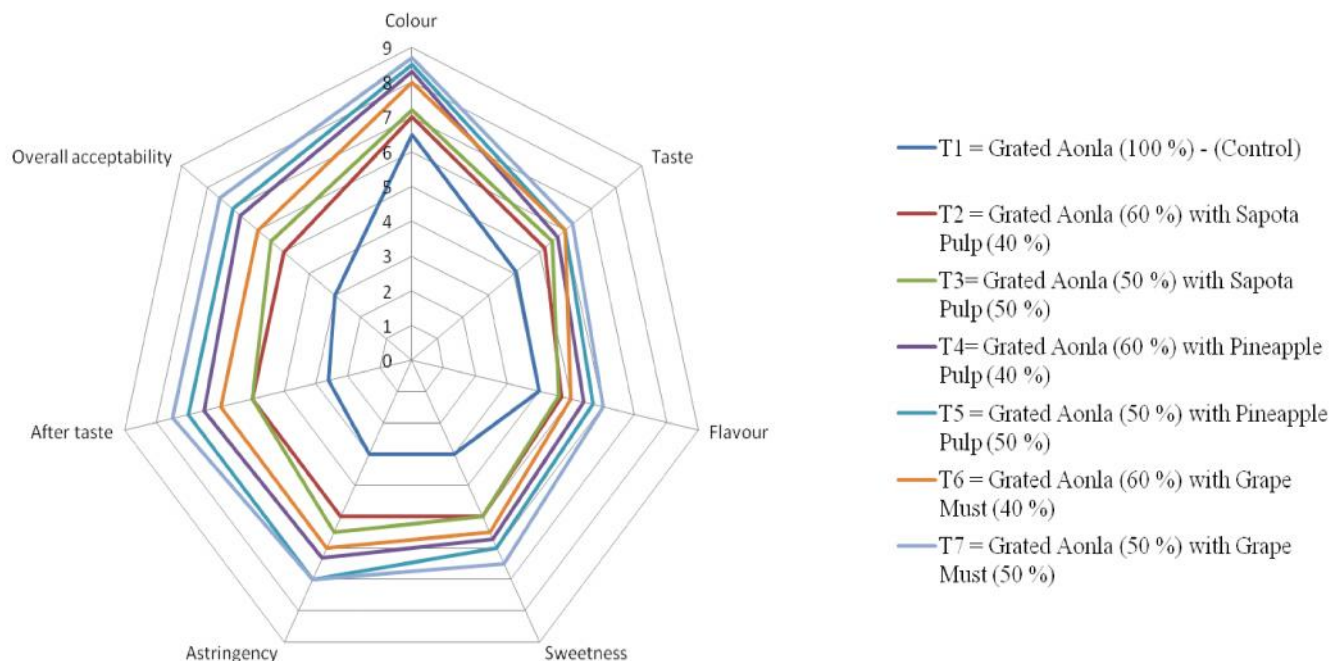


Fig. 1 : Sensory evaluation of the blended beverages

## Conclusion :

The following trends were observed during the storage of the prepared blended beverage, the alcohol per cent, the titratable acidity, organoleptic scores increased during storage period. Treatment T<sub>7</sub> [Grated aonla (50 %) with Grape must (50 %)] was found to be best when compared to all the other treatment and followed by Treatment T<sub>5</sub> [Grated Aonla (50 %) with Pineapple Pulp (50 %)] which was second best treatment as compared to other treatments. Whole aonla fruits can be utilised for fermentation and here the phenolic content may decrease and clarity of beverage can be obtained with better taste.

Authors' affiliations :

K.N. SREENIVAS, M. KARAN, G.S. MANJULA AND H. MOHAMAD TAYEEB ULLA, College of Horticulture, BENGALURU (KARNATAKA) INDIA

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