



## Effect of water dipping on separation techniques of pomegranate (*Punica granatum* L.) arils

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**Abstract:** For easy separation of arils, pomegranate fruits were subjected to hot water dipping and normal water dipping treatments. Minimum time of separation as 4.10 min/kg of fruit was observed in case of hot water ( $80\pm 2^\circ\text{C}$ ) dip for 2 min which was at par with hot water ( $80\pm 2^\circ\text{C}$ ) dip for 1 min as 4.7 min/kg. All treatments saved time over the traditional method but only hot water dipping was significant without any significant adverse effect on aril quality in comparison with traditional method except anthocyanin and phenols. Anthocyanin content reduced and phenols content increased in comparison to traditional method.

**Keywords:** Arils, Pomegranate, Separation, Water dipping

### INTRODUCTION

Pomegranate (*Punica granatum* L.) belongs to the plant family Punicaceae. According to Smith (1979), *P. granatum* has chromosome number  $2n = 16$  whereas doubled flower varieties have  $2n=18$ . According to De Candolle pomegranate is an ancient fruit which has originated from South-West Asia, probably in Iran and some adjoining countries. Even though native to Iran, it is extensively cultivated in Spain, Morocco, Egypt, Afghanistan and Baluchistan. In India, it is found from Kashmir to Kanyakumari but is cultivated commercially on large scale only in Maharashtra. Small scale plantations are also seen in Gujrat, Rajasthan, Karnataka, Tamil Nadu, Andhra Pradesh, Uttar Pradesh, Punjab and Haryana. In India, it is considered as a crop of the arid and semi-arid regions because it withstands different soil and climatic stresses (Kaulgud, 2001). In India, it is cultivated on a small scale covering an area of 0.13 million ha with production of 1.34 MT and productivity of 10.3 MT/ha (Saxena and Gandhi, 2014).

The fruit known as balausta ripens towards August to September and are handpicked. Fruits are borne terminally on short spurs from mature shoot. They are non climacteric in nature based on the pattern of  $\text{CO}_2$  and ethylene production. Pomegranate fruit consists of three parts: the seeds, the juice and the peels which include the husk and interior network membranes. The edible portion (arils-bright red pulp surrounding the individual seed) is about 45-61% of total fruit weight and consists of about 60 – 85% juice and 15 – 25% seeds (Lee *et al.*, 1974, Al-Maimam *et al.*, 2002, Patil *et*

*al.*, 2002, Kader, 2006) and 33 – 40% peel (Jagtap *et al.*, 1992). Pomegranates are a well-known source of many valuable substances, such as hydrolyzable tannins (punicalagins and punicalins) (Gil *et al.*, 2000), condensed tannins (proanthocyanidins) (Poyrazoglu *et al.*, 2002), anthocyanin (Hernandez *et al.*, 1999), phenolic acids (gallic acid and ellagic acid) (Mousavinejad *et al.*, 2009) and organic acids (Poyrazoglu *et al.*, 2002). All these compounds show high antioxidant activity (Garcia-Alonso *et al.*, 2004) and induce health benefits against cancer, cardiovascular diseases and other diseases (Sun *et al.*, 2002). The removal of arils from pomegranate is a difficult process, since the arils of pomegranate are tightly adhered to each other. Removal of seeds manually results in staining of hands and dress of the workers. Moreover, it is labour consuming. Therefore, it is necessary to standardize different separation techniques for separation of pomegranate aril. Keeping in view the above mentioned points, the study is planned with the following objective;

To standardize the separation techniques of pomegranate arils.

### MATERIALS AND METHODS

Medium sized fruits of pomegranate cv. Wonderful were selected for separation. For each treatment four medium size fruits were taken. Before separation the fruits were subjected to following treatments:

T<sub>1</sub> - Traditional method\*

T<sub>2</sub> - Hot water ( $80 \pm 2^\circ\text{C}$ ) dip for 1min

T<sub>3</sub> - Hot water (80 ± 2°C) dip for 2 min

T<sub>4</sub> - Water (30 ± 2°C) dip for 5 min

T<sub>5</sub> - Water (30 ± 2°C) dip for 10 min

Note\* Separation of arils was done manually without any water dipping.

After the treatments, the seeds were separated manually using a stainless steel knife, giving vertical cut to the fruits and collecting the seeds.

The chemical characteristics of arils after separation were determined as described below. TSS and pH were determined by using hand refractometer and pH metre respectively. Titrable acidity and ascorbic acid content were determined by AOAC (2000). Sugars were estimated by using the method of Hulme and Narain (1993). Anthocyanin content was estimated by pH difference method (Kirca et al., 2007). Total phenols were estimated by the method of Swain and Hillis (1959). All the statistical analysis was carried out by using OPSTAT statistical software.

## RESULTS AND DISCUSSION

All the treatments saved time over the traditional method but only hot water dipping were significant. Since the arils were tightly adhered to the outer layer and with the peel, the traditional method was difficult and took maximum time (8.78 min/kg) for separation of arils from fruit followed by water (30±2°C) dip for 10 min, water (30±2°C) dip for 5 min, hot water (80±2°C) dip for 1 min, hot water (80±2°C) dip for 2 min. Minimum time of separation as 4.10 min/kg of fruit was observed in case of hot water (80±2°C) dip for 2 min which was at par with hot water (80±2°C) dip for 1 min as 4.70 min/kg. A similar result was also reported by Aghajain *et al.* (2012) and Parashar *et al.* (2009) in pomegranate treated with hot water for easy aril separation.

There was no significant difference between the treatments for TSS, pH and ascorbic acid content of the fresh arils. Similar result was found by Palma *et al.* (2013) in tarocco oranges for soluble solid content of the fruit. Djiova *et al.* (2009) found similar result for TSS in mangoes. No significant difference between the treatments was found for ascorbic acid content of arils though

contradictory results were reported by Aghajain *et al.* (2012) and Parashar *et al.* (2009). Aghajain *et al.* (2012) and Parashar *et al.* (2009) found that the acidity and ascorbic acid content of the pomegranate aril separated by hot water dip was high.

Acidity was significantly at 5% level of significance affected by the water dipping. Maximum acidity was found in case of water (30±2°C) dip for 10 min (1.03%) followed by water (30±2°C) dip for 5 min (0.97%), hot water (80±2°C) dip for 2 min (0.86%), traditional method (0.73%) and minimum in hot water (80±2°C) dip for 1 min (0.66%). The highest amount of titrable acidity related to fruits which exposed to cold water dipping treatments. Aghajain *et al.* (2012) reported similar result. They found that titrable acidity of pomegranate aril separated by hot water dip was less than cold water dip and control method.

The anthocyanin content of arils was significantly affected at 5% level of significance with different water dipping methods. Maximum anthocyanin content was found in case of water (30±2°C) dip for 10 min followed by water (30±2°C) dip for 5 min and traditional method. Minimum anthocyanin content was recorded in case of hot water dipping. Minimum anthocyanin content may be due to degradation of anthocyanin pigments by hot water dipping of fruits.

Water dipping treatments affect the phenols content significantly at 5% level of significance. Maximum phenol content was recorded in case of hot water (80±2°C) dip for 1 min (34.66 mg/100g) which was at par with water (30±2°C) dip for 10 min (34.16 mg/100g), water (30±2°C) dip for 5 min (33.33 mg/100g), hot water (80±2°C) dip for 2 min (32.83 mg/100g) and minimum phenol of 26.33 mg/100g was found in case of traditional method. Palma *et al.* (2013) found that there was no significant difference between the different water treatments for total phenols in tarocco oranges.

Total sugars, reducing sugars and non reducing sugars of arils were significantly affected at 5% level of significance by water dipping. Total sugars were highest in case of hot water dipping which was at par with water (30±2°C) dip for 5 min and traditional method.

**Table 1.** Effect of water dipping on separation of arils of five pomegranate fruits per treatment with 3 replication of pomegranate cv. Wonderful.

Treatments	Fresh fruit average weight (kg)	Aril average weight (g)	Rind average weight (g)	Separation time (min/kg)
Traditional method	1.17	594.33	565.00	8.78
Hot water (80±2°C) dip for 1 min	1.34	683.33	641.00	4.70
Hot water (80±2°C) dip for 2 min	1.28	669.33	596.00	4.10
Water (30±2°C) dip for 5 min	1.27	665.33	582.00	6.81
Water (30±2°C) dip for 10 min	1.21	635.00	544.00	7.06
C.D. (P ≤ 0.05)				2.17

**Table 2.** Effect of water dipping on TSS, pH, ascorbic acid, acidity, anthocyanin, phenols, total sugars, reducing sugars and non reducing sugars of fresh arils of five pomegranate fruits per treatment with 3 replication.

Treatments	TSS (°Brix)	pH	Ascorbic acid (mg/100g)	Acidity (%)	Anthocyanin (mg/100g)	Phenols (mg/100g)	Total sugars (%)	Reducing sugars (%)	Non reducing sugars (%)
Traditional method	13.33	4.01	13.16	0.73	24.89	26.33	8.43	8.19	0.24
Hot water (80±2°C) dip for 1 min	13.33	4.55	11.84	0.66	14.45	34.66	9.30	8.20	1.10
Hot water (80±2°C) dip for 2 min	13.33	4.57	11.18	0.86	13.46	32.83	9.59	7.59	2.00
Water (30±2°C) dip for 5 min	12.66	4.40	11.83	0.97	27.20	33.33	9.01	7.12	1.89
Water (30±2°C) dip for 10 min	12.16	4.26	9.21	1.03	32.77	34.16	7.42	6.10	1.31
C.D. (P≤ 0.05)	NS	NS	NS	0.25	3.09	5.35	1.28	1.07	1.10

Minimum content of total sugars were reported in case of water (30±2°C) dip for 10 min. Reducing sugars were found maximum in case of hot water dipping which was at par with traditional method. Increases of reducing sugar during hot water dip may be due to inversion of sucrose content of arils which produce by heat. A similar observation has been reported by Aghajain *et al.* (2012) and Parashar *et al.* (2009) for reducing sugars of pomegranate aril treated with hot water dip and Minimum amount of reducing sugars were found in water (30±2°C) dip for 10 min. which may be due to entry of water into the fruit. Maximum non reducing sugars were found in hot water (80±2°C) dip for 2 min. which was at par with water (30±2°C) dip for 5 min., water (30±2°C) dip for 10 min., hot water (80±2°C) dip for 1 min. and minimum non reducing sugars were recorded in traditional method. The variation in non reducing sugar content of arils may be due to the variation in fruit non reducing sugar that are used for water dipping treatment

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