Research Paper | *The Asian Journal of Horticulture,* (June, 2010) Vol. 5 No. 1 : 199-202

Influence of pre-drying treatments and drying methods on bio-chemical properties of different recipes of aonla (*Emblica officinalis* Gaertn.) product preparation

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Accepted : *May, 2010*

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ABSTRACT

An experiment was conducted on "Influence of pre–drying treatments and drying methods on storability of different recipes of aonla (*Emblica officinalis* Gaertn.) product preparation" and revealed that among various treatments, the acidity and ascorbic acid was recoded minimum when fruits of aonla blanched or blancheing with sulphitation (KMS @ 1000 mg/l) and pieces were treated with common salt at 3% were dried under sun as compared to oven drying treatment. In case of total soluble solid, reducing sugar and total sugar content of aonla product increased with increase of storage period and they were recorded maximum in control as compared to other treatment combinations throughout the storage period with non-significant result.

Key words : Aonla, Total soluble solid, Ascorbic acid, Pre drying treatments

The aonla or Indian goose berry (*Emblica officinalis* Gaertn, syn *Phyllanthus emblica* Linn) is one of the most important indigenous fruit crop of India. It is a very hardy and prolific bearer and highly remunerative crop without much care. Aonla is known for its great medicinal and therapeutic properties from the ancient times in India. It is not only a source of nutrients and medicine for human being, but growing this crop has also proved to be highly remunerative. Huge harvest of produce during peak harvesting season creates glut and the growers are compelled to sell their produce at distress prices. Owing to restricted availability and high perishability of aonla fruits, value addition through processing would be the only effective tool for economic utilization for increase production of aonla fruits. A number of economically cheaper techniques have been evaluated to improve the quality of dehydrated fruits and vegetables. Among these the treatment of blanching before drying, checks the enzymatic spoilage, removes astringency and also improved the texture of fruits. After blanching sulphitation is done, since it improves the quality and increases the shelf life of dehydrate products (Bhatia *et al.,* 1962). This entirely depends on the process, *i.e.*, blanching and drying. Sun drying of fruits and vegetables is a cheap method of preservation. This method can be used on commercial scale as well as home scale provided that sunshine intensity is relatively more after the normal harvesting period. The sun drying is simple and cheaper to several condition and small scale food processing industries.

MATERIALS AND METHODS

The Fully matured and uniform shape and size fruits of aonla cultivar 'Anand-2' were used for experiment during the year 2006-2007 at P.G. Laboratory, Department of Horticulture, N.M. College of Agriculture, Navsari Agricultural University, Navsari. Experiment conducted under Completely Randomized Design (CRD) with factorial concept and replicated thrice for various treatments, two levels of pre-drying (*i.e.* blanching and blanching with sulphitation), four levels of recipe (*i.e.*, Fruit pieces with 3 per cent black salt and 3 per cent common salt with and without ginger juice 10 per cent), two drying methods (*i.e.*, sun drying and oven drying) and their combinations were used. Therefore, seventeen treatment combinations were tried in the present investigations. The selected fruits were thoroughly washed with tap water and cut into small pieces, then placed under different treatments after initial bio-chemical analysis.

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been summarized under following heads

Acidity (%):

The data presented in Table 1 reveal that pre-drying treatments *i.e.* blanching and blanching with sulphitation significantly affected the acidity of dehydrated aonla product. The highest acidity was recorded at control while, minimum acidity at blanching with sulphitation treatment.

Table 1: Effect of various pre-drying treatments, drying methods and recipes on acidity (%), ascorbic acid content (mg/100 g) and total soluble solids (%) of aonla

Treatments	Acidity (%)					Ascorbic acid content (mg/100 g)					Total soluble solids (%)				
	Initial	1st Month	2nd Month	3rd Month	4th Month	Initial	1st Month	2nd Month	3rd Month	4th Month	Initial	1st Month	2nd Month	3rd Month	4th Month
C_0	2.82	2.80	2.76	2.72	2.66	242.10	228.51	185.23	135.26	110.12	76.23	76.32	77.15	77.62	77.91
Pre-drying treatments															
D_1	2.79	2.78	2.75	2.72	2.65	272.90	248.34	201.53	152.11	121.21	74.45	74.68	74.85	75.07	75.29
D_2	2.71	2.69	2.66	2.64	2.60	285.53	267.53	224.18	169.31	142.16	75.28	75.52	75.69	76.04	76.26
S.E. ±	0.013	0.016	0.019	0.022	0.017	2.077	1.897	1.953	1.908	1.183	0.255	0.262	0.283	0.308	0.325
C.D. (P=0.05)	0.04	0.05	0.05	0.06	0.05	5.98	5.46	5.62	5.50	3.43	0.74	0.76	0.82	0.89	0.93
Recipes															
R_1	2.72	2.70	2.67	2.65	2.58	261.00	233.35	194.00	144.70	117.27	74.27	74.50	74.67	74.96	75.18
R_2	2.75	2.73	2.70	2.67	2.62	276.17	261.45	209.48	164.20	138.75	74.68	74.91	75.08	75.37	75.58
R_3	2.77	2.76	2.73	2.71	2.66	272.78	256.95	205.50	159.94	131.38	75.10	75.34	75.51	75.79	76.01
R_4	2.77	2.76	2.72	2.69	2.64	306.92	279.99	242.42	173.99	139.35	75.41	75.65	75.82	76.10	76.32
S.E. ±	0.018	0.023	0.026	0.028	0.025	2.938	2.683	2.762	2.699	1.674	0.361	0.371	0.401	0.435	0.460
C.D. (P=0.05)	NS	NS	NS	NS	NS	8.46	7.73	7.95	7.77	4.82	NS	NS	NS	NS	NS
Drying methods															
M_1	2.73	2.71	2.69	2.67	2.61	250.34	231.25	190.78	140.73	116.53	74.60	74.84	75.01	75.30	75.52
M_2	2.77	2.76	2.72	2.68	2.64	308.09	284.63	234.92	180.68	146.84	75.12	75.86	75.53	75.81	76.03
S.E. ±	0.013	0.016	0.019	0.022	0.017	2.077	1.897	1.953	1.908	1.183	0.255	0.262	0.283	0.308	0.325
C.D. (P=0.05)	NS	NS	NS	NS	NS	5.98	5.46	5.62	5.50	3.43	NS	NS	NS	NS	NS
Interaction effect															
D x M	NS	NS	NS	NS	NS	NS	Sig	NS	Sig	NS	NS	NS	NS	NS	NS
D x R	NS	NS	NS	NS	NS	Sig	NS	NS	NS	Sig	NS	NS	NS	NS	NS
R x M	NS	NS	NS	NS	NS	Sig	Sig	Sig	NS	Sig	NS	NS	NS	NS	NS
D x R x M	NS	NS	NS	NS	NS	Sig	NS	NS	Sig	NS	NS	NS	NS	NS	NS
C.V. %	2.31	2.90	3.39	4.08	3.26	3.64	3.60	4.49	5.82	4.40	1.67	1.71	1.85	1.99	2.10

N.S. –Non significant

These results are in confirmation with findings of Sethi (1986) in aonla. Low acid content of dehydrated aonla product in pre-drying treatment might be due to greater leaching losses of acid content during blanching and sulphitation treatment which ultimately resulted into lower acidity percentage of dehydrated product. The findings of the present investigation are in confirmation with the work of Dabhade and Khedkar (1980). In the present study, the individual effect of different recipe and drying method treatments as well as various interactions treatments on acidity of dehydrated aonla product was found to be non significant during entire period of storage (Table 1).

Ascorbic acid (mg/100g):

Among the various chemical characteristics, ascorbic acid (Vit.-C) is very important qualitative parameter of aonla fruits. The ascorbic acid content of dehydrated aonla product decreased with the advancement of storage period in all the treatments including control. However, various pre-drying treatments, recipe and drying methods attempted in the present study helped in reducing the loss of ascorbic acid during storage. The reduction in ascorbic acid during storage is probably due to the process of oxidation of ascorbic acid forming dehydrating ascorbic acid by enzyme ascorbinase (Das and Desh, 1967).

The maximum retention of ascorbic acid content was obtained with blanching as compare to sulphitation treatment and control (Table 1). Thus, blanching and sulphitation treatments reduced the ascorbic acid losses to greater extent. Sulphur treatment reduced the

Table 2 : Effect of various pre-drying treatments, drying methods and recipes sugar contents (%) of aonla cv. ANAND-2 product during storage period

Treatments	Reducing sugar (%)					Total sugar (%)				
	Initial	1st Month	2nd Month	3rd Month	4th Month	Initial	1st Month	2nd Month	3rd Month	4th Month
C_0	3.41	3.44	3.45	3.48	3.53	25.93	26.02	26.12	26.25	26.34
Pre-drying treatments										
D_1	3.36	3.38	3.39	3.40	3.42	25.51	25.65	25.69	25.81	25.93
D_2	3.27	3.29	3.30	3.32	3.35	24.48	24.61	24.73	24.93	25.07
S.E. ±	0.019	0.018	0.019	0.017	0.019	0.229	0.216	0.232	0.181	0.268
C.D. (P=0.05)	0.05	0.05	0.05	0.04	0.05	0.66	0.62	0.67	0.52	0.77
Recipes										
R_1	3.27	3.29	3.31	3.32	3.33	24.14	24.28	24.32	24.49	24.56
R_2	3.28	3.31	3.32	3.33	3.35	24.76	24.90	25.19	25.26	25.50
R_3	3.33	3.34	3.36	3.38	3.41	25.30	25.44	25.47	25.77	25.84
R_4	3.39	3.40	3.41	3.42	3.44	25.76	25.90	25.94	25.96	26.10
S.E. ±	0.026	0.026	0.026	0.025	0.027	0.324	0.306	0.329	0.353	0.379
C.D. (P=0.05)	0.08	0.07	0.08	0.07	0.07	0.93	0.88	0.95	0.74	0.1.09
Drying methods										
M_1	3.29	3.31	3.32	3.34	3.36	24.74	24.88	24.92	25.01	25.22
M_2	3.34	3.36	3.37	3.39	3.41	25.24	25.38	25.50	25.73	25.78
S.E. ±	0.019	0.018	0.017	0.017	0.019	0.229	0.216	0.232	0.181	0.268
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.77
Interaction effect										
D x M	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
D x R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
R x M	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
D x R x M	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C.V. %	2.74	2.68	2.73	2.52	2.72	4.47	4.23	4.54	3.55	5.18

N.S. – Non significant

Treatment details:

C_0- Absolute control D_1- Blanching of fruits

D_2- Blanching of fruits with sulphitation (KMS @ 1000 mg/1)

R_1- Fruit pieces with common salt (3%)

R_2- Fruit pieces with black salt (3%)

R_3- Fruit pieces with common salt (3%) and ginger juice (10%)

R_4- Fruit pieces with black salt (3%) and ginger juice (10%)

M_1- Sun drying

M_2- Oven drying

destruction of ascorbic acid. This might be attributed to inactivation of oxidase enzyme responsible for degradation of ascorbic acid content due to blanching and inhibition of oxidative changes of ascorbic acid by SO_2 released by KMS (Singh *et al.*, 2006) in dehydrated aonla product. The different recipe treatment had significant effect on retention of ascorbic acid content of dehydrated aonla product in the present experiment. Among the various treatment attempted, the minimum ascorbic acid content was recorded with fruit pieces with 3 per cent black salt treatment and it remained lowest during entire period of storage. The possible explanation for the better retention of ascorbic acid due to common and black salt with ginger juice treatment over control might be due to inhibition of oxidative changes of ascorbic acid by salt and ginger juice.

Drying methods significantly affected the ascorbic acid content of dehydrated aonla product. Maximum ascorbic acid content was obtained with oven drying (M_2) and minimum of at sun drying (M_1). The present finding is supported by Singh *et al.* (2006) in ber.

Total soluble solids (%):

The maximum TSS content was obtained with sulphitation treatment and control as compared to blanching (Table 2). Thus, sulphitation treatments increased the TSS content to a greater extent. Pre-drying treatments significantly affected the TSS content of dehydrated aonla product. Maximum TSS content was obtained with D_2 (blanching of fruits with sulphitation (KMS @ 1000 mg/1)) and minimum of at D_1 (blanching of fruits) during the entire storage period. This might be due to more sugar conversion in D_2 as compared to D_1. Similarly, increasing trend in TSS content was earlier reported by Tripathi *et al*. (1988).

Sugars (%):

The data recorded in present investigation indicate that untreated control fruit pieces exhibited higher reducing and total sugar content after dehydration and remain highest during entire period of storage as compared to all the treatments (Table 2). However, among the various pre-drying treatments, the maximum reducing sugar and total sugar was recorded in pre-drying treatment. The maximum reducing sugar and total sugar content were recorded in blanching of fruits (D_1) treatment which were significantly higher than blanching of fruits with sulphitation (D_2). Maximum sugars in control were due to the fact that it prevented any type of sugar losses by blanching and sulphitation. The findings of present experiment are in line with the work of Sethi (1986) and Dabhade and Khedkar (1980).

In case of different recipe treatment the application of 3 per cent common salt treatment resulted the minimum reducing and total sugar content which was significantly lower than other treatments.

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