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## Studies on evaluation of physio-chemical properties of osmo-convectively dried Aonla slices

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### Abstract

Quality of osmo-convectively dried Aonla slices were investigated, results showed that the highest TSS (52°Brix) was observed both in case of NA-7 and Chakaiya variety when product was osmo-convectively treated at 70°Brix sugar concentration and immersion time of 180 min. but, ascorbic acid content was found to be decreasing at higher temperature, concentration and immersion time (92.5mg /100g). Highest ascorbic acid 230 mg and 330 mg were observed for treatment 40 °C, 60°B, STFR 8 and immersion time 60 min. in case of Chakaiya and NA-7 respectively. Colour of the samples was found to be close to the standard value when treated at lower level of each independent parameter. Rehydration ratio (2.349) for the treatment 40 °C, 60°B, STFR 6 and immersion time 60 min. was superior for NA-7 variety and rehydration ratio (2.430) for the treatment, 40 °C, 60°B, STFR 6 and 120 min. was also superior for Chakaiya variety over all other treatments.

**Keywords:** Aonla slices, osmotic dehydration

### Introduction

The Aonla (*Emblia officinalis* syn. *Phyllanthus Emblica*) is one of the most important minor fruit and a crop of commercial significance. It belongs to the family *Euphorbiaceae*. It is quite hardy, prolific bearer and much remunerative even without much care. It is also known as Indian gooseberry *amlaki*, *amia*, *amali*, *ambala*, *nelli*, etc. Its importance lies in its high richness of vitamin C.

There are various advantages of osmotic dehydration, such as it is low temperature water removal process and hence gives minimum loss of color and flavor, flavor retention is more when sugar or sugar syrup used as osmotic agent, the quality of product is better after reconstitution. Therefore, experiment was conducted to evaluate physio-chemical properties such as TSS, ascorbic acid, colour and rehydration ratio of osmo-convectively dehydrated Aonla slices, of variety NA-7 and Chakaiya which were already prepared at different temperature 40, 50 and 60 °C, with syrup concentration of 50, 60 ad 70°B with sugar solution to fruit ratio of 4:1, 6:1, 8:1.

### Materials and Methods

Fresh Aonla fruits of variety NA-7 (Neelam) and Chakaiya were procured from an orchard of Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri (Fig. 1).



**Fig 1:** Aonla Fruit



Fig 2: Osmo-convectively Dried Aonla slices NA-7 and Chakaiya

**Physiochemical properties of Aonla slices**

The osmo-convectively dried Aonla slices of variety NA-7 and Chakaiya prepared with different treatments as given in Table 1 and Fig. 2 were provided for analysis. The work was carried out at the Dept. of Agriculture Process Engineering, Dr. A. S. C. A. E., MPKV Rahuri.

Table 1: Treatment details for osmo-convectively dried Aonla slices

Sr. No.	Temperature (°C)	Concentration (°B)	Sugar to fruit ratio	Time (min)
1	50	60	6	120
2	50	60	6	120
3	50	60	6	120
4	50	60	4	60
5	50	60	4	180
6	50	60	8	60
7	50	60	8	180
8	50	50	6	60
9	50	50	6	180
10	50	50	4	120
11	50	50	8	120
12	50	70	6	60
13	50	70	6	180
14	50	70	4	120
15	50	70	8	120
16	60	60	6	60
17	60	60	6	180
18	60	60	4	120
19	60	60	8	120
20	60	50	6	120
21	60	70	6	120
22	40	60	6	60
23	40	60	6	180
24	40	60	4	120
25	40	60	8	120
26	40	50	6	120
27	40	70	6	120

**Total soluble solid determination**

One gram of osmo-convectively dried Aonla slices were soaked in 20ml of distilled water for 1h. Then slices were grinded into fine pieces by using hand grinder. After 1h by using separation machine centrifuge was done and sample were collected in Petridis and placed in oven dryer. After obtaining constant weight reading samples were removed from oven and put in desiccators for 5 min. to attain atmospheric temperature and moisture condition.

**Ascorbic acid determination**

Sodium salt of 2,4 - dichloro phenol indophenol is taken 50mg & dissolved approximately in 150 ml of hot glass distilled water containing 42mg of sodium bicarbonate. There after cooled & dilute with glass distilled water to 200ml. 10g of sample will blended with 3% HPO<sub>3</sub> and volume made up to 100ml with HPO<sub>3</sub> which was filtered and centrifuged. An aliquot (2 -10ml) of HPO<sub>3</sub> extract of the sample will be taken & titrated with std. dye to pink color which was persist for 15 second (Agarwal S, 2004) [1].

$$\text{Ascorbic acid (mg/100g)} = \frac{(\text{Titre} \times \text{Dye factor}) \times (\text{Volume made up} \times 100)}{\text{Aliquot of extract taken for estimation} \times \text{wt. or volume of sample taken for estimation}}$$

**Colour determination**

Colour of fresh Aonla fruit and Osmo-convectively dried Aonla slices of varieties NA-7 and Chakaiya was determined by using “Premier colour scan instrument” and by using Standard procedure (Gnanasekharan et al., 1992) [6].

**Rehydration ratio determination**

The known weight of (5g) of each sample was soaked in sufficient volume of distilled water in glass beaker (approx. 30 times weight of Aonla sample) at 95 °C for 20 minutes. After soaking, the excess water was removed with the help of filter paper and samples were weighed. The water bath was used for maintaining the boiling temperature and the rehydration ratio was computed (Ranganna, 2000) [13].

**Results and Discussion**

After experimentation results obtained were tabulated and analysed. The average initial moisture content of osmo-convectively dried Aonla slices was 10 per cent (wb).

**Total soluble solids (TSS)**

From the data regarding total soluble solids content in the NA-7 and Chakaiya variety were presented in Table 2. It is observed that TSS content of osmo-convectively dried Aonla slices was higher as compared to fresh Aonla fruit. TSS content was increased due to reduction in moisture content as a result of drying. It is clear from Table 2 For NA-7 variety sample with treatment 60 °C, 50°B, STFR 6 and 120 min. has highest TSS content (52°B) and sample with treatments 40 °C, 50°B, S/F ratio of 6 and immersion time of 120 min. has lowest TSS content (27°B). Thus, for NA-7 variety TSS

content ranges from 30°B to 50°B. The results were in agreement with Trapthi *et al.* (1988)<sup>[14]</sup> who studied the TSS of Aonla candy.

In case of chakaiya variety highest TSS was observed with treatment temperature of 60 °C, 70°B, STFR of 6- and 120-min. Sample with treatment 50 °C, 60°B, STFR 6, and 120 min. has lowest TSS content (22°B). Thus, for chakaiya variety TSS content ranges from 20°B to 40°B. From these

results, it was observed that as the concentration of solution and immersion time increases total solid contain also increases at a given temperature this was because of addition of solid content in the product and removal of most of the water content from the product. The results were in agreement with Trapthi *et al.*, (1988)<sup>[14]</sup> who studied the TSS of Aonla candy.

**Table 2:** TSS of variety of osmo-convectively dried Aonla slices Cv. Chakaiya and NA-7

Temp. (°C)	Conc. (°B)	Sugar to fruit ratio	Time (min)	TSS (°B)	
				NA-7	Chakaiya
50	60	6	120	47.20	32
50	60	6	120	47	33
50	60	6	120	47.2	28
50	60	4	60	42.60	32
50	60	4	180	51	33
50	60	8	60	41	31
50	60	8	180	40	27
50	50	6	60	33	26
50	50	6	180	41	38
50	50	4	120	32	40
50	50	8	120	43	26
50	70	6	60	38	33
50	70	6	180	52	29
50	70	4	120	40	27
50	70	8	120	33	22
60	60	6	60	38	24
60	60	6	180	42	37
60	60	4	120	30	37
60	60	8	120	42	30
60	50	6	120	46	37
60	70	6	120	41	41
40	60	6	60	35	32
40	60	6	180	36	31
40	60	4	120	35	40
40	60	8	120	37	32
40	50	6	120	27	22
40	70	6	120	27	29

### Colour measurement by colour scan instrument

The result of colour measurements L\*, a\* and b\* units, were L\* indicates luminosity or brightness, a\* corresponds to greenness (-)/ redness (+) and b\* corresponds to blueness (-)/ yellowness (+). By colour scan instrument for osmo-

convectively dried Aonla slices of variety NA-7 and Chakaiya treated with different treatments for surface colour are presented in Table 3 and Table 4 respectively. The colour parameters showed considerable deviations between various treatments.

**Table 3:** Colour of fresh Aonla fruit and osmo-convectively dried Aonla slices of Cv. NA-7

Temp. (°C)	Conc. (°B)	S/F ratio	Immersion time (min)	Treatment Value	L*	a*	b*	ΔE
				<b>Standard</b>	<b>65.99</b>	<b>-3.00</b>	<b>9.72</b>	<b>.....</b>
50	60	6	120	1	67.76	-2.74	15.57	6.12
50	60	6	120	2	67.57	-2.55	15.01	5.54
50	60	6	120	3	67.53	-2.95	14.89	5.39
50	60	4	60	4	67.71	-2.77	15.46	5.99
50	60	4	180	5	67.24	-2.45	14.29	4.77
50	60	8	60	6	66.29	-2.63	11.06	1.45
50	60	8	180	7	66.99	-2.26	13.59	4.06
50	50	6	60	8	68.58	-2.27	18.28	8.97
50	50	6	180	9	67.72	-2.05	15.85	6.44
50	50	4	120	10	68.02	-1.78	16.89	7.55
50	50	8	120	11	67.39	-2.29	14.74	5.27
50	70	6	60	12	66.95	-2.41	13.24	3.69
50	70	6	180	13	66.15	-2.84	10.24	0.57
50	70	4	120	14	67.13	-2.48	13.63	4.11
50	70	8	120	15	66.99	-2.95	13.05	3.48
60	60	6	60	16	67.69	-1.83	15.84	6.46
60	60	6	180	17	66.96	-2.67	13.11	3.54

60	60	4	120	18	67.37	-2.41	14.38	4.89
60	60	8	120	19	67.58	-1.93	15.44	6.03
60	50	6	120	20	67.41	-2.45	14.85	5.36
60	70	6	120	21	67.12	-2.62	13.66	4.12
40	60	6	60	22	67.85	-2.01	16.15	6.76
40	60	6	180	23	67.88	-1.52	16.58	7.27
40	60	4	120	24	67.60	-2.43	15.19	5.73
40	60	8	120	25	66.31	-2.35	11.16	1.61
40	50	6	120	26	68.23	-2.83	17.19	7.82
40	70	6	120	27	66.79	-2.66	12.59	3.00

From Table 3 it is observed For NA-7 variety sample with treatment 50 °C, 70°B and STFR 6 and 180 min. has very low colour deviation 0.569 which was very close to std. reading

and sample with treatment 40 °C, 50°B, STFR 6 and 120 min. has large deviation 7.821.

**Table 4:** Colour of fresh Aonla fruit and osmo-convectively dried Aonla slices Cv. Chakaiya

Temp. (°C)	Conc. (°B)	S/F ratio	Time (min)	Treatment Value Standard	L*	a*	b*	ΔE
					59.81	-1.55	13.186	.....
50	60	6	120	1	60.69	-1.56	15.78	2.74
50	60	6	120	2	61.03	-0.58	17.23	4.33
50	60	6	120	3	60.66	-1.44	15.76	2.72
50	60	4	60	4	61.48	-1.28	18.15	5.26
50	60	4	180	5	60.47	-1.17	15.45	2.39
50	60	8	60	6	60.96	-1.64	16.50	3.52
50	60	8	180	7	60.72	-1.64	15.92	2.89
50	50	6	60	8	59.82	-1.43	13.22	0.12
50	50	6	180	9	60.36	-1.56	14.78	1.69
50	50	4	120	10	60.32	-1.48	14.75	1.65
50	50	8	120	11	59.09	-1.21	10.7	2.53
50	70	6	60	12	60.10	-1.97	14.11	1.0
50	70	6	180	13	59.36	-2.11	11.49	1.83
50	70	4	120	14	60.09	-2.41	13.88	1.14
50	70	8	120	15	60.07	-1.65	13.96	0.82
60	60	6	60	16	58.85	-1.83	9.75	3.58
60	60	6	180	17	60.04	-2.06	13.73	0.78
60	60	4	120	18	59.09	-1.56	10.82	2.47
60	60	8	120	19	59.47	-2.15	11.73	1.61
60	50	6	120	20	59.43	-1.45	11.88	1.36
60	70	6	120	21	59.02	-2.48	10.14	3.28
40	60	6	60	22	58.68	-1.67	9.28	4.06
40	60	6	180	23	58.68	-2.01	9.11	4.25
40	60	4	120	24	59.65	-1.85	12.69	0.59
40	60	8	120	25	60.15	-1.47	14.39	1.25
40	50	6	120	26	60.11	-1.84	14.01	0.93
40	70	6	120	27	59.48	-2.39	11.85	1.61

From Table 4. It is observed that for Chakaiya variety sample with treatment 50 °C, 50°B, STFR 6 and 60 min. has very low deviation 0.12, which is very close to std. reading and sample with treatment 50 °C, 60°B, STFR 6 and 120 min. has large deviation 4.334.

#### Ascorbic acid

The result (Table 5) showed that there was statistically significant difference in ascorbic acid of osmo-convectively dried Aonla slices with advancement of temperature. The

decrease of ascorbic acid content with increase temperature might be due to oxidation of ascorbic acid.

From Table 5, it is observed that for NA-7 variety the treatment, 40 °C, 60°B, STFR 6 and 60 min. (330mg/100 g) was superior over other treatment and followed by treatment 40 °C, 50°B, STFR 6 and 120min. (280 mg/100 g) and treatment 60 °C, 50°B, STFR 6, and 120 min. (40mg/100 g) has lowest ascorbic acid content. During processing, ascorbic acid was reported to reduce by 13 per cent of fresh Aonla fruits (kalra *et al.*, 1998) <sup>[10]</sup>.

**Table 5:** Ascorbic acid content of osmo-convectively dried Aonla slices of Cv. NA-7 and Chakaiya

Temp. (°C)	Concentration (°B)	Sugar to fruit ratio	Time (min)	Ascorbic acid Content (Mg/100gm)	
				NA-7	Chakaiya
50	60	6	120	75	182.5
50	60	6	120	75	147.5
50	60	6	120	80	132.5
50	60	4	60	110	230.0
50	60	4	180	80	100.0
50	60	8	60	100	220.0
50	60	8	180	87.5	107.5
50	50	6	60	177.5	240.0
50	50	6	180	77.5	117.5
50	50	4	120	100	125.0
50	50	8	120	90	135.0
50	70	6	60	192.5	127.5
50	70	6	180	107.5	92.5
50	70	4	120	107.5	95.0
50	70	8	120	105	92.5
60	60	6	60	165	130.0
60	60	6	180	62.5	75.0
60	60	4	120	95	85.0
60	60	8	120	110	132.5
60	50	6	120	40	120.0
60	70	6	120	140	115.0
40	60	6	60	330	140.0
40	60	6	180	187.5	77.5
40	60	4	120	220	82.5
40	60	8	120	152.5	90.0
40	50	6	120	280	77.5
40	70	6	120	225	107.5

In case of chakaiya variety the treatment, 50 °C, 50°B, STFR 6, and 60 min. (40mg/100g) was superior over other treatment and followed by treatment 50 °C, 60°B, STFR 4 and 60min. (230 mg/100 g) and treatment 60 °C, 60°B, STFR 6 and 180 min. (75mg/100 g) has lowest ascorbic acid content.

#### Rehydration ratio

It is clear that the rehydration ratio is significantly affected by osmotic pre treatment. The rehydration ratio is highest for unosmoted samples and lowest for osmotically pre-treated sample. From Table 6, it is observed that for NA-7 variety, the treatment, 40 °C, 60°B, STFR 6, and 60 min. (2.349) was

superior over other treatment and followed by treatment 50 °C, 50°B, STFR 4 and 120min. (2.320) and treatment 50 °C, 60°B, STFR 8 and 180 min. (1.852) has lowest rehydration ratio.

For chakaiya variety (Table 6) the treatment, 40 °C, 60°B, STFR 8 and 120 min. (2.430) was superior over other treatment and followed by treatment 50 °C, 50°B, STFR 8 and 120min. (2.396) and treatment 50 °C, 60°B, STFR 8 and 180 min. (1.965) has lowest rehydration ratio. Bhuvaneshwari *et al.* (1999) reported that rehydration ratio of osmotically treated peas was higher than those of untreated samples.

**Table 6:** Rehydration ratio of osmo-convectively dried Aonla slices of Cv. NA-7 and Chakaiya

Temp. (°C)	Concentration (°B)	Sugar to fruit ratio	Time (min)	Rehydration ratio (RR)	
				Cv. NA-7	Chakaiya
50	60	6	120	1.956	2.402
50	60	6	120	1.950	2.081
50	60	6	120	1.959	2.073
50	60	4	60	1.936	2.252
50	60	4	180	1.904	2.227
50	60	8	60	2.027	2.305
50	60	8	180	1.852	1.965
50	50	6	60	2.137	2.393
50	50	6	180	1.993	2.104
50	50	4	120	2.320	2.256
50	50	8	120	2.129	2.396
50	70	6	60	2.244	2.350
50	70	6	180	1.967	2.348
50	70	4	120	1.947	2.255
50	70	8	120	2.063	2.336
60	60	6	60	2.051	2.383
60	60	6	180	1.972	2.153
60	60	4	120	2.150	2.300
60	60	8	120	2.088	2.286

60	50	6	120	1.893	2.225
60	70	6	120	2.060	2.143
40	60	6	60	2.349	2.234
40	60	6	180	2.087	2.283
40	60	4	120	2.138	2.178
40	60	8	120	2.192	2.430
40	50	6	120	2.249	2.357
40	70	6	120	2.040	2.320

### Summary

Results showed that the highest TSS (52°Brix) was observed both in case of NA-7 and Chakaiya variety when product was osmo-convectively treated at 70°Brix sugar concentration and immersion time of 180 min. but, ascorbic acid content was found to be decreasing at higher temperature, concentration and immersion time (92.5mg /100g). Highest ascorbic acid 230mg and 330mg were observed for treatment 40 °C, 60°B, STFR 8 and immersion time 60 min.in case of Chakaiya and NA-7 respectively. Colour of the samples was found to be close to the standard value when treated at lower level of each independent parameter. Rehydration ratio (2.349) for the treatment 40 °C, 60°B, STFR 6 and immersion time 60 min. was superior for NA-7 variety and rehydration ratio (2.430) for the treatment, 40 °C, 60°B, STFR 6 and 120 min. was also superior for Chakaiya variety over all other treatments.

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