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Processing, preservation and quality evaluation of sweetened *Anardana*

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SUMMARY :

This study relates to the development of sweetened *Anardana* by using osmodehydration technology combining with coating of pomegranate arils and its quality evaluation during different storage conditions. Pomegranate fruits were subjected for blanching, then arils were separated carefully with minimum damage by hand peeling and further dipping arils in 40 per cent hypertonic sugar solution for overnight at room temperature (25±2^{0}C for about 14 hrs) was conducted. Drained arils were partially dehydrated in a cabinet drier at 45±2^{0}C for 16 hrs, subsequently coating with a mixture of glucose powder containing CMC (0.2%), sodium alginate (0.1%) for binding and sodium citrate (0.1%) for preservation followed by drying in cabinet dryer again. The step of coating and drying was repeated twice as moisture in arils was absorbing coating material and again appearing moist. Finally drying was done till desired level of moisture *i.e.* 10 per cent was attained. The experimental results showed that there was a significant loss in vitamin C content, slight decrease in moisture, ash, non-reducing sugars while there was increase in acidity, reducing sugars and total sugars. In case of refrigerated sample, the rate of change was significantly slower than the ambient sample. Microbial analysis showed that, there was increase in total plate count as well as yeast and mold count. Vacuum packed sample in multilayer bags *i.e.* standy pouches stored under refrigerated condition was found to be the best in terms of retaining chemical, microbial and sensory quality parameters over the storage period of 60 days.

KEY WORDS : Processing, Preservation, Quality evaluation, Sweetened *Anardana*

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Pomegranate (*Punica granatum* L.) is an important fruit of tropical and subtropical regions. The versatile adaptability, table and therapeutic values and better keeping quality are the features responsible for its cultivation on wide scale (Dhandar and Singh, 2002).

Conventional utilization of wild pomegranate fruit mostly lies in the drying seeds along with pulp known as arils which constitutes the product *Anradana* (Kingsly *et al*., 2006) having sour taste. *Anardana* helps in

Table A: Treatment details

Treatment	Details
T_1 Control	Arils were only dried without osmosis
T_2	Osmosis õ of arils and then drying
T_3	Partial dehydration (16hrs), coating with coating mixture in õ õ (powder form) and drying
T_4	Partial dehydration (16hrs), coating with solution of coating mixture instead of powder form and drying
T_5	Osmosis with hypertonic sugar solution, partial dehydration, coating with solution of coating material and then drying at 45 ± 2^0C
T_6	Osmosis, coating with coating mixture as in T_3 and drying
T_7	Osmosis, partial dehydration, coating with coating mixture same as in T_3, and then drying with intermittent coating
T_8	Osmosis with hypertonic sugar syrup containing citric acid (0.2%), ascorbic acid (0.2%) and sodium benzoate (0.1%) then processed further same as T_7
T_9	Same as T_7, but synthetic cardamom flavour was added in solution of osmosis
T_{10}	Same as T_9, but synthetic cardamom flavour was replaced with natural cardamom powder

õ **:** Osmosis in hypertonic sugar syrup (40^0Brix) at room temperature for overnight (25 ± 2^0C for 14 hrs)
õ õ **:** Coating mixture containing glucose powder (20% *i.e.* on the basis of weight of arils), carboxy methyl cellulose *i.e*. CMC (0.2%), sodium citrate (0.1%) and sodium alginate (0.1%).

improving the mouthfeel and digestion and is widely used as an acidulent in culinary preparations. Mahajan *et al*. (1992) reported its richness in vitamin C, minerals (Ca, Zn and Mn) and usefulness for making many digestive and other ayurvedic medicines. The seeds have estrogenic activity due to the presence of steroidal estrogens (Singh and Sethi, 2003). In addition, *Anardana* finds its wide application in traditional Asian medicine for stomach ache, diarrhea, bronchitis etc. (Anonymous, 1969).

Traditionally, *Anardana* is prepared by sundrying of arils on roofs in open condition because of which it often gets dirt, dust and bugs on it which is further sold loosely. This method is very unhygienic. Hence, present study was undertaken to develop a new value added product from pomegranate *i.e.* sweetened *Anardana* in hygienic environment, which will add variety in wide range of its products.

EXPERIMENTAL METHODS

The fully ripened, sound, free from damage and bruised surface pomegranate fruits of *Arakta* variety were obtained from the National Agricultural Research Project, Ganeshkhind, Pune, 7. Fruits were washed, blanched (70^0C for 2 min and cooled in ice cold water) (Singh *et al*., 2006), arils were separated by hand peeling using tapping method, then they were subjected for the following treatments and finally dried at 45 ± 2^0C in cabinet drier upto 10 per cent moisture.

Out of these treatments, treatment T_7 was selected as the "Best acceptable treatment" by sensory panel member's report (5 point Hedonic rating scale) and product prepared by only this treatment was used for further studies (Table A).

The final product was vacuum packed in multilayer bags *i.e.* standing pouch (Purchased from local market) of capacity 50 g. The physico-chemical characteristics such as moisture, ash, titrable acidity as citric acid, vitamin C, sugars (reducing, non-reducing and total) were determined by using standard analytical procedures of AOAC (2005). The observations on visual colour change, textural change and sensory evaluation were also carried out at 10 days interval during the storage period of 60 days under ambient (A) and refrigerated (R) storage conditions.

Fresh pomegranate fruit had total soluble solids content of about 15^0Brix, after osmosis it reached upto 19^0Brix. Titrable acidity and vitamin C content of fresh fruit was 0.37 per cent of citric acid and 15.4 mg, respectively. As vitamin C is readily oxidized when exposed to oxygen and destroyed at high temperature, in freshly prepared sweetened *Anardana* its content decreased upto 5.4 mg.

EXPERIMENTAL FINDINGS AND ANALYSIS

The data presented in Fig. 1 clearly indicates that, fresh pomegranate fruit has 81 per cent moisture. It reached to 74 per cent after osmosis for 14 hrs. 62 per cent moisture was noticed after partial dehydration for 16 hrs. Finally product was dried till 10 per cent moisture

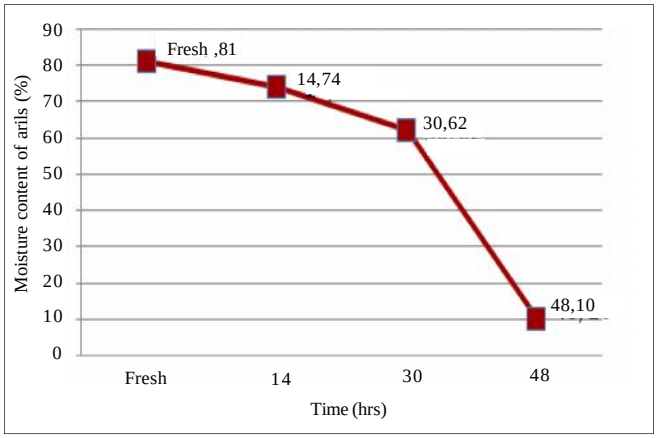

Fig. 1 : Drying behaviour of arils

which took about 18hrs.

The moisture content of sweetened *Anardana* was found to be decrease rapidly in case of ambient samples than the refrigerated one (Fig. 2) *i.e.* from 10.40 per cent to 10.03 per cent and 9.49 per cent, respectively. This might be due to low temperature and high humidity of refrigerator. Ash is nothing but the inorganic matter (minerals) which was not found to be much decreased during the storage period (Fig. 3). It was changed from 1.80 per cent to 1.52 per cent and 1.50 per cent in case of ambient and refrigerated sample, respectively. Similarly, the decreasing trend in respect of sour *Anardana* has been also reported by Garande *et al*. (2004).

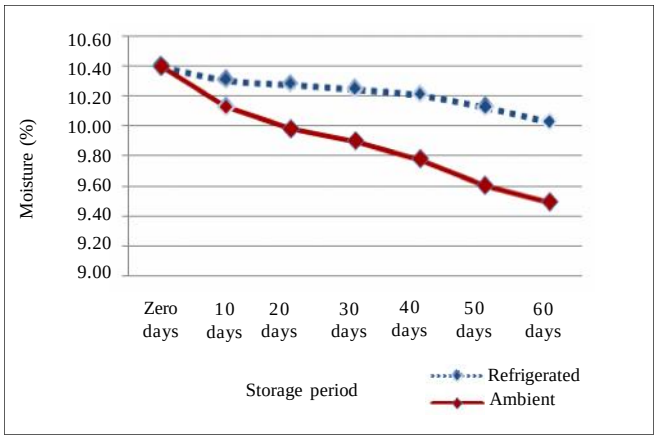

Fig. 2 : Changes in moisture content of sweetened *Anardana* during storage

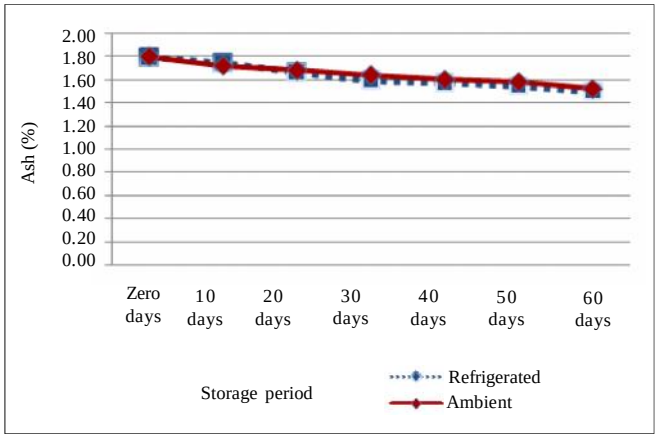

Fig. 3 : Changes in ash content of sweetened *Anardana* during storage

The data in respect of change in physico-chemical parameters such as acidity, vitamin C, reducing sugars, non-reducing sugars and total sugars during storage period of 60 days under Ambient (A) and Refrigerated (R) conditions have been presented in Table 1. The data revealed that the total titrable acidity was found to be

Table 1 : Changes in physico-chemical constituents during storage period

Constituents	Titrable acidity (%)		Vitamin C (mg)		Reducing sugars (%)		Non-reducing sugars(%)		Total sugars (%)	
Samples → / Storage period ↓	A	R	A	R	A	R	A	R	A	R
Zero days	0.08	0.08	5.37	5.37	46.053	46.053	6.20	6.20	52.253	52.253
10 days	0.093	0.082	5.13	5.21	46.218	46.176	6.17	6.19	52.388	52.366
20 days	0.098	0.095	4.97	5.05	46.507	46.323	6.06	6.08	52.567	52.403
30 days	0.113	0.109	4.70	4.98	46.615	46.457	5.97	6.03	52.585	52.487
40 days	0.125	0.112	4.58	4.84	46.830	46.679	5.92	5.98	52.750	52.659
50 days	0.137	0.117	4.34	4.76	47.108	46.902	5.86	5.89	52.968	52.792
60 days	0.160	0.128	4.19	4.62	47.300	47.019	5.79	5.83	53.090	52.849
S.E. ±	0.029	0.017	0.23	0.20	0.10	0.10	0.02	0.02	0.30	0.20
C.D. (P=0.05)	0.09	0.051	0.70	0.60	0.30	0.30	0.06	0.06	0.90	0.60

A: Ambient (25±2^{0}C RH 80%), R: Refrigeration (7±2^{0}C RH 90%)

Table 2 : Changes in texture, visual colour observation and mean sensory scores (5 point hedonic rating scale) during storage

Parameters → / Storage period ↓	Texture		Visual colour		Mean sensory score	
	A	R	A	R	A	R
Zero day	Crisp, slightly soft	Crisp, slightly soft	Bright pink	Bright pink	4.0	4.0
10 days	Crisp, less soft	Crisp, slightly soft	Pink	Bright pink	3.58	4.0
20 days	More crisp, less soft	Crisp, slightly soft	Faint pink	Pink	3.28	3.97
30 days	Crunchy, free flowing	Crunchy, slightly soft	Faint pink with brownish tinge	Pink	3.27	3.97
40 days	Crunchy, free flowing	Crunchy, slightly soft	Faint pink with brownish tinge	Faint pink	3.21	3.95
50 days	Crunchy, free flowing	Crunchy, slightly soft	Dull brown	Faint pink	3.17	3.88
60 days	Crunchy, free flowing	Crunchy, slightly soft	Dull brown	Faint pink	3.14	3.88

A: Ambient (25±2^{0}C RH 80%), R: Refrigeration (7±2^{0}C RH 90%)

increased from 0.08 per cent to 0.16 per cent and 0.128 per cent in case of ambient and refrigerated sample, respectively. Pruthi and Saxena (1984) and Garande *et al*. (2004) observed a slight decrease in sour *Anardana* during storage.

As vitamin C is very sensitive to heat applied during processing and its content was observed to be reduced from 5.37mg to 4.62 mg and 4.19 mg in case of ambient and refrigerated sample, respectively. Similar results were observed by Patil *et al*. (2003) while working with standardization for preparation of *Anardana*. Reducing sugars were found to be increased from 46.053 per cent to 47.30 per cent and 47.019 per cent under ambient and refrigerated conditions, respectively whereas non- reducing sugars were observed to be decreased from 6.20 per cent to 5.79 per cent and 5.83 per cent in case of ambient and refrigerated sample, respectively which may be due to inversion of non-reducing sugars to reducing sugars during storage period. The total sugar content showed similar trend as observed in reducing sugars. These results are in accordance with the results reported by Garande *et al*. (2004) while working with preparation and storage of sour *Anardana* from *Ganesh*.

Sensory evaluation during storage period (Table 2) showed that refrigerated samples scored higher ratings than ambient samples; at the end of storage period mean score was 3.88 and 3.14, respectively. Texture of ambient and refrigerated sample was changed from crisp, slightly soft to crunchy, free flowing and crunchy, slightly soft, respectively. The colour of anardana stored at ambient temperature was found to be changed from dark pink to dull brown and light pink in refrigerated samples. The similar change in colour of *Anardana* has been reported by Garande *et al*. (2004).

From this study, it was concluded that excellent quality of sweetened *Anardana* with good physico-chemical and sensory characteristics could be obtained by conducting osmosis of arils in 40 per cent hypertonic sugar solution for overnight at room temperature (25±2^{0}C for about 14 hrs) and then partial dehydration (16 hrs) followed by coating with mixture of glucose powder (20%) containing CMC (0.2%), sodium alginate (0.1%) and sodium citrate (0.1%) and again drying with intermittent coating upto 10 per cent moisture then vacuum packaging in multilayer bags and storage under refrigerated condition (7±2^{0}C RH 90%) for 60 days.

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