



Effect of Thermal and Chemical Pre-treatments on Shelf Life and Quality of Egyptian Pomegranate Arils

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THIS investigation was carried out to study the preserving of Egyptian pomegranate aril with different thermal and chemical pre-treatments to increase shelf life and maintain quality of Arils. TSS, pH, acidity, vitamin C, T. Phenol, antioxidant activity color characteristics, microbiological and sensory evaluation were determined for the different thermal and chemical pre-treatments of on Egyptian pomegranate aril for 21 days. All untreated and treated samples were storage at 4 °C for 21 days and the previous parameters were analyzed after zero, 7, 14 and 21 days. Results evidenced that it was found that the Total soluble solids (TSS) content, titratable acidity and pH decreased during storage of pomegranate arils in pre-treated samples through 21 days storage at 4 °C. During successive storage period the Hunter color Lab* value and parameters (L*, a*, b*, ΔE, C*, H* and BI) of arils decreased, showing a decrease in brightness (L*), redness (a*) & yellowness (b*). On 21th day of storage the least microbial count was observed for samples thermal pre-treated with SB and WB, then chemical pre-treated with SO₂ and PS. The results showed that the non-enzymatic browning and the concentration of total anthocyanine (TACN) were low in SO₂ and PS pre-treatment pomegranate arils samples compared with un-treatment samples. However, all pretreatments did not effect on total phenol contents. The sensory score revealed that there was not much variation in color scores over the storage period. On 21th day of storage highest sensory score was observed for arils treated with SO₂ and PS pre-treated pomegranate arils. The present study exposed that the thermal and chemical pre-treatments such as water blanching (WB), steam blanching (SB), sodium metabisulfite (SO₂) and potassium sorbate (PS) can be applied for increasing shelf life of pomegranate arils maintaining the functional compounds during storage at 4 °C.

Keywords: Thermal, Chemical, Color, Pomegranate, Arils, Storage, Quality, Shelf life.

Introduction

In the last few decades, some certain foods and its health benefits had been investigated. One of the key research preservation of the food industry is development of foods that promote health (Klaenhammer and Kullen, 1999). This led to increase production, preservation and consumption of enriched foods which activate components such as pomegranate arils which are recognized as functional foods (Shanahan, 2004).

Pomegranate (*Punica granatum* L.) considered a native crop of Iran, which extensively cultivate

in different countries: Egypt, India, Russia, China, Argentina, France, and also in Japan (Patil and Karade, 1996). Dhandar and Singh (2002) mentioned that the versatile adaptability, better keeping quality and table and therapeutic value are the feature responsible for its cultivation and extension a wide areas. It belongs to family Punicacea. Pomegranate is considering a novel category of exotic plant source called supper fruits.

Due to the highly acidic nature of the wild pomegranate (*Punica granatum* L.) it is therefore considered a great economic value. Pomegranate belongs to family Lyhraceae, due to response

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Received:11/12/2019; accepted:25/3/2020

DOI: 10.21608/EJFS.2020.20365.1032

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to higher technological practices, therapeutic values, fine table and excellent keeping quality, minimum water requirements, export possibility pomegranate have made highly gainfull and its high hardly nature as reported by Afaq *et al.* (2003). Moreover, the pomegranate (*Punicagranatum Punicaceae*) is known as a vital health-promoting characteristic according to his antimicrobial, antioxidant, anticancer, antiviral and anti-mutagenic effects (Negi *et al.*, 2003).

Aril is the edible part of the pomegranate fruit constituting 52% of the total fruit weight (w/w) in comparable with 22% arils and 78% juice. The aril of pomegranate are rich in vitamin K, vitamin C and antioxidant and polyphenols which are such as anthocyanin, tannins and quercetin which have good effects for heart and have anti-cancer properties (Kulkarni and Aradhya, 2005 and Adams *et al.*, 2016).

In addition, Pomegranate consumption is good source of flavonoids which help in reducing risk. Analysis of the edible portion of the fruit evident clear that it contents nearly all essential nutrients including minerals and vitamins (Sanghavi, 1997).

Pomegranate arils in “ready to eat” form will be a suitable and desired alternate to promote the fresh fruits consumption and increase pomegranate agriculture in future. Pomegranate consumption is an exclusive problem whereas, its difficult to peel it to obtain the arils. The pigmented products in pomegranete arils, problem appeared such as the discoloration caused by oxidation of phenolic compounds stimulated by phenolases (Gil, *et al* 1996). Constancy of pomegranate arils color must be kept, because its color is the important quality characteristics for consumers. Pomegranate arils should be washed with citric acid and ascorbic acid as antioxidants to deny grow of microorganisms, because it’s minimum post-harvest life (Sepulveda *et al.*, 2001).

Results found that the different pre-treatments of the pomegranate arils for quality exports lead up to the development of appropriate technologies to export it from place to others. However, little works on different pre-treatments of pomegranate arils has been well-done. Therefore, a study has been undertaken to know the effect of thermal and chemical pre-treatments on shelf life and quality of pomegranate arils.

Traditionally, the present study was done to

evaluate the different pre-treatments (thermal or chemical) to obtain a good quality of arils preserved.

There is little published material on the manufacture, composition, packaging, storage and quality of pomegranate arils. The storage and quality of pomegranate arils is significantly influenced by the processing conditions such as type of preserving method, T.S.S., acidity, moisture, hardness of seeds, reducing sugars, species and cultivar of pomegranate *etc.* however, very little information is available on the influence of these factors on pomegranate arils. Efforts have been made in this investigation to study the preserving of pomegranate aril with different thermal and chemical pre-treatments to increase shelf life and maintain quality of arils.

Materials and Methods

The present experiment was carried out at Food Technology Department, National Research Centre, and Cairo, Egypt. The experiment was conducted by washing the minimally processed pomegranate arils with antioxidants *viz.*, sodium hypochlorite (SH) 200ppm for 5minutes in replicated thrice. After peeling, arils tested by different thermal and chemical pre-treatments including:

Thermal pre-treatments

Water blanching for 2minutes and steam blanching for 2minutes, and then arils cooled in cooled water and dried in air for 30 min at 23°C to remove residual water before analysis.

Chemical pre-treatments

Also, arils were divided into uniform groups (120 g) and each was dipped in 5 L of appropriate solution of sodium metabisulfite (1000ppm), then 1.5gm of sodium metabisulphite dissolved in 1 litre of water will give 1000ppm (0.1%) SO₂ ([Regulation \(EU\) No. 1169/2011](#)) and Potassium sorbate (1000ppm) (as a Food and Agriculture Organization of the United Nations) pre-treatments were carried out at 23°C for 5minutes. Then arils were air dried for 30 min at 23°C to remove residual water before analysis. All untreated and treated samples were storage at 4°C for 21 days and the following parameters were analyzed after zero, 7, 14 and 21 days.

Physical and chemical analysis

Chemical changes were determined by sampling during the processing in 24 hr intervals.

A digital pH meter (HANNA, HI 902 meter, Germany) was used for pH measurements. Titratable acidity of pomegranate juice samples, expressed as percent citric acid, was determined by titrating with titrazol 0.1 N NaOH (Merck, Germany) to pH 8.2 according to the method reported by Tung-Sun et al. (1995). The pH of untreated, thermal and chemical pre-treated arils pomegranate samples was measured using a digital pH-meter (HANNA, HI 902 meter, Germany). The percent of Total Soluble Solids (TSS), expressed as °Brix (0-32), was determined with a Hand refractometer (ATAGO, Japan). Titratable acidity of untreated, thermal and chemical pre-treated arils pomegranate samples was determined according to the method reported by Tung-Sun et al. (1995).

Color characteristics:

Color of pomegranate arils control, thermal and chemical pre-treated samples was measured using spectro-colorimeter (Tristimulus Color Machine) with the CIE lab color scale (International Commission on Illumination) as mentioned by Hunter (1975). Color of arils pomegranate control and pre-treated samples was measured using a Hunter Lab colorimeter Hunter a*, b* and L*. Parameters were measured with a color difference meter using a spectro-colorimeter (Tristimulus Color Machine) with the CIE lab color scale (Hunter, Lab Scan XE - Reston VA, USA) in the reflection mode. The instrument was standardized each time with white tile of Hunter Lab Color Standard (LX No.16379): X= 72.26, Y= 81.94 and Z= 88.14 (L*= 92.46; a*= -0.86; b*= -0.16). The instrument (65°/0° geometry, D25 optical sensor, 10° observer) was calibrated using white and black reference tiles. The color values were expressed as L* (lightness or brightness/ darkness), a* (redness/greenness) and b* (yellowness/blueness). The Hue (H)*, Chroma (C)* and Browning Index (BI) was calculated according to the method of Palou et al., (1999) as follows:

$$H^* = \tan^{-1} [b^*/a^*] \dots \dots \dots (1)$$

$$C^* = \text{square root of } [a^{*2} + b^{*2}] \dots \dots \dots (2)$$

$$BI = [100 (x-0.31)] / 10.72 \dots \dots \dots (3)$$

$$\text{Where: } - X = (a^* + 1.75L^*) / (5.645L^* + a^* - 3.012b^*)$$

$$\Delta E = (\Delta a^2 + \Delta b^2 + \Delta L^2)^{1/2} \dots \dots \dots (4)$$

Where, all values were recorded as the mean of triplicate readings.

Non-enzymatic browning determination:

Non-enzymatic browning was measured spectrophotometrically by 4054 - UV/Visible spectrophotometer, (LKB-Biochrom Comp., London, England), as absorbance at 420nm using ethanol as blank according to the method of Birk et al.,(1998).

Determination of total phenolic content:

The total phenolic content was determined according to the Folin-Ciocalteu procedure (Zilic et al., 2012). Briefly, the extract (100 µL) was transferred into a test tube and the volume adjusted to 3.5 mL with distilled water and oxidized with the addition of 250 µL of Folin-Ciocalteu reagent. After 5 min, the mixture was neutralized with 1.25 mL of 20% aqueous sodium carbonate (Na₂CO₃) solution. After 40 min, the absorbance was measured at 725 nm against the solvent blank. The total phenolic content was determined by means of a calibration curve prepared with gallic acid, and expressed as milligrams of gallic acid equivalent (mg GAE) per g of sample. Additional dilution was done if the absorbance value measured was over the linear range of the standard curve.

Determination of anthocyanins content:

Concentration of total anthocyanins (TACN) was determined by the pH differential method as described by Wrolstad (1976). Absorbance was measured in the spectrophotometer at 515nm and at 700 nm in buffer pH 1.00 and pH 4.50, using $A = (A_{515} - A_{700})_{pH 1.00} - (A_{515} - A_{700})_{pH 4.50}$. Results were expressed as milligrams of cyanidin-3-glucoside equivalent per liter of fresh weight using an extinction coefficient of 29600 and molecular weight of 445.2 g mol⁻¹.

Sensory evaluation

The sensory evaluation for assessing the color, odour, taste and texture was done by semi-trained panel of judges with the help of 10 - point hedonic scale. The panel was composed of eleven panellists and staff from the Department of Food Technology at National Research Centre. Color, odour, taste, and texture of the pomegranate arils samples were determined using a ten point scale (10 = excellent and 1 = bad) as described by García et al., (2001) and Bertolini et al., (2008). The limit of the acceptability was 5. Samples were served in a randomized complete block design with all panellists evaluating all samples at one sitting. Sample order presentation was randomized. Three replications were completed.

Statistical analysis

Experiments were carried out in triplicate, and each sample was analysed in duplicate. The results are expressed as Mean. The two way analysis of variance (ANOVA) was used to analyze the experimental data (SAS 9.1 software Institute Inc., Cary, NC, USA). Mean analysis using Duncan's multiple range tests was carried out if needed. The obtained results were analyzed statistically using the analysis of variance (ANOVA with two ways) as described by Richard and Gouri, (1987).

Results and Discussion

Effect of pre-treatment and storage time on physicochemical composition of arils pomegranate

The Total soluble solids (TSS) content decreased during storage of pomegranate arils from 14 to 13 in all untreated and treated samples through 21 days storage at 4°C (Table 1). The minimum TSS (13) was recorded in all pomegranate arils control and pre-treated samples after 21 days storage at 4°C. This may be due to concentration of sugars on samples. Similar finding also reported by More *et al.* (2017). Total acidity that means the fruit contains citric acid as the main acid besides oxalic acid, succinic acid, tartaric acid and malic acid (Saxena *et al.* 1987). The titratable acidity decreased from 0.1968 to 0.1248 during storage from 0 to 21 days of pomegranate arils by SO₂ pre-treatment. Maximum T. acidity (0.2304) was recorded in control (without-pre-treatment) samples where as minimum T. acidity (0.1248) was recorded in SO₂ pre-treated samples. Pomegranate arils samples had more acidity in control (without-pre-treatment) than water blanching, steam blanching, SO₂ and PS pre-treated samples during storage at 4°C for 21 days. Results showed that the total acidity is increased in the sulphured sample (SO₂) might be due to forming of sulphurous acid (Dabhade and Khedkar 1980). The pH also decreased during storage from zero time to 21 days in control (without-pre-treatment) and water blanching pre-treated, but increased in steam, SO₂ and PS pre-treated pomegranate arils. Maximum pH (4.215) was recorded in SO₂ pre-treatment samples where as minimum pH (3.625) was recorded in control (without-pre-treatment) samples. Pomegranate arils samples had higher pH in SO₂ pre-treatment than in control (without-pre-treatment) samples during storage at 4°C for 21 days, as seen in Table 1.

Effect of pre-treatment and storage time on color characteristics and their parameters of arils pomegranate

Changes in the aril pomegranate color was brightness, redness and yellowness with respect to Hunter color of L*, a* and b* values as a good

indicator. The arils pomegranate fruit became red color may be due to increase anthocyanin pigments.

After 21 days storage at 4°C, results found that the maximum color values of L*, a* and b* in water blanching pre-treated arils pomegranate were 31.1, 33.71 and 11.68 and the lowest values in control (without-pre-treatment) arils pomegranate samples were 25.58, 26.04 and 11.22, respectively (Table 2). Also after 21 days storage at 4°C, results found that the maximum values of ΔE, C*, H* and BI in water blanching pre-treated arils samples were 71.5, 35.67, 19.11 and 494.67 and the lowest values were PS pre-treatment arils samples were 70.39, 27.04, 23.03 and 355.65, respectively (Table 2).

During 21 days storage at 4°C as a good storage period the color characteristics values of pre-treated arils pomegranate decreased in L*, a* & b*-values. However, increase in a*-values with respect to produce of browning compounds or increase of anthocyanins pigments and decrease in L*- values indicates that the pre-treated arils pomegranate become darker than untreated samples (Ayhan and Esturk 2009 and Ramesh *et al.* 2017).

Effect of pre-treatment on Non-enzymatic browning, anthocyanine and total phenol contents of arils pomegranate

Total anthocyanin content, total phenol content and non-enzymatic browning of pomegranate arils was determined immediately peeling, as seen in Table (3). Control pomegranate arils showed higher anthocyanin content as compared to all pre-treated aril samples. Additionally, our results showed that SO₂ pre-treatment reduced degradation of anthocyanins in pomegranate arils.

Data illustrated in Table 3 revealed that the concentration of total anthocyanine (TACN) in pomegranate arils samples decreased from 62.09mg/100ml in control to 62.82mg/100ml in water blanching samples, as seen in table 3. Approximately, no differences in the total anthocyanines (TACN) of pomegranate arils with steam blanching, So₂ and potassium sorbate samples. Decreasing b*-values results were identical to decreasing total anthocyanines (TACN) results by decreasing TACN in water blanching pretreated samples, but increased in control samples, as seen in tables 2&3. However, anthocyanine pigments were heat sensitive and preferably be used as a guide of food product quality.

TABLE 1. Effect of pre-treatments and storage time on Physico-chemical properties of pomegranate arils.

Treatments	Zero time			7 days storage			14 days storage			21 days storage		
	Ph	T.acidity	TSS	Ph	T.acidity	TSS	Ph	T.acidity	TSS	Ph	T.acidity	TSS
Control	3.765	0.1824	14	3.380	0.2304	14	3.455	0.1920	13	3.625	0.2208	13
WB	3.860	0.1776	14	3.515	0.1872	14	3.825	0.1632	13	3.690	0.1776	13
SB	3.785	0.1728	14	3.620	0.1632	14	3.59	0.1728	13	4.100	0.1536	13
SO ₂	3.705	0.1968	14	3.745	0.1584	14	3.6	0.1632	13	4.215	0.1248	13
PS	3.795	0.2256	14	3.705	0.1536	14	3.515	0.1872	13	3.955	0.1584	13

* Water blanching (WB), Steam blanching (SB), sodium metabisulfite (SO₂) and Potassium sorbate (PS).
T. acidity expressed as percent citric acid and TSS expressed as °Brix or %.

TABLE 2. Effect of pre-treatments and storage time on color characteristics and their parameters of pomegranate arils.

Treatments	Storage time at 10 °C								
	L*	a*	b*	ΔE	R420	R400	C*	H*	BI
Zero time									
Control	26.86	23.53	13.63	71.34	2.455	1.955	27.19	31.6	357.17
WB	29.75	29.77	12.04	70.92	3.83	3.22	32.11	22.03	428.75
SB	30.12	26.37	12.66	69.28	3.46	2.77	29.25	25.67	348.34
SO ₂	23.92	24.76	12.2	74.27	2.29	1.99	27.6	26.2	465.37
PS	25.41	24.73	11.82	72.82	2.48	2.075	27.41	25.6	416.39
7 days storage									
Control	23.67	25.67	12.73	74.93	2.155	1.805	28.65	26.36	508.57
WB	33.005	28.42	10.75	67.23	4.725	3.75	30.39	20.73	327.16
SB	27.19	26.27	12.96	71.95	2.63	2.12	29.3	26.29	421.62
SO ₂	26.475	24.96	13.53	72.28	2.42	2.00	28.4	28.43	402.56
PS	25.22	27.51	12.88	74.2	2.42	1.98	30.37	25.08	514.72
14 days storage									
Control	19.92	21.66	7.55	76.45	2.12	2.08	22.94	19.1	548
WB	34.97	25.99	8.51	64.19	6.02	5.16	27.34	18.14	253.45
SB	24.89	27.58	9.77	73.56	3.06	2.79	29.26	19.5	518.69
SO ₂	24.78	25.04	10.67	73.35	2.63	2.32	27.22	23.08	438.82
PS	27.45	23.37	10.36	70.25	2.99	2.47	25.56	23.9	327.32
21 days storage									
Control	25.58	26.04	11.22	73.06	2.6	2.19	28.35	23.32	445.1
WB	31.1	33.71	11.68	71.5	4.7	4.21	35.67	19.11	494.67
SB	27.56	25.18	11.47	70.98	3.08	2.59	27.67	24.52	369.5
SO ₂	26.63	24.78	11.52	71.69	2.87	2.48	27.32	24.94	382.14
PS	28.09	25.22	10.72	70.39	6.23	3.08	27.4	23.03	355.65

* Water blanching (WB), Steam blanching (SB), sodium metabisulfite (SO₂) and Potassium sorbate (PS).

TABLE 3. Effect of pre-treatments on Non-enzymatic browning, anthocyanine and total phenol contents of pomegranate arils.

Treatments	Total phenol contents (µm/100ml)	Anthocyanine (mg/100ml)	NEB (OD at 420nm)
Control	0.078±0.09	62.09±0.12	0.129±0.22
WB	0.078±0.05	52.82±0.14	0.136±0.24
SB	0.078±0.02	57.33±0.15	0.128±0.37
SO ₂	0.078±0.04	58.75±0.19	0.121±0.18
PS	0.078±0.06	58.68±0.24	0.118±0.21

* Water blanching (WB), Steam blanching (SB), sodium metabisulfite (SO₂) and Potassium sorbate (PS). ± Standard Deviation (SD) /SQR² (n), where, n=3

Also, the results showed that the non-enzymatic browning was low in SO₂ and PS pre-treatment pomegranate arils samples (0.121 and 0.118 OD_{420nm}) compared with 0.129 OD_{420nm} in control (without-pre-treatment) pomegranate arils samples. The total phenol content was 0.078 µm/100ml for control (without-pre-treatment) and all pretreatments pomegranate arils samples. However, all pretreatments did not effect on total phenol contents, as cleared in Table (3).

Effect of pre-treatment and storage time on microbiological counts evaluation of arils pomegranate:

Total microbial count in different thermal and chemical pre-treatments was showed in (Table 4). Total microbial count in log CFU/g was determined for minimally processed and stored arils over the storage period for all thermal and chemical pretreatments. Therefore, the thermal and chemical pre-treatments killed or delayed the growth of microorganisms. The safe maximum microbial limit set by international legislation for fresh-cut vegetables and fruit, minimally processed, as well as pre-treated arils pomegranate is log 7 CFU/g is considered for storage studies (Lopez-Rubira *et al.*, 2005). Thus, neither untreated nor thermal and chemical pre-treated arils surpassed exceeded the maximum microbial limit during this trial (< log 1.85 CFU/g).

Control samples were having higher microbial count (yeast and molds counts and total plate bacterial counts) at the end of storage period. On 21th day of storage the least microbial count was observed for samples chemical pre-treated with SB and WB, then chemical pre-treated with SO₂ and PS.. The total plate bacteria in SO₂ pretreated samples were in the range of 0.00 to 1.627 log CFU/g during 21 days of storage while yeast and mold count were in the range of 0.00 to 1.7 log CFU/g.

Lopez-Rubira *et al.*, (2005) founded that the microbial counts of UV-C pre-treated arils pomegranate stored at 5°C increased throughout shelf life. The range of 0.00 to 4.52 log CFU/g. was showed in the fungal count during 19 days of storage while the range of 0.00 to 4.53 log CFU/g were seen in aerobic mesophilic bacteria counts.

Effect of pre-treatment and storage time on Sensory evaluation of arils pomegranate:

The sensory evaluation score of pomegranate arils samples with the pre-treatments and storage a 4°C for 21 days presented in (Table 5). The maximum color score by visualized recorded (9.0^a) in SO₂ and PS pre-treatment of arils pomegranate samples. The maximum odor score of arils pomegranate was recorded (8.5^a and 8^b) in untreated and SO₂ pre-treatment arils samples. The maximum taste score and texture was recorded (8.5^a and 8.6^a) in SO₂ pre-treatment aril samples. The similar results are reported by Chauhan *et al.* (1994) and More *et al.* (2017) the sensory characteristics tested (color, texture, taste and odor) was observed that the SO₂ pre-treated arils samples had maximum values after 21 days storage at 4°C whereas water blanching pre-treated arils sample had minimum values (Table 5). The presence of low brown color in arils pomegranate is due to better color values, While the low humidity in the arils pomegranate leads to a good texture of arils omegranate and long-term storage at 4 ° C for arils pomegranate it retains the taste and smell of Arils, thus improving general acceptance. Retained of flavor and color properties during storage of arils pomegranate may be due to the SO₂ pre-treatment effect as results demonstrated by Joslyn and Braverman (1954) and Thakur *et al.* (2010).

TABLE 4. Effect of pre-treatments and storage time on Microbiological evaluation of pomegranate arils.

Treatments	Total plate Bacterial count (log CFU/g)				Yeast and molds count (log CFU/g)			
	zerotime	7days	14days	21days	zerotime	7days	14days	21days
Control	0	1.230	1.420	1.780	0.650	1.540	1.670	1.850
WB	0	0	0.239	1.320	0.301	0.588	0.874	1.319
SB	0	0	0	0.972	0.301	0.900	0.998	1.359
SO ₂	0	0.690	0.850	1.700	0.389	1.360	1.423	1.627
PS	0	1.017	1.094	1.504	0.651	1.397	1.462	1.591

* Water blanching (WB), Steam blanching (SB), sodium metabisulfite (SO₂) and Potassium sorbate (PS).

TABLE 5. Effect of pre-treatments and storage time on Sensory evaluation of pomegranate arils after 21 days storage

Treatments	Odor	Taste	Texture	Color
Control	8.5 ^a	8.5 ^a	8.5 ^b	8.5 ^b
WB	4.5 ^f	4.6 ^f	4.5 ^f	4.4 ^f
SB	5.6 ^d	6.6 ^d	6.0 ^d	7.0 ^c
SO ₂	8.0 ^b	8.5 ^a	8.6 ^a	9.0 ^a
PS	7.0 ^c	8.0 ^b	8.6 ^a	9.0 ^a

* Water blanching (WB), Steam blanching (SB), sodium metabisulfite (SO₂) and Potassium sorbate (PS).

Sensory evaluation was done on nine point hedonic scale by trained sensory panelist. (Table 5) showed that 21th sensory score. The control sample has lower sensory score up to 21 days of storage at 4°C. The average scores for sensory evaluation of pomegranate arils stored for 21 days. The sensory score revealed that there was not much variation in color scores over the storage period however other parameters such as taste, texture, and odor varied much over storage period. On 21th day of storage highest sensory score was observed for arils treated with SO₂ and PS pre-treated pomegranate arils.

Conclusion

Pomegranate arils fruit is well known for its nutritional and medicinal value, which used for better digestion. Results showed that, the arils pomegranate fruit pre-treated with SO₂ was good with quality, flavor, color, texture and taste over the other of thermal and chemical pre-treatments. Pomegranate arils fruit pretreated with SO₂ and PS showed increased shelf life to 21 days and it was found to be good in quality properties in terms of color characteristics, TSS highest (as sugars) and sensory properties. Also, results suggested that the SO₂ was to be better pretreatments in increasing the shelf life up to 21 days on the basis of sensory and microbial quality parameters maintaining the arils pomegranate quality during storage at 4°C. The thermal and chemical pre-treatments such as water blanching (WB), steam blanching (SB), sodium metabisulfite (SO₂) and potassium sorbate (PS) can be applied for increasing shelf life of pomegranate arils maintaining the functional compounds during storage at 4°C.

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