EFFECT OF DIFFERENT PRETREATMENTS ON MINIMALLY PROCESSED POMEGRANATE ARILS DURING STORAGE

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ABSTRACT

Minimally processed and “ready-to-eat” pomegranate arils are more popular due to their convenience, high value, unique sensory characteristics and health benefits. Increasing the shelf life of pomegranate arils is the most important aspect of this study. Studies were conducted on three different pretreatments viz. aloe vera gel (40, 50%), salicylic acid (2.0, 2.5mM), ascorbic acid: citric acid combination (0.5 & 1.0%) and control of minimally processed arils. The treated pomegranate arils were filled in punnet sealed with BOPP film and stored at 5°C. Arils quality and shelf life were evaluated during 0, 7, 14, 17, 19 days of storage. The results showed that the physicochemical parameters such as TSS, acidity, colour values a*, b* and L* were increased during storage of arils and their was decrease in colour value L* and anthocyanin values during storage. In minimally processed arils microbial count of 7 log cfu/g is the end point of storage. Based on visual, microbial and sensory quality the shelf life of pomegranate arils was count upto 19 days for aloe vera 50%, salicylic acid 2.5mM, ascorbic acid: citric acids 1%. This study provides a useful guide for storage of pomegranate arils.

Keywords: Minimal Processing, Pretreatments, Quality Evaluation, Shelf Life.

1. INTRODUCTION

Pomegranate is generally consumed fresh or processed into juice, syrup, jams, or wine. In recent years, minimally processed “ready-to-eat” pomegranate arils have popular due to their convenience and high value. Pomegranate fruit has seen a remarkable increase in the commercial farming, due to its potential health benefits such as, its high antioxidant, anti-mutagenic, anti hypertension activities and the ability to reduce liver injury (Violeta Lopez-Rubira, 2005) (18). Minimal processing which involves light processing such as peeling is of great importance for adding convenience to the consumers.

A commercialization of minimally processed and “ready-to-eat” fresh arils is the good alternative to later demands of newly evolving health conscious consumer class which also expects convenience (Zehra, 2009) (23). The minimal processing consists of washing with sanitizing agents to reduce the primary inoculum load, pH modification, temperature control and others, to control partially the high perishability of the fruits.

Most of the studies on pomegranates dealt with chemical composition, the chemical and physical changes during ripening of whole fruit and the determination of shelf life at different storage condition (Zehra, 2009) (23). Packaging plays an important role in maintaining the nutritional and microbial quality of fresh or fresh cut produce (Opara, 2013) (9). Packaging protects the food products, serves as an alternative measure for controlling diseases and provides structural support for convenient storage. Significant role is extending shelf life of food products and reduce the risk of food borne pathogens.

However, maintaining the nutritional and microbial quality of pomegranate arils is a major challenge, because, minimally processed arils easily deteriorate in texture, colour, overall quality and a reduction in shelf (Gil et al. 1996) (13). This is due to the active metabolic processes due to endogenous enzymatic activity, enhanced respiration rate with increased production of ethylene. Minimally processed pomegranates i.e., arils are susceptible for fungal and bacterial contamination (Corbo, 2009) (10). Vishwanta (2000) (22) reported that bacterial and fungal contaminations are responsible for food borne diseases and consequently making them unfit for consumption. Several chemical compounds have been used to reduce bacterial populations on fruit and they are still the most widely used treatments, either before processing or during pre and post cutting operations (Gil, 2009 and Nabigol, 2013) (14, 20). Extracting the pomegranate arils is very difficult and time consuming; its consumption is not widespread (Lopez-Rubira et al., 2005) (18). Commercial production of pomegranate arils is now possible with today's technologies.

The objective of this investigation was to study the effect of different pretreatments aloe vera gel, Salicylic acid, ascorbic acid and citric acid combination in different concentration in minimally processed arils for maintaining physico-chemical, microbial and sensorial quality attributes. For this purpose, pomegranate arils
were filled in punnets and sealed with BOPP film and stored at 5°C.

2. MATERIAL AND METHODS

Plant material pomegranate (punica granatum L. cv. Bhagawa) fruits were harvested from orchard of ICAR-NRPC, Solapur. Pomegranate fruits were selected for uniformity in size, shape and colour. Diseased, sunburned, bruised and injured fruits were discarded. Fruits were transported to the cold room in laboratory and stored at 5°C before experimentation.

2.1 PRETREATMENTS AND STORAGE CONDITION

Arils were treated with three different treatments, aloe vera gel (40%, 50%), salicylic acid (2 mM, 2.5 mM), ascorbic acid: citric acid (0.5:0.5%, 1:1%) and control. Arils were dipped in different concentration of aloe vera gel solution for 5 minutes (Arowora, 2013) (5). Arils were dipped in prepared solution of salicylic acid for 10 minutes (Arowora, 2013) (5) and ascorbic acid: citric acid for 2 minutes (Lucimara, 2012) (19). Treated arils were dried with blotting paper for surface moisture removal. Thereafter, arils were filled in plastic punnet which was sealed with biaxially oriented polypropylene film and packaged arils were stored at 5°C. All the processing operations were carried out at 16°C.

2.2 FRUIT SAMPLING AND EVALUATION

Fruits rind was carefully cut at the equatorial zone with sharp knives. Arils were manually separated. The damaged or cut arils separated manually. The arils were washed with chlorinated water for 2 minutes except control sample. The changes in aril colour, texture, total soluble solids (TSS), titratable acidity (TA), anthocyanin content, microbial and sensorial quality were evaluated during storage after 0, 7, 14, 17 and 19 days.

2.3 ANALYSIS OF MINIMALLY PROCESSED POMEGRANATE ARILS

Aril colour values

Pomegranate arils colour parameters was measured using colorimeter (Lab Scan XE, of hunter Lab, USA). The colour is expressed in dimensions of L*, a*, b* (Fawole and opera 2013) (15, 9). Values of L* indicate lightness of sample colour, while a* indicates red colour. The b* indicates a yellow colour (Lizanne, 2014) (17). The pomegranate aril samples to be tested were transferred into a beaker, and the beaker was covered with top pan.

Texture

Texture of the pomegranate arils were measured using texture analyzer (TA-XT Plus, Stable Micro Systems). The load cell of 50 kg capacity and cylindrical probe of 25 mm diameter was used for the compression test (Bchir et al., 2012) (7). Firmness was expressed as maximum compression force (N) required rupturing the arils.

Total soluble solids, titratable acidity

Total soluble solids (TSS) of arils juice was determined with a digital pocket refractometer (PAL - α, of ATAGO) expressed as % (°Brix). Titratable acidity (TA) of arils juice was determined by titrating with 0.1 N NaOH, results were expressed as % citric acid and end point was faint green colour (Sartaj Ali, 2013) (3).

Total Anthocyanin content

Total anthocyanin content (TAC) was carried out by spectrophotometric method in accordance with (Zaouay, 2012) (24). Absorbance was measured at 535 nm using UV spectrophotometer, and calculated according to following equation:

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\text{Total anthocyanins content} = \frac{(\text{Absorbance at 533nm X volume made up of the extract used for colour measurement X total volumeX100})}{(\text{ml of the extract used X wt of sample taken})/98.2}.
\]

The results were expressed as mg/100ml juice.

Microbial quality

Microbial quality of pomegranate aril analysis was screened by total plate count. Two types of media was used for total plate count for bacterial count nutrient glucose agar (NGA) was used and for fungal count potato dextrose agar (PDA) was used (Zehra, 2009) (23). Arils punnets were opened under hygienic conditions. The results of total plate count were expressed as log CFU/g.

Sensory evaluation

Sensory evaluation of pomegranate arils was performed on nine point hedonic scale by trained sensory panelist. The parameters used for evaluation were color, texture, taste, flavor, and overall acceptability. The sensory and microbial analysis were taken at the same days. (9 = Like extremely, 8= Like very much, 7= Like moderately, 6= Like slightly, 4= Dislike slightly, 3=Dislike moderately) (Ayhan, Z, 2009) (6).

Statistical analysis

Data were analyzed using ANOVA procedure SAS software Version 2.0. The effect of different pretreatment on quality parameters were analyzed by Completely Randomised design with examination for significant difference at (0.05%).

3. RESULTS AND DISCUSSION

The changes of pomegranate arils colour values was showed in (Fig. 1). The results showed that L* values of arils were decreased over the storage period showing darkness increase in the arils during storage. The L* value were in the range between 18.51 to 21.64. In case of a* values overall increase was observed in redness values the higher values of redness were observed in salicylic acid 2, 2.5mM treated arils and 0.5, 1% ascorbic and citric acid combination treated arils shown higher redness values (Fig. 2) (Ayhan). The average colour value a* of arils were in the range between 14.53 to 36.53. In case of b* values overall increase was observed at the end of storage. The b* value (Fig. 3) of aril colour were in the range 4.28 to 14.60. The similar results were observed by Zehra, 2009 (23).
The texture of the arils was decreases as the storage period increases in all treatments as shown in (Fig. 4). The similar results were observed by Caleb (2013) (9) and Ayhan and Estruk (2009) (6). Changes of texture value of arils was due to changes in water content during storage period.

The changes in Total soluble solid (TSS) and titrable acidity (TA) (Fig. 5, 6) of minimally processed and packaged pomegranate arils during storage were summarizes in Fig. Total soluble solids (TSS) content was found to be increased at the end of storage period for irrespective of treatments. Similar results were observed by (Caleb, 2012) (8). The increase in TSS may be attributed to moisture loss from arils. Titrable acidity values were also found to be increasing over the storage period. The treatments having AG 50%, SA 2.5mM, AA:CA 1% besides SA 2mM was lower acidity at the end of storage. The highest titrable acidity was observed in the control sample after 19 days of storage. Artes and others (2000) (4) reported that there was no significant but slight changes observed in TSS pomegranate during cold storage).

Changes in total anthocyanin content (TAC) was recorded in (Fig. 7). The results showed that degradation in TAC may be very but overall degradation in anthocyanin content was observed over the storage period. the similar results were reported by Lizanne (2014) (17) in pomegranate arils and observed overall degradation in anthocyanin content as the storage period increases. Control arils showed lower anthocyanin content as compared to treated arils. Additionally, our results showed that coating treatment reduced degradation of anthocyanins over storage period.

Total microbial count in different treatment was showed in (Fig. 8). Total microbial count in log CFU/g was determined for minimally processed and packaged arils over the storage period for all pretreatments. The safe maximum limit set by Spanish legislation for minimally processed is 7 log cfu/g is considered for storage studies. Control samples were having higher microbial count at the end of storage period. On 19th day of storage the least microbial count was observed for samples treated with SA 2.5M, AA:CA 1%, AG 50%. Lopez-Rubira and others (2005) (18) reported that microbial counts of minimally processed arils increased throughout shelf life at 5°C including UV-C treated arils. The aerobic mesophilic bacteria were in the range of 0.00 to 4.53 log CFU/g during 19 days of storage while fungal count were in the range of 0.00 to 4.52 log CFU/g.

Sensory evaluation was done on nine point hedonic scale by trained sensory panelist. (Fig. 9) showed that 19th sensory score. The control sample having lower sensory score upto 19 days of storage. The average scores for sensory evaluation for arils stored for 19 days. The sensory score revealed that there was not much variation in colour scores over the storage period however other parameters such as taste, texture, flavor and overall acceptability varied much over storage period. On 19th day of storage highest sensory score was observed for arils treated with SA 2.5mM, followed by AG 50% and AA : CA 1%.
The GRAS chemicals and natural compounds such as salicylic acid, citric acid, ascorbic acid and aloe vera gel can be used for extension of shelf life of pomegranate arils maintaining the functional compounds during punnet packaging and low temperature storage. SA 2.5mM, AG 50%, and AA:CA 1% were found to be best pretreatments in increasing the shelf life up to 19 days on the basis of microbial and sensory quality parameters maintaining the quality of the arils during storage at 5°C.

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BIOGRAPHIES

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