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Effect of drying process on phenolic compounds and antioxidant capacity of pomegranate (*Punica granatum* L.) fry flowers

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Abstract. The pomegranate (*Punica granatum* L.) is an important medicinal plant. It has been reported that phenolic compounds contained in the flowers have antioxidant potential. The objective was to determine the concentration of total phenolics and antioxidant capacity of three selections of pomegranate flower dried under different conditions. The highest phenolic content and antioxidant capacity was observed in the orange colored flowers dried at room temperature. Compared to red and dark red flowers, the dark red showed higher anthocyanins. The room temperature and oven drying processes preserved a higher content of phenols compared to sun drying. The results showed that orange pomegranate flowers dried at room temperature could be used for the preparation of antioxidant beverages.

Keywords. Pomegranate flower – Phenolic compounds – Antioxidant capacity – Drying process.

I – Introduction

Pomegranate (*Punica granatum* L.) flowers have a wide variety of bioactive compounds of therapeutic value and have been used in India's traditional medicine to treat diabetes (Lansky and Newman, 2007). Studies related to pomegranate flower extract have shown hypoglycemic activity, reduction of total cholesterol, tryglicerides and LDL-C in serum and also a potent antioxidant effect (Huang *et al.*, 2005; Bagri *et al.*, 2009). Currently in Mexico, the Instituto Nacional de Investigaciones Forestales, Agricolas y Pecuarias (INIFAP) is involved in the genetic improvement of pomegranate, and their goal is to enhance the quality of the products and productivity of the pomegranate orchards in the benefit of small farmers. In this study flowers from different genotypes developed by INIFAP were used. These genotypes are characterized by its profuse flowering and deep red color, suggesting they could present high antioxidant capacity.

II – Materials and methods

1. Plant material

The pomegranate flowers were harvested during April 2008 at the Bajio Research Station (INIFAP) located in Celaya, Gto, México. The selections evaluated are characterized by abundant flowering of orange, red and dark red color. They were collected on a piece of white non-woven fabric of polypropylene (Agribon®), placed underneath the tree canopy. Thereafter they were subjected to three drying methods; sun drying (25 ℃, 48 h), room temperature (20-22℃, 48 h) and convective oven (50 ºC, 48 h).

2. Preparation of pomegranate flowers (PGF) aqueous extract

One gram of ground pomegranate dry flowers was boiled in 100 ml of distilled water during 10 min, the aqueous extract was stirred for 1h and filtered through a Whatman filter and restored to a 1% (w/v) volume.

3. Determination of phenols and antioxidant capacity

The determination of total phenols was performed by the spectrophotometric method of Folin-Ciocalteu (Singleton *et al*., 1999). Anthocyanins were determined by the method of Abdel-Aal and Hucl (Abdel-Aal and Hucl, 1999). The capacity of the PGF to scavenge a free radical was determined by the method of van der Berg *et al.* (van der Berg *et al*., 1999).

4. Statistical analysis

The statistical analysis of data was performed by one-way ANOVA, and the differences among treatments were calculated by comparison of means using the Tukey-Kramer test. The level of statistical significance was taken at $P < 0.05$. All data are presented as mean ± SE.

III – Results and discussion

1. Effect of drying method on the concentration of phenolic compounds of pomegranate flower extracts

Maximum total phenol content was obtained in the orange flowers, dried at room temperature. This method [DH1] preserved the largest amount of these compounds, compared to the red and dark red colored flowers. Sun and oven dried processes did not show significant statistical differences (P <0.05) on total phenol content (Fig. 1). These results suggest that the content of phenolic compounds decreases at higher temperatures, similar results have been reported by other authors (Rozek *et al.*, 2008).

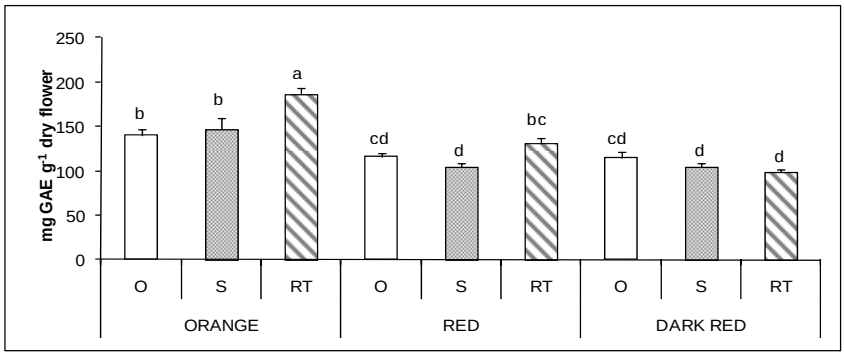

Fig. 1. Effect of drying method on the phenolic compounds in the aqueous extract of pomegranate flower selections. Different letters indicate significant statistical differences (p<0.05). (O) Oven (S) Sun (RT) Room temperature.

2. Effect of drying method on the concentration of anthocyanins of pomegranate flower extracts

In this study we found that dark red flowers dried in the oven and at room temperature have the highest concentration of anthocyanins, followed by red flowers, then orange flowers (Fig. 2). It has been suggested that the degradation of anthocyanins increases with the temperature (Gil *et al*., 2000), however, in the oven drying process and at room temperature the flowers contained the same anthocyanins concentration. One explanation for this event is that, the hydrolyzation of the pyrilium ring resulted in production of chalkons, which are responsible for brown color developed in food containing anthocyanin (Laleh *et al.*, 2006).

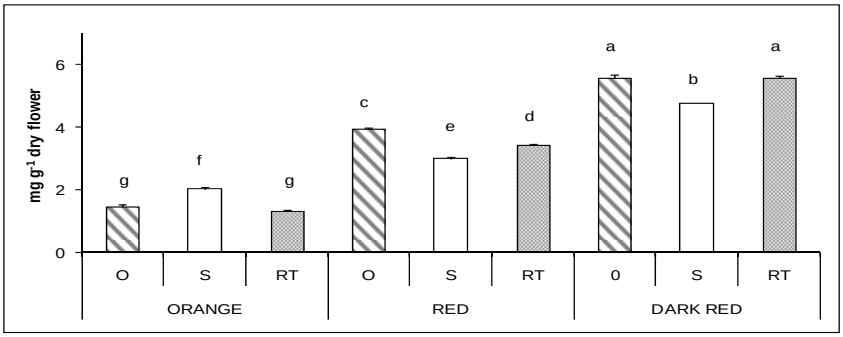

Fig. 2. Effect of drying processes on the anthocyanin content in the aqueous extract of pomegranate flower selections. Different letters indicate significant statistical differences ($p<0.05$). (O) Oven (S) Sun (RT) Room temperature.

3. Effect of drying processes on the antioxidant capacity of pomegranate flower aqueous extracts

The ABTS assay measures the antioxidant activity of hydrophilic and hydrophobic bioactive compounds (Re *et al.*, 1999). This study showed that the aqueous extract from orange flowers has the highest antioxidant capacity, followed by red and dark red flowers. Additionally, the room temperature drying process preserved the *in vitro* antioxidant potential of orange colored flowers. A different effect is observed for dark red flowers, which a sun drying process maintained the highest antioxidant potential. This result suggests that the antioxidant activity shown by each selection is due to the total phenol content.

IV – Conclusions

Our findings prove that the aqueous extract from orange flowers dried at room temperature preserved both, a highest phenolic content and in vitro antioxidant capacity, which suggests that this selection could be used for the preparation of beverages with antioxidant potential.

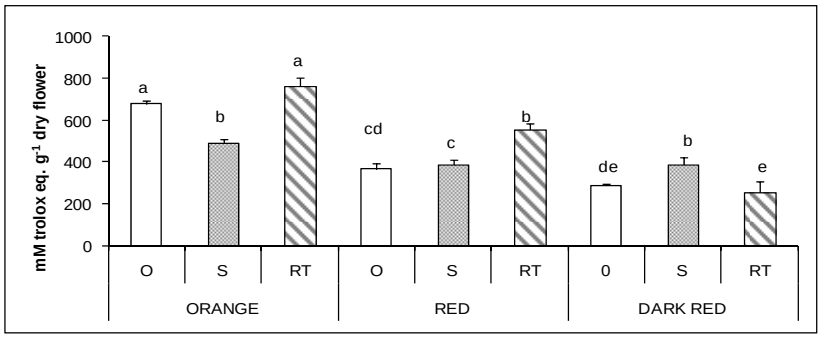

Fig. 3. Effect of drying processes on the antioxidant activity of aqueous extract of pomegranate flower selections. Different letters indicate significant statistical differences (p<0.05). (O) Oven (S) Sun (RT) Room Temperature.

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