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ADVANCES IN PROCESSING AND PRODUCT DEVELOPMENT OF AONLA (*EMBLICA OFFICINALIS*) IN INDIAN CONTEXT- A REVIEW

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ABSTRACT

Aonla is an important fruit crop indigenous to Indian sub-continent, which can be grown successfully in dry and neglected regions in the minimum management input. The area under aonla has been expanding rapidly in the last couple of years. Aonla is one of the oldest Indian fruits and considered as “*Wonder fruit for health*” because of its unique qualities. It is having high context of Vitamin C and comparable to only that of Barbados cherry (*Malpighia glabra L.*). The fruit is used as an antiscorbic, diuretic and laxative, hence used for treating common cold, gastric troubles, acidity and scurvy, dysentery and bronchitis, diabetes, diarrhoea, jaundice and dyspepsia and coughs, asthma, headache, ophthalmic disorders, colic, flatulence, skin diseases, leprosy, and greyness of hair etc. It has great potential in processed forms, which can have great demand in national as well as international market. Lot of work has been made in processing and product development in this fruit. Majority of products are sugar based and they have very little scope for export and for domestic use, the trend is changing and the demand for new novel products is increasing. An attempt has been made in this paper to compile all the information on various products development from aonla and future prospectus for processing and value addition. The present investigation was carried out to develop processing techniques for making different Aonla products such as Jam, Jelly, Squash, Juice, Candy, Supari, Powder, Biscuit, Chutney, Chayavanprash, Instant Juice and Soup mixes, Ladoo, Mouth freshener, Nectars, Oil, Pickle, Preserve, Sauce, Shred, Sweet Aonla Flakes, Syrup, Toffee, Triphala and so on which can be used at domestic and for commercial scale.

Keywords: Aonla, Aonla Products, Vitamin C and Benefits.

INTRODUCTION

Aonla is an important fruit crop indigenous to Indian sub-continent, which can be grown successfully in dry and neglected regions. The area under aonlahas has been expanding rapidly in the last couple of years. Aonla is one of the oldest Indian fruits and considered as “*Wonder fruit for health*” because of its unique qualities. It is a rich source of Vitamin C and its content of ascorbic acid is next to only that of Barbados cherry (*Malpighia glabra L.*). In India, aonla is grown in an area of about 50,000 ha with a production of around 2, 00,000 metric tonne. A fully mature aonla tree may yield 250-300 kg of fruit annually. The area under aonla (Indian gooseberry) has been expanding rapidly in the last couple of years. From about 3,000 ha in the early 80s the area had stretched to over 25,000 ha in 2000. It has doubled to 50,000 ha in the last two years.

Aonlaor amla (*Emblca officinalis*), popularly known as the Indian gooseberry, is a small-sized, minor subtropical fruit and grows widely along the hillsides and sub-mountainous areas of North India. It can be grown successfully in dry and neglected regions owing to its hardy nature, suitability to various kinds of wasteland. A

mature aonla tree can tolerate freezing as well as high temperature of 46 °C. The major Aonla producing States in India are Rajasthan, Uttar Pradesh, Gujarat, Tamil Nadu, Maharashtra, Andhra Pradesh, Karnataka and Bihar. Aonla is one of the important non-traditional fruit of Indian origin having immense potentiality of cultivation on marginal lands. Aonla is not consumed as fresh in its raw state due to its highly acidic and astringent taste. It is an edible fruit indigenous to tropical India. It is grown in diverse climate and soil conditions. The storage of Aonla depends on maturity at harvest. The fruit keeps well in cool chamber for 17-18 days compared to 8-9 days at ambient temperature. Rich source of Vitamin C and has a medicinal and therapeutically value and frequently recommended for the treatment of common cold, cancer and heart diseases. It has superior antioxidant activity. Their trees continue to bear fruits till 60-70 years of age. Fruit season is short and usually October to January. The main cultivated varieties are Banarasi (Drying), Bansi Red, Chakaiya (Pickle, Candy and Syrup), Desi, Krishna (Candy and Jam), Kanchan/NA-4 (Candy and Jam), Francis (Hathijool), NA-

6, NA-7 (Candy and Jam), NA-8, NA-9, NA-10, Anand-7 (Pickle) and Pink tinged (Rakesh *et al.* 2004). The fruit is used as an antiscorvic, diuretic and laxative (Singh and Pathak 1987), hence used for treating common cold, gastric troubles, acidity and scurvy (Tandon *et al.* 2003), dysentery and bronchitis, diabetes, diarrhoea, jaundice and dyspepsia (Bhosale *et al.* 2000) and coughs, asthma, headache, ophthalmic disorders, colic, flatulence, skin diseases, leprosy, and greyness of hair etc.

This fruit is extensively used in the preparation of Ayurvedic and Unani medicines like Chyavanprash, which promotes health and longevity (Rajkumar *et al.* 2001). It contains 500-1500 mg of ascorbic acid per 100g of pulp. The gallic acid present in Aonla fruit has antioxidant properties. The fruit is a very good source of Vitamin C containing chemical substances called lucoanthocyanin and polyphenols which retard the oxidation of Vitamin C. The main objective of the review is to highlight its uses, existing processing methods and their limitations and further propose to develop pilot plant for aonla processing.

VARIOUS PRODUCTS OF AONLA

The fresh Aonla fruits are not popular as a table fruit due to their high astringency and its storability after harvesting is also limited due to its high perishable nature (Kumar and Nath 1993). It has got great potential in processed forms, which can have great demand in national as well as international market. Hence attention has been focused on the preparation of different value added products from aonla. Despite of potential source of Vitamin C traditional method of processing provides a poor quality of product with low nutrient content and limits the utilization of the fruit locally and internationally. Streaming or blanching the fruit prior to processing can minimize ascorbic acid loss in the products.

Aonla fruits are a very rich source of Vitamin C having an ascorbic acid content varying from 0.9 to 1.3 per cent. It is therefore necessary to develop improved methods for processing. Efforts made by producers are still lacking in manufacturing Aonla based processed products. Thus the present investigation was carried out to develop processing techniques for making different Aonla products such as Jam, Jelly, Squash, Juice, Candy, Supari, Powder, Biscuit, Chutney, Chyavanprash, Instant Juice and Soup mixes, Ladoo, Mouth freshener, Nectars, Oil, Pickle, Preserve, Sauce, Shred, Sweet Aonla Flakes, Syrup, Toffee, Triphala and so on which can be used at home scale as well as commercial level. There are the following products describe briefly here:

BEVERAGE

Fruit beverages are well relished by all age groups of the society. It can help to reduce high cholesterol levels in our blood. Functional beverages are drinks that have been enhanced with added ingredients to provide specific health benefits and disease preventing property beyond general nutrition. Amla have been reported to possess expectorant, purgative, spasmolytic, antibacterial, hypoglycemic activity (Jamwal *et al.*, 1959; Jayshri and Jolly, 1993).

Recently, CIPHET has also developed the process technology for making Aonla based beverage in the form of juice with attractive colour, appealing flavour and smell. The composition of 20 per cent Aonla juice, other fruit juices like, guava, pineapple juice, etc 10 % and 70 per cent sugar syrup of 25 °B are found best in terms of acceptability. This process technology developed under the project, 'Development of Aonla Processing Plant' started at CIPHET is also applied for patent.

Aonla and Kinnow fruits are considered to be the rich source of ascorbic acid, pectin, citric acid, and minerals like calcium and phosphorous. Three levels of each Cardamom and Ginger were used as herbal additives and were compared with control. All the herbal treatments were found better in respect of TSS, pH, Acidity and ascorbic acid content over control. Highest mean TSS (15.13°Brix), pH (3.50) and ascorbic acid content (19.4%) were observed in T5 (ginger powder @100 gram/ lit.), All the sensory parameters were based on the overall acceptability which was dependent on Colour, Texture, Flavour and Taste was recorded highest (7.78 score) in T5 (ginger powder @100 gram/ lit.).

Aonla juice and ginger juice were utilized at various combinations with sugar and artificial sweeteners (aspartame and saccharine) for preparation of nutritious ready-to-serve (RTS) beverages and evaluated for various physico-chemicals and sensory attributes during storage. The study revealed that the RTS beverage prepared by blending aonla and ginger juice with Aspartame scored maximum for almost all sensorial quality attributes such as appearance, color, flavor, taste and overall acceptability and also found ascorbic acid content (180 mg/100 g).

BISCUITS

Dietary fibre, Vitamin C and antioxidant-enriched biscuits were developed by incorporation of Aonlapomace (a byproduct generated in Aonla juice processing). The dietary fibre content of the finished product was about 5 times higher than Thermal disinfections set-up for pulses has a batch capacity of 100 kg the control, while Vitamin C and antioxidant concentration were 15.6 mg/100g and 0.25 g, respectively. Biscuits had a shelf-life of more than 3 months when wrapped in 100-gauge polypropylene pouches under ambient conditions. The biscuits prepared in accordance with the invented process can be supplemented as fibre, Vitamin C and antioxidant fortified diet for children and adult alike. The fibre-enriched biscuits may be helpful in curing the constipation and other ailments related to fast food habits (CISH, Lucknow).

CANDY

Fruit candies are becoming more and more popular because of high acceptability, minimum volume, higher nutritionally value and longer storage life. These have additional advantage of being least thirst provoking and ready to eat snacks. The candy of variety Chakkiya ranked first in respect of ratings for color, flavor, texture and total score and overall ranking. The variety Banarasi ranked first for texture and variety, Francis ranked first for color. After a storage period of 4 months at room

temperature, the variety Chakkiya again ranked first in all attribute except flavor. The candy of Banarasi ranked second overall.

Singh and Pathak (1987) reported that aonla fruit can be utilized for making excellent quality of candy or intermediate moisture food. Tandon *et al.* (2003) studied the effect of blanching and lye peeling on candy preparation. They found that the candy prepared from lye peeled fruits of aonla showed decreased content of ascorbic acid than blanched fruits. Singh *et al.* (2005d) prepared aonla candy with four different recipe viz., whole fruit with sugar coating, segmented fruit with sugar coating, whole fruit with pectin coating, and segmented fruit with pectin coating. Candy prepared from segmented fruit with pectin coating recorded the highest organoleptic score.

CHURAN

Tandon *et al.* (2005) standardized the procedure and recipe for preparation of churan from dried aonla powder. The retention of Vitamin 'C' is hardly 50%. Therefore, alternately a ecofriendly option through integration of solar tunnel drying can be employed, which can be designed as per requirement and produces high retention capacity as far as Vitamin 'C' is concerned in final products.

CHYAVANPRASH

It is an ages old Ayurvedic preparation made from amla fruits. It is prescribed as a restorative tonic which also develops resistance in body against various diseases. The legend is that this preparation was specially formulated by the Ashwinikumars, the physicians to gods in heaven, for sage Chyavan who had grown very frail and old after years of penance. There was drastic transformation of the sage after taking this tonic. The sage was looking so young and youthful that even his wife failed to recognize him when he reached home after years of absence from home. This tonic has become very popular not in India, but outside India too. Therefore the demand for amla fruits has now outgrown its production. So amla cultivation is becoming very profitable. It is prepared by mixing the aonla pulp pest and sugar while cooking. In this mixture spices and medicinal plants extracts are added for further cooking.

INSTANT JUICE AND SOUP MIXES

Fruits and Vegetables are important in human diet and have a potential for the development of low cost beverages of high nutritional value. Even though many processed products are available, consumer prefers dehydrated products. Hence, there is a need to develop Instant mixes with prolonged shelf life. Therefore an attempt has been made to develop an Instant Juice and Soup mixes from Ash gourd and Aonla. Juice and soup samples were prepared with six different variation of each with different quantities of ingredients. Sensory evaluation was done for all the juice and soup samples. Among all, the juice sample of AGJ4 (7.30) and soup of AGS3 (8.40) were scored highest for overall acceptability. It can be

concluded that the blended instant mixes from Ash gourd and Aonla are the natural nutri-mix, which saves time for cooking and also provides additional nutrients.

JAM

Jam is a product made by boiling fruit pulp with sugar and citric acid to a desirable thick consistency. The ideal fruit jam should have minimum 45% pulp, 68% total soluble solids and 0.5% acidity. Best quality jam can be prepared from the varieties which have low fiber content and more pulp percentage.

Singh *et al.* (2005d) standardized the recipe for preparation of herbal jam. They prepared the different recipes for preparation of 5 kg herbal jam. Recipe No.1- containing 50% aonla pulp, 5% asparagus + 2% ashwagandha extract with 68% TSS and 1.2% acidity was found the best and it was closely followed by recipe No. 2- which contained 10% asparagus juice. Herbal extracts added in aonla pulp for preparation of jam improved the medicinal quality and attracted the market. The preparation of herbal jam is exactly same as that of simple jam.

JUICE

Aonla(*Embllica officinalis* Gaertn.) fruits are preserved either in water or salt solution for a couple of weeks for the commercial preparation of products. In the quality of Aonla (cv. Chakaiya) juice prepared from fruits steep preserved in water for 30 days was assessed during storage up to 9 months under ambient conditions. The juice was prepared from fruits withdrawn at 0, 5, 10, 15, 20 and 30 days of steeping preservation in water, pasteurized at 90°C and preserved with 500 ppm SO₂ in glass bottles under ambient conditions. The contents of ascorbic acid and polyphenols in fresh juice decreased from 309 to 43 mg/100 ml and 3.09 to 0.57 per cent, respectively, when extracted from fruits after 30 days of steeping preservation. In juice, prepared from fruits steep preserved for more than 10 days, the decline in nutritional quality was more pronounced.

Jain and Khurdiya (2002) standardized a procedure for the extraction of juice from aonla fruits. Blanching the fruits prior to juice extraction significantly improved the juice recovery increased the density and tannin content of the juice but reduced the Vitamin 'C' content were obtained by blanching the fruits and separating the segments. Among the methods of juice extraction, centrifugal juice extraction recorded higher density, soluble constituents and higher Vitamin 'C' and tannin contents as compared to crushing and pressing whole or segments of aonla fruits. Nazni *et.al.*, 2013 standardized an vitamin C rich juice in *Ziziphus Jujube*.

MOUTH FRESHENER

Aonla *supari* available in the market suffers huge processing losses in Vitamin C and other nutrients. This defeats the purpose of producing the product. Since dehydrated aonla pulp retains sufficient amount of Vitamin C, there is a need to develop an alternate chewing product with health promoting nutrients. Therefore, develop aonla

mouth freshener which can prove to be a novel innovative product that can provide a better substitute.

Nutritive and palatable mouth fresheners were prepared from dehydrated aonla (*Emblica officinalis* Gaertn) pulp of 'Desi' and 'Banarsi' cultivars by mixing carboxy methyl cellulose, gums, arecanut, cardamom, sugar and milk powder at different proportions as a substitute for *pan masala*, tobacco and *gutka*. Mouth fresheners developed were packed in high density polyethylene pouches (HDPE, 100 gauge), stored at ambient conditions (8–20 °C, 60%RH). During storage for 6 months, ascorbic acid and overall acceptability of mouth freshener decreased ($p \leq 0.05$) and moisture content increased. The equivalent relative humidity of mouth freshener was 49% and 53% in 'Desi' and 'Banarsi' cultivars, respectively. Mouth freshener prepared with 50% dehydrated aonla pulp, 15% fennel, 10% areca nut and 20% sugar.

NECTAR

With a view to develop value added products, nectar using fruits of cultivar NA-7 with various recipes was prepared. The nectar remained acceptable up to 240 days at ambient condition. The nectar prepared from T3 (20 per cent juice, 20 per cent TSS and 0.3 per cent acidity) recorded maximum organoleptic score. Minimum bacterial counts, yeast counts and mould counts and the maximum benefit: cost ratio, good sensory evaluation score and high nutritional quality was noted.

PICKLE

Small size aonla fruits, which are not suitable for preparation of preserves and other confectionary items, may be utilized for pickle making. To improve upon the texture of the fruit and also to remove astringency, brining is important in pickling. For its preparation, add oils, spices etc. and leave it for few days in sunshine. When pickle is ready after few days, can be store at room temperature.

Premi et al. (2002) standardized the method for preparation of instant oil less pickle from aonla. Two varieties of aonla (Desi and Chakaiya) were used for the preparation of dehydrated oilless pickle. The overall quality of dehydrated pickle made from pretreated segments of local cultivar was better than variety Chakaiya. For curing aonla fruits for pickling, bringing along with potassium meta-bi-sulphite was found to be more effective for long term storage than dry salting or other pretreatment for controlling of white specks, better retention of texture and nutrients in both the varieties. The drying rate was faster in pickle made from cured and steam blanched segments of local variety than in other variety.

PRESERVE

Aonla preserve is an extremely popular traditional product, which is also known as amla murabba in India. Aonla preserve has the beneficial effect of purifying blood. This also helps in reducing the cholesterol levels in blood and in improving eyesight. Lack of scientific approach in its preparation and preservation renders this valuable

product vulnerable to spoilage in a short period of time after its preparation.

In case of murabba the variety Krishna ranked first in all attribute followed by Chakkiya, which ranked second in all attribute except texture, where it ranked first. Tough texture, shrinkage or gaseous fermentation during storage is commonly encountered troubles that pose a big problem in stabilizing the shelf life and commercialization of this product. Scientists at the Punjab Agricultural University studied the scientific approach to enhancing the shelf life of Aonla preserve to improve its commercial production.

For the preparation of aonla preserve, the fruits are washed, dipped in brine solution for a couple of days until the color of the fruits changes from green to a yellowish or creamish colour, pricked after washing and blanched. Then the fruit are put in sugar syrup of 45-50 o Brix strength. The following day the syrup is highly concentrated; fruit are added to it without knowing the final concentration of sugar in the covering syrup, which determines the shelf life of product. Tough texture, shrinkage or gaseous fermentation during storage are commonly encountered troubles that pose a big problem in stabilizing the shelf life and commercialization of this product.

Central institute for arid horticulture (CIAH) developed a new modified protocol for preparation of murabba (Anonymons, 2003). The advantage over other methods is to repeat change of concentration daily could be avoided.

SAUCE

Five kg of sauce containing 50% Aonla pulp and 50% tomato pulp with 75g sugar, 10g salt, 60g onion, 6g garlic, 12g ginger, 5g red chilies, and 12g hot spices was prepared. Acetic acid and sodium benzoate as preservatives were added at the rate of 1ml and 0.3g/kg of final product, respectively. Finally the sauce was filled in glass bottles and crown corked followed by processing in boiling water for 30 minutes and air-cooled. The product was highly acceptable even after the storage period of more than 9 months.

SHRED

Alam and Singh (2005) have conducted a study to prepare aonla powder from its fruits. The pricked aonla fruits were blanched for 5 min in 5% boiling salt solution containing 0.15% NaHCO₃ and 0.10% MgO. The blanched aonla fruits were sulphited for 30 min in 0.5% KMS. The treated fruit were sliced manually with knife. For the dehydration of aonla slices, the mechanical dryer (50, 60, 70°C), solar and cabinet dryers were used. They found that the mechanically dried slices contained higher in vitamin C content and were organoleptically superior to slices dried under solar and cabinet dryer.

In a study, the raw and treated (KMS) samples of Banaras and Chakkiya varieties of aonla were dehydrated by sun and mechanically dried (60°C) for the preparation of aonla powder (Sharma et al., 2002). The processed dehydrated powder was packed in 100 gauge packages of high-density polyethylene (HDPE) and low-density

polyethylene (LDPE). The packages were stored under ambient (5-18°C and 60% RH) and refrigerated (4±1 and 90% RH). It was found that the aonla powder prepared from pretreated, Chakkiya variety and mechanically dried can be stored effectively in HDPE packages under refrigerated condition for 3 months without much loss in vitamin C, having better overall acceptability in terms of appearance, taste, flavor and texture.

Pragati *et al.* (2003) conducted an experiment on effect of drying methods on nutritional composition of dehydrated aonla fruit during storage. Aonla fruit cv. Chakaiya was dried using four different methods viz., osmo-air drying, direct sun drying, indirect solar drying and oven drying. The osmo-air drying method was found to be the best method for drying of aonla because of better retention of nutrients like ascorbic acid and sugars.

Kavitha *et al.* (2003) studied the effect of osmotic dehydration on Vitamin 'C' content of aonla at different salt concentrations and different temperatures. The overall retentions of Vitamin 'C' was found better in the un-blanching osmotically dehydrated and air dried samples.

SQUASH

Squash was prepared by blending aonla juice with other juices viz., ginger, roselle, pineapple and lime. Organoleptic evaluation of squash revealed that score for color, flavour and consistency increased with addition of ginger and Roselle. The blend of aonla, ginger, roselle (80:15:5) ranked first in all attributes including overall ranking, this was followed by blend of aonla, lime, ginger (75:20:5). Roselle helps in improving the color and ginger helps in improving the flavor of squash.

Singh *et al.* (2005d) standardized the recipe for preparation of herbal squash. Five different recipes with or without asparagus juice and ginger juice were developed. asparagus and ginger juice were mixed with aonla pulp and the remaining procedure is as such followed for simple squash. A recipe containing 25% aonla pulp, 5% asparagus extract and 2% ginger juice with 50% TSS and 1.2% acidity is found most ideal for preparation of herbal squash.

SUPARI

Aonla supari was prepared by treating blanched Aonla segments with salts (white and black) for extracting water from fruit pieces by osmosis. Acidity, moisture content and water activity declined slightly during storage period. Retention of ascorbic acid in supari was highest in Banarsi cultivar (42.8%) followed by Chakaiya and NA-7 i.e. 41.07 and 40.06 per cent respectively.

SWEET AONLAFLAKES

To develop a product "sweet aonla flakes" of high consumer acceptability, the aonlaslices of 2 mm thickness were first osmotically pretreated and then convectively dried at constant air temperature of 60°C to safe moisture level of 10% wet basis. Different experimental combinations of osmotic process parameters i.e. sugar concentration, solution temperature, solution to fruit ratio and immersion time were tried using Box and Behnken

design of experiments. Response surface methodology (RSM) was used to investigate the effect of sugar concentration (50-70°B), solution temperature (30-60°C), solution to fruit ratio (4:1-8:1) and immersion time (60-180 min) on the water loss, solute gain, vitamin-C loss and overall acceptability of osmo-convectively dried aonla slices having moisture content of 10% w.b. An analysis of variance (ANOVA) revealed that among the process variable temperature has remarkable effect on responses. In comparison to solution to fruit ratio the sugar concentration, solution temperature and immersion time showed significantly higher effect on all the quality responses. Optimization of the osmotic dehydration process was performed to result maximum water loss, solute gain, overall acceptability and minimum vitamin-C loss. The optimum process parameters obtained by computer generated response surfaces, canonical analysis and contour plot interpretation were: 700°B of sugar concentration, 60°C of solution temperature, 6.8:1 of solution to fruit ratio and 72 min of immersion time. The sweet aonla flakes developed under optimized condition were of high consumer acceptability and were in close agreement to the predicted quality values.

SYRUP

Syrup from aonla pulp can be prepared according to FPO specifications i.e., 45% pulp, 68% TSS and 1.2% acidity. The procedure for the preparation of syrup is similar to that of squash. The fruits are blanched in boiling water for 6-8 minutes and segments are separated. The segments are dipped for 24 h each in increasing concentration of syrup by adding sugar with boiling and segments are immersed in it and packed in clean jars.

CONCLUSION

The Amla or Aonla (*Emblca Officinalis* Gaertn) also known as Indian Gooseberry is a minor sub-tropical deciduous tree indigenous to Indian sub-continent and it can be grown successfully in dry and neglected regions owing to its hardy nature, suitability to various kinds of wasteland. The growing popularity for alternate medicines, health foods and herbal products are enhancing the requirement for aonla fruit. The fruits are rich in Vitamin C, Protein, Fat, Crude fibre, Starch, Sugars and Minerals. The fruits are rich in Ascorbic acid and Tannins. Because of its highly acidic and astringent nature, the consumers do not relish this fruit in fresh form. Hence, it is necessary to process this fruit and develop novel innovative products of high value. The modern technologies mentioned in the study for preparation of different aonla products are hygienic, consume lesser time and provide maximum retention of nutrients. The information generated by other researchers will be basis for development of pilot plant for aonla processing which is need of hour to mechanize processing operations to produce quality products of aonla for domestic as well as global market. The fruit is acrid, cooling, refrigerant, diuretic and laxative, hence used for treating chronic dysentery, bronchitis, diabetes, fever, diarrhoea, jaundice, dyspepsia, & coughs etc. By using these simple scientific techniques, judicious processing of

Aonla fruit will not only open new dimensions for establishing commercial processing industries in the form of value added products, but will also provide health benefits to the consumers. The findings of the present study clearly indicate that there is a greater scope of processed Aonla products. Inclusion of these products in diet defiantly helps in improving the nutritional value of Indian meal. Low cost of the products as well as good sensory, nutritional and shelf life qualities establish that the processed Aonla products are appropriate for commercialization.

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