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Effect of Machine Pricked Aonla *(Phyllanthusemblica G.)* on Preparation and Storage of Candy

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Abstract: The present investigation was carried out to study the effect of machine pricked aonla and changes in chemical composition of aonla candy during storage when packed in sealed polyethylene bags (200 guage) up to 180 days at ambient (25°C) and refrigerated temperature (7°C). The respective values of moisture content, TSS, acidity, reducing sugars, non-reducing sugars, total sugars and ascorbic acid of fresh aonla fruit were found as 84.28% (wb), 10.74 °B, 1.75%, 4.16%, 7.93%, 12.1% and 700.0 (mg/100g). The TSS of aonla fruit with double pass is comparatively higher than single pass. The mean values of TSS for single and double pass were found to be 44.92 °B and 48.25 °B respectively. The percent moisture loss in aonla fruit with double pass is comparatively higher than single pass. The mean values of moisture content for single and double pass were found to be 34.43 and 42.38% (db), respectively. The moisture content was found to be decreasing from 18.02 to 17.17% (db) during storage under ambient condition and 19.46 to 18.42% (db) during storage under refrigerated condition. The TSS of aonla fruits was found to increasing from 79.33 to 83.00 °B during storage under ambient condition and 78.33 to 81.67 °B during storage under refrigerated condition. The values of ascorbic acid and acidity were found to be decreasing with advancement of storage period. The values of ascorbic acid and acidity under ambient and refrigerated conditions were reported as 168.67 to 146.67 (mg/100g), 171.67 to 148.67 (mg/100g) and 0.80 to 0.61% and 0.80 to 0.63% respectively. The reducing sugars and total sugars of candies were found to significantly increase with an increase in storage period. The reducing sugars and total sugars were found to be increasing from 36.90 to 43.33% and 65.47 to 68.97% during storage under ambient condition and 36.60 to 42.60%and 64.77 to 67.93% during storage under refrigerated condition. The non reducing sugars of aonla fruits was found to decreased from 28.57 to 25.63% during storage under ambient condition and 28.17 to 25.33% during storage under refrigerated condition. It was noted that the power operated aonla pricking machine could used to prick the aonla for making candy. The cost of preparation of whole pricked aonla candy was worked out to be Rs. 91.20/kg.

Keywords: Aonla Candy, Double Pass, Blanching, Pricking

1. Introduction

Aonla *(Phyllanthusemblica G.)* known as Indian Gooseberry is a minor sub-tropical deciduous medium size tree belonging to the family Euphorbiaceae. It can be grown successfully in dry and neglected regions besides its hardy nature, suitability to various kinds of wasteland. In Maharashtra, its cultivation is increasing in Pune, Ahmednagar, Aurangabad, Akola and Amravati districts. Due to its versatile nature, recently aonla is receiving rapid popularity especially on orchard scale in Maharashtra and the area is increased at very fast rate.

In recent years, the processing and value addition of aonla has increased many folds due to an increase in area and production. Aonla has acquired wide popularity all over the world for its medicinal properties. Aonla has good nutritional value. It is the richest source of ascorbic acid (vitamin C) and also contains tannin, polyphenol, pectin, gallic acid, and fiber. About 600–900 mg of vitamin C is found in 100 g of aonla pulp [1].

Osmotic dehydration is a process of partial removal of water by soaking foods, mostly fruits and vegetables, in hypertonic solutions. The driving force for the diffusion of water from the plant tissue into the solution is difference between osmotic pressures of hypertonic solution and plant tissue [2].

The pricking of aonla is necessary but tedious and time

consuming process. In food industries, pricking is done with the help of an ordinary fork having four spikes. This process is highly inefficient. The power operated aonla pricking machine has been developed and tested for its applicability in making value added products from aonla (candy) by single and double pricking. The storage behavior of whole pricked aonla candy is also assessed.

2. Material and Methods

2.1. Fresh Aonla Fruit

A fresh aonla fruit of variety NA-7 (Neelam) was procured from an orchard. The fruits were sorted for uniform size, colour and physical damage and washed with fresh tab water and then the fruits were wiped with muslin cloth to remove surface moisture. Aonla was pricked through single pass and double pass by using the power operated aonla pricking machine.

2.2. Sugar Solution

The osmotic solutions of different concentrations (50, 60 and 70 °Brix) of sugar was prepared by dissolving required amount of sugar in distilled water using glass rod as stirrer. Concentration of sugar syrup was checked by using Erma, Japan make hand refractometer (0-32, 28-62, 58-92 °B) of appropriate range. Sugar was used as osmotic agent as it prevents food discolouration to a large extent and imparts good taste to the final product. In osmotic dehydration, whole pricked aonla of average weighing 130 g with syrup to fruit ratio V/W (1:1) were immersed in the sugar syrup (50, 60 and 70 °B) contained in a 1000 ml glass beakers. The beakers were placed at room temperature. The pricked aonla candy was prepared by cold syruping method.

2.3. Preparation of Whole Pricked Aonla Candy

Double pricked aonla fruit obtained from machine was selected for preparation of candy. The sample size was 3 kg for each storage condition with three replication. The aonla candy was prepared by using cold syruping method [3]. The pricked fruits were blanched by holding in loosely tied piece of muslin cloth and dipping in the boiling water for 10 minutes. After blanching the fruits were immediately held in running tap water to prevent further cooking [4].

The candy was prepared by using cold syruping method suggested by [5]. The blanched segments were soaked in 50 °Brix of sugar syrup for 24 h. followed by rising the Brix to 60 °Brix on second day and to 70 °Brix on third day and segments are kept for 5 days by maintaining the 70 °Brix constant before air drying of product. Then the fruits were removed from sugar syrup quickly rinsed with tap water and dried in shade on stainless steel trays till the moisture content reduced upto 18 percent [5]. The prepared candy was then packed in Polythene bags of 200 gauge for 180 days. To study the storage behavior of whole pricked aonla candy the packed samples were placed in ambient temperature and in refrigerated condition for 180 days. The observations were recorded after every 10 days.

3. Results and Discussion

3.1. Chemical Composition of Fresh Aonla Juice

The fresh aonla juice contained 84.28 per cent moisture, 10.74 °Brix TSS, 1.75 per cent acidity while reducing sugars, non reducing sugars and total sugars were 4.16 per cent, 7.93 per cent and 12.1 per cent respectively. The ascorbic acid in the juice was 700 mg/100 g respectively. Similar results for different chemical properties of NA-7 were reported by [6], [7], [8] and [9].

3.2. Effect of Power Operated Machine Pricked Aonlaon TSS

The data on the effect of machine pricking on the TSS are graphically shown in Figure 1. It was observed that the increase in TSS was slowest at single pass as compared to double pass. It was observed the TSS increased from 10.75 to 64.00 °Brix at single pass whereas from 10.76 to 68.33 °Brix at double pass. The TSS of whole pricked aonla candy increases with the increasing number of days.

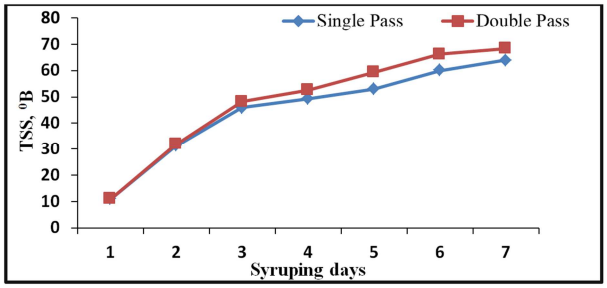

Figure 1. *Effect of pricking on TSS (°Brix).*

3.3. Effect of Power Operated Machine Pricked Aonla on Percent Moisture Loss

The data on the effect of power operated machine pricking on the percent moisture loss are graphically shown in Figure 2. The percent moisture loss increased from 11.33 to 50.37 per cent at single pass whereas, from 13.28 to 56.31 per cent at double pass. From the data it is clear that the percent moisture loss was minimum in case of single pass (34.43 per cent) whereas, the percent moisture loss was maximum in case of double pass (42.38 per cent). The percent moisture loss increases with the increasing number of days.

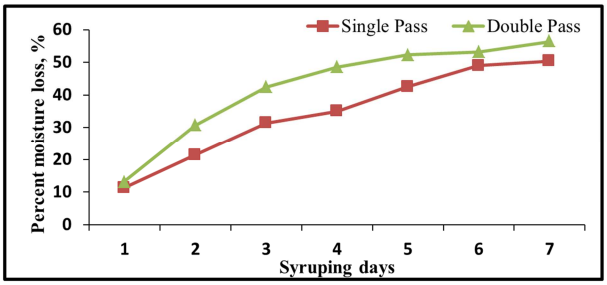

Figure 2. *Effect of pricking on percent moisture loss (%).*

Similar results for effect of machine pricked aonla on percent moisture loss were reported by [10] and [11].

3.4. Effect of Storage on Chemical Composition of Candy

3.4.1. Moisture

The moisture content of candy was found to significantly decrease with increase in storage period. The decrease in moisture content in aonla candies with increase in storage period might be due to the evaporation of moisture from the product during storage at ambient condition. The reduction of moisture content varied from 18.02 to 17.17 per cent storage at ambient temperature whereas, 19.46 to 18.42 per cent storage at refrigerated temperature. The reduction of moisture was slight decreased in ambient temperature than the cold temperature during storage as graphically shown in Figure 3. Decreased in moisture with storage of candies were also reported by [12] in aonla candy from 20.1 to 12.9 per cent at high storage temperature for 24 weeks. After 270 days of storage, the moisture content decreased from an initial range 16.5 and 17.2 per cent to a final of 14.7 and 15.4 per cent in flavoured candy of four aonla cultivar [5].

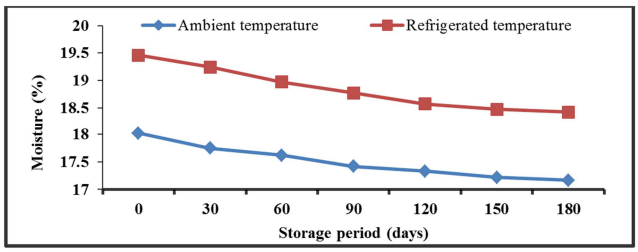

Figure 3. *Changes in moisture (%) of aonla candy during storage.*

3.4.2. Total Soluble Solids

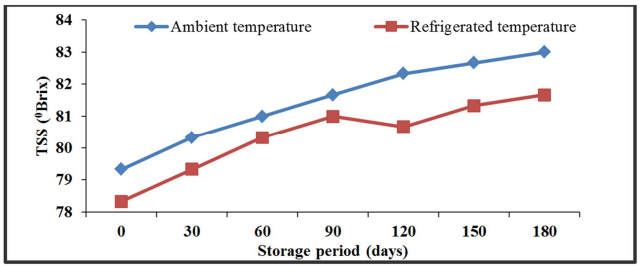

Figure 4. *TSS (°Brix) content of aonla candy as influenced by storage period.*

TSS gradually increased in storage period. It was observed that the TSS increased from 79.33 to 83.00 and from 78.33 to 81.67 °Brix for ambient and refrigerated storage conditions respectively. The increased in TSS might be due to conversion of polysaccharides into sugars during hydrolysis process. Increased in TSS might also be attributed to the reduction in moisture content of the product with storage. The candy stored at ambient temperature showed significant increase in TSS than those stored in cold temperature as graphically shown in Figure. 4. Increased in TSS with storage was reported by [12]. [5] reported that the TSS content in four cultivar of aonla with cardamom and ginger flavour candy increased from an initial range of 75.10 and 75.20 °Brix to a final range of 104.90 and 132.80 °Brix during storage for 270 days. [13] reported that the TSS content in NA-7 cultivar of aonla with honey coated and non-coated candy increased from an initial range of 74.8 and 75.0 °Brix to a final range of 75.9 and 76.2 °Brix during storage for 90 days.

3.4.3. Ascorbic Acid

Ascorbic acid was found to decrease gradually during storage. The ascorbic acid content decreased during storage due to oxidation of ascorbic acid to dehydro ascorbic acid. The decrease in ascorbic acid varied from 168.67 to 146.67 (mg/100g) storage at ambient temperature whereas, from 171.67 to 148.67 (mg/100g) storage at refrigerated temperature. The candy stored at ambient temperature indicated significant decreased in ascorbic acid than those stored in cold temperature as graphically shown in Figure 5. [13] reported that the ascorbic acid in NA-7 cultivar of aonla with honey coated and non-coated candy increased from an initial range of 106.30 and 106.41 (mg/100g) to a final range of 92.55 and 92.95 (mg/100g) during storage for 90 days. [14] reported that ascorbic acid losses were 83.86, 83.11, 56.58 and 34.72 per cent respectively with shreds, candy, jam and squash. [5] reported that the ascorbic acid content in four cultivar of aonla with cardamom and ginger flavour candy decreased from an initial range of 104.90 and 132.80 mg/100g to a final range of 44.10 and 57.00 mg/100g during storage for 270 days.

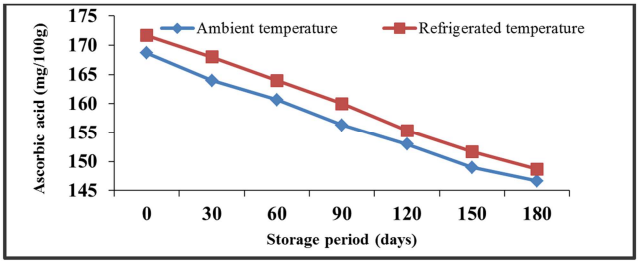

Figure 5. *Changes in ascorbic acid (mg/100g) of aonla candy during storage.*

3.4.4. Acidity

It was observed that the acidity decreased from 0.80 to 0.61 and from 0.80 to 0.63 per cent for ambient and refrigerated storage conditions respectively. Pectic acid had been reported to increase the acidity in fruit products; hence, decrease of pectic substances into soluble solids might have contributed towards decrease in acidity of aonla products. Acidity value is a measure of stability and shelf-life of aonla candy. It was due to the organic acids in fruits and those which were added while making the aonla candy. The rate of decrease in acidity was higher in candy stored at ambient temperature than the refrigerated temperature as graphically shown in Figure 6. [6] reported the acidity of aonla candy was found to be varying from 0.78 to 0.64 per cent during storage for 90 days. The freshly prepared aonla candies had 0.72 per cent acidity which decreased to 0.70 per cent during

storage for 135 days at room temperature [12]. The rate of decrease in acidity was higher in candy stored at ambient temperature than the refrigerated temperature.

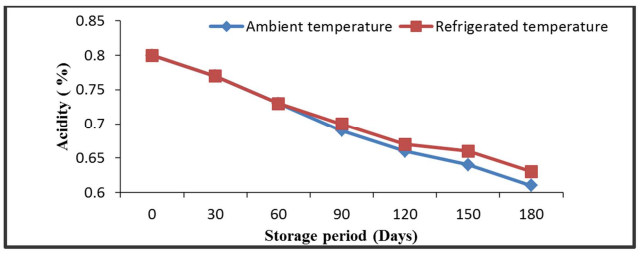

Figure 6. *Effect of storage period on acidity (%) of aonla candy during storage.*

3.5. Reducing Sugar

There was significant increase in reducing sugar during storage period of 180 days. The increase in TSS and sugar would be attributed to the conversion of starch and other insoluble carbohydrates into sugar. The increase of reducing sugar varied from 36.90 to 43.33 per cent storage at ambient temperature whereas, from 36.60 to 42.60 per cent storage at refrigerated temperature. The rate of increased in reducing sugar was higher in candy stored at ambient temperature than cold temperature as graphically shown in Figure 7.

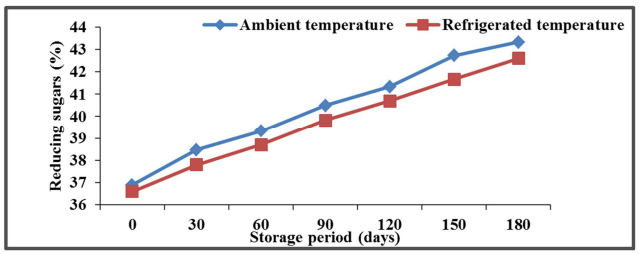

Figure 7. *Changes in reducing sugars (%) of aonla candy during storage.*

The results were in agreement with [12] who reported that the reducing sugar content in aonla preserve increased from 35.50 to 41.80 per cent. [6] reviewed the reducing sugars content of aonla candy and found to be varying from 38.34 to 42.00 per cent. [13] reported that the reducing sugar in NA-7 cultivar of aonlaincreased from 30.63 to 30.80 °Brix during storage for 90 days. [5] reported that the reducing sugar in four cultivar of aonla with cardamom and ginger flavour candy increased from an initial range of 36.5 and 37.2 per cent to a final range of 43.0 and 43.5 percent during storage for 270 days.

3.6. Non-reducing Sugar

The non-reducingsugar was found to decrease gradually during storage period. The reduction of non-reducing sugar varied from 28.57 to 25.63 per cent storage at ambient temperature whereas, 28.17 to 25.33 per cent storage at refrigerated temperature. The rate of decreased in reducing sugar was higher in candy stored at ambient temperature than cold temperature as graphically shown in Figure 8. The results were in agreement with [12] reported decreased in non-reducing sugars in aonla candy from 25.50 to 21.30 per cent during storage for 135 days at room temperature. [5] reported that the non-reducing sugars in four cultivar of aonla with cardamom and ginger flavour candy decreased from an initial range of 27.8 and 28.4 per cent to a final range of 25.4 and 25.1 percent during storage for 270 days. The non-reducing sugars content showed a continuous fall from 34.40 to 31.50 per cent during storage of aonla preserve for 6 months at room temperature [15].

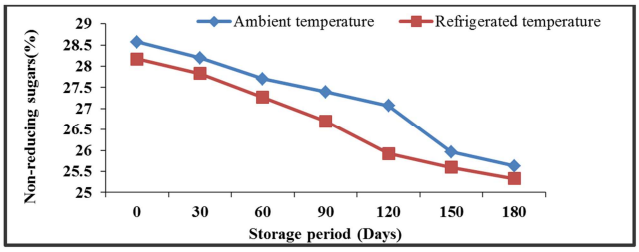

Figure 8. *Changes in non-reducing sugars (%) of aonla candy during storage.*

3.7. Total Sugar

The increase in total sugar was also observed; the increase would be attributed to the conversion of starch and other insoluble carbohydrates into sugars. There was gradually increase in total sugars content of aonla candy during storage. The increased of total sugars varied from 65.47 to 68.97 per cent storage at ambient temperature whereas, from 64.77 to 67.93 per cent storage at refrigerated temperature. The rate of total sugar increased was higher in candy stored at ambient temperature than cold temperature as graphically shown in Figure 9. [6] reviewed the total sugars content of aonla candy and found to be varying from 49.94 to 52.80 per cent. [5] reported that the total sugars content in four cultivar of aonla with cardamom and ginger flavour candy increased from an initial range of 64.30 to 66.60 per cent to a final range of 67.40 to 69.80 per cent during storage for 270 days.

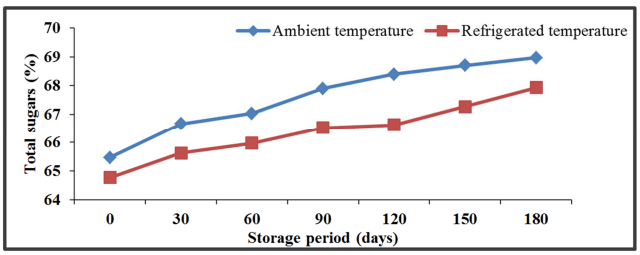

Figure 9. *Changes in total sugars (%) of aonla candy during storage.*

4. Conclusions

1. The machine pricked (double pass) aonla candy could be prepared by cold syruping method
2. The refrigerated storage of whole pricked aonla candy shows better result when compared with ambient storage
3. The overall acceptability of candy was found within the acceptable limit after 180 days storage period.

4. The cost of preparation of whole pricked aonla candy was worked out to be Rs. 91.20 per Kg.

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