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Optimization of pomegranate jam preservation conditions

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Abstract. One of the most important parameters to which consumers are sensitive when selecting jams is the color. Anthocyanin and colour development of pomegranate jams made from 'Mollar' cultivar were analysed during five months. Different temperatures (5ºC and 25ºC) and light exposures (daylight and darkness) were tested during storage. Also the influence of pectin on jam preparation was evaluated. The results concluded that high methoxy pectins yielded better pomegranate jams because of their high a* values (34% higher than low methoxy ones). Optimal storage conditions were achieved at 5ºC and no light exposure at all.

Keywords. Pomegranate – Jam – Anthocyanins – Color – Storage.

I – Introduction

Pomegranate fruits are rich in anthocyanins, pigments responsable for external and seed color development, being this a quality attribute. The following anthocyanins were identified in pomegranates: delphinidin 3-glucoside and 3,5-diglucoside, cyanidin 3-glucoside and 3,5-diglucoside, and pelargonidin 3-glucoside and 3,5-diglucoside (Gil *et al.*, 1995). Anthocyanins have a crucial role in the colour quality of many fresh and processed fruits. They are a good source of natural antioxidants, however, they are quite unstable during processing and storage. Temperature and time of processing (Markakis, 1982; Martí *et al.*, 2001) and storage (García-Viguera *et al.*, 1999) were found to exert a great influence on anthocyanin stability. Loss of anthocyanins have been attributed to many factors such as pH and acidity, phenolic compounds, sugars and sugar degradation products, oxygen, ascorbic acid, fruit maturity and thawing time (Markakis *et al.*, 1957; Withy *et al.*, 1993; García-Viguera *et al.*, 1998).

The effect of the pectin type on the jam colour has not been extensively studied. Although it has been suggested that pectin has a role in the colour degradation of the jam products (Lewis *et al.*, 1995). Kopjar *et al.* (2007) investigated the influence of different pectins and their concentration on the colour and texture of raspberry jams and they concluded that different pectins and their concentrations affect the colour and texture.

The objective of the present work was to evaluate anthocyanin content of pomegranate jam and its color development during storage under temperatures and light regimes. Also the influence of pectin on jam preparation was evaluated.

II – Material and methods

The pomegranate cultivar *Mollar* was used on this study since it is the largest cultivated in Spain. Fully ripe pomegranate fruits were harvested at the germplasm bank located at the Higher Polytechnic Agricultural College (Orihuela, Alicante, Spain) during the first half of October.

1. Jam preparation

Pomegranate jam was obtained according to a typical commercial protocol. Low and high methoxy pectins were used for jam production (Danisco Cultor España, S.A. (Grindsted® Pectin LA 210 and Grindsted® Pectin RS 400, respectively). Different types of jam were prepared:

(i) High methoxy pectin jam (HM) 350 g $kg^{-1}$of edible seeds, plus 1.65 g kg^{-1} of pectin, 3 g kg^{-1} of citric acid, 0.5 g kg^{-1} of ascorbic acid and 1 g kg^{-1} of sorbic acid. The final sucrose concentration was 65º Brix.

(ii) Low methoxy pectin jam (LM) recipe was 350 g $kg^{-1}$of edible seeds, plus 7 g kg^{-1} of pectin, 4,5 g kg^{-1} of citric acid, 0.5 g kg^{-1} of ascorbic acid and 1 g kg^{-1} of sorbic acid. The final sucrose concentration was 65º Brix.

2. HPLC anthocyanins analysis

Anthocyanins were extracted according to García-Viguera *et al.* (1997). An 1100 *Hewlett-Packard* High Performance Liquid Chromatograph (HPLC) was used for anthocyanin identification and quantification as described by García-Viguera *et al.* (1999).

3. Color measurements

A *Minolta* CR-300 color spectrophotometer was used for this study. Analyses were performed by reflection on a 2.5 mm thick sample placed over a white surface. L a* b* values were calculated using illuminant D65 (8 mm diameter measuring area) and a 10º observer.

4. Storage of pomegranate jam

Pomegranate jam samples were stored at different temperatures (5ºC and 25ºC) and light exposures (daylight and darkness). Both types of pomegranate jam (high and low methoxy pectin jam) were analysed after the preparation and after 30, 60, 90, 120 and 150 days of storage.

5. Statistical analysis

All data were subjected to statistical analyses. Analyses multifactorial ANOVA were performed along with the least significant difference tests (LSD) to detect any statistically significant differences ($p \leq 0.05$).

III – Results and discussion

When storage is done at 25ºC, anthocyanin total content went down quickly in both low and high methoxy pectin jams (Fig. 1). Regarding those jams stored at 5ºC, there were a 32% pigment degradation in HM ones and a 14% reduction in LM jams after 150 days. These results completely agreed with those obtained by García-Viguera (1999).

According to Markakis (1982), anthocyanin content could be negatively correlated to light exposure. Likewise, García-Viguera (1999) found no significant effect of light exposure on strawberry jam pigment composition. And these results could be definitively due to the protective effect of high amounts of sugar (Wrolstad *et al.*, 1990). All anthocyanin pigments showed a reduction over time. This statement completely agrees with pomegranate marmalade results obtained by Zafrilla *et al.* (1998).

Samples with high methoxy pectin had lower values of anthocyanins than samples with low methoxy pectin at 5ºC. Similar results were reported by Kopjar *et al.* (2007) on raspberry jam at 4ºC. This could be explained by interactions of anthocyanins and pectin. Regardless of

ingredients and storage conditions, pomegranate jams yielded the same predominant pigments. The most abundant ones were cyanidin 3-glucoside and 3,5-diglucoside. Degradation of them was quicker at 25ºC than at 5ºC storage (Figures 2 A and B).

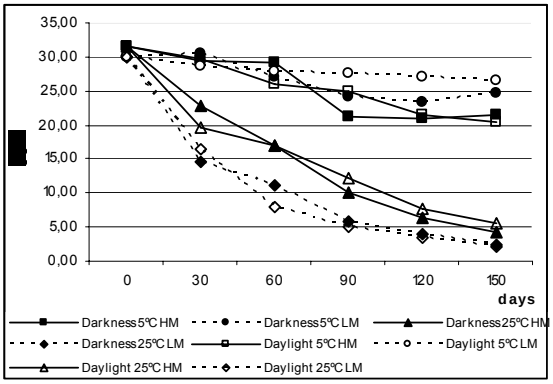

Fig. 1. Anthocyanin content evolution during storage conditions.

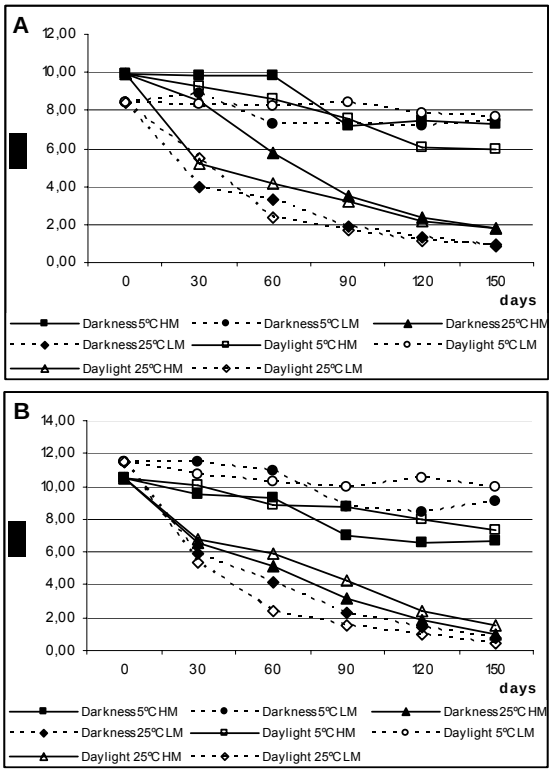

Fig. 2. Cyanidin 3,5-diglucoside (A) and cyanidin 3-glucoside (B) content development.

Regarding temperature effect on pomegranate jam color during storage conditions, there was a continuous decrease on a* values for both storage temperatures (Table 1).

Table 1. Temperature effect on pomegranate jam colour during storage

Storage (days)	a* ± SD	
	5ºC	25ºC
0	25,25 ± 6,40 a	22,71 ± 5,24 a
30	21,09 ± 1,82 b	19,00 ± 4,50 ab
60	17,75 ± 1,73 c	16,68 ± 6,47 bc
90	16,42 ± 3,10 cd	14,02 ± 3,48 cd
120	14,64 ± 2,25 de	13,40 ± 3,98 cd
150	12,84 ± 3,08 e	11,30 ± 3,90 d

The light conditions did not significantly affect pomegranate jam color (a* values). However, when considering the a* parameter evolution over time, there were reductions of 47% and 51% in daylight and dark conditions respectively after 150 days storage (Table 2).

Table 2. Light exposure effect on pomegranate jam colour during storage

Storage (days)	a* ± SD	
	Daylight	Darkness
0	25,83 ± 5,87 a	25,14 ± 5,74 a
30	19,62 ± 4,57 ab	20,48 ± 2,16 b
60	18,07 ± 5,95 bc	16,37 ± 2,91 c
90	16,20 ± 3,34 bc	14,24 ± 3,40 cd
120	14,47 ± 3,56 cd	13,57 ± 2,93 cd
150	12,03 ± 3,26 d	12,11 ± 3,91 d

High methoxy pectin jams (HM) yielded higher a* values (about 34% more) than low methoxy pectin ones (LM). Statistically significant differences were detected between HM and LM jams (Table 3). Even though high methoxy pectins yielded pomegranate jams with 34% more color than low methoxy pectins, there was an a* value reduction of 50% in both cases after a 5 months storage. The type of pectin as well as storage temperatures definitively affect pomegranate jam colour (Table 4).

Table 3. Pectin effect on pomegranate jam colour during storage

Storage (days)	a* ± SD	
	LM	HM
0	18,92 ± 2,10 a	29,05 ± 3,39 a
30	17,54 ± 3,01 a	22,56 ± 1,77 b
60	14,62 ± 3,18 b	19,82 ± 4,53 c
90	12,48 ± 2,03 c	17,97 ± 2,07 cd
120	11,66 ± 2,03 c	16,39 ± 2,32 de
150	9,33 ± 1,62 d	14,81 ± 2,64 e

Table 4. Mean a* values based on temperature, light conditions and pectins

a* ± SD					
Temperature		**Light conditions**		**Pectin**	
5ºC	18,00 ± 5,33 a	**Daylight**	17,20 ± 5,64 a	**LM**	14,09 ± 4,07 a
25ºC	16,18 ± 5,94 b	**Darkness**	16,98 ± 5,79 a	**HM**	20,09 ± 5,52 b

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References

García-Viguera C., Zafrilla P., and Tomás-Barberán F.A., 1997. Determination of authenticity of fruit jams by HPLC análisis of anthocyanins. In: *Journal of the Science Food and Agriculture*, 73, p. 207-213.

García-Viguera C., Zafrilla P., Artés F., Romero F., Abellán P. and Tomás-Barberán F., 1998. Colour and anthocyanin stability of red raspberry jam. In: *J Sci Food Agric*, 78, p. 565-573.

García-Viguera C., Zafrilla P., Romero F., Abellán P., Artés F. and Tomás-Barberán F.A., 1999. Color stability of strawberry jam as affected by cultivar and storage temperature. In: *Journal of Food Science*, 64(2), p. 243-247.

Gil M.I., García-Viguera C., Artés F. and Tomás-Barberán F.A., 1995. Changes in pomegranate juice pigmentation during ripening. In: *J. Sci. Food Agric.*, 68, p. 77-81.

Kopjar M., Pilizota V., Nedic Tiban N., Subaric D., Babic J. and Ackar D., 2007. Effect of different pectin addition and its concentration on color and textural properties of raspberry jam. In: *Deutche Lebensmittel-Rundschund*, 103, p. 164-168.

Lewis C.E., Walker J.R.L. and Lancaster J.E., 1995. Effect of polysaccharides on the colour of anthocyanins. In: *Food Chemistry*, 54, p. 315-319.

Markakis P., 1982. Stability of anthocyanins in foods. In: Markakis P. (ed.), *Anthocyanins as Food Colors*. New York: Academic Press, pp: 163-180.

Markakis P., Livingston G.E. and Fellers C.R., 1957. Quantitative aspects of strawberry pigment degradation. In: *Food Res*., 22, p. 117-130.

Martí N., Pérez-Vicente A. and García-Viguera C., 2001. Influence of storage □emperature and ascorbic acid addition on pomegranate juice. In: *J Sci Food Agric.*, 82, p. 217-221.

Withy L.M., Nguyen T.T., Wrolstad R.E. and Heatherbell D.A., 1993. Storage changes in anthocyanin content of red raspberry juice concentrate. In: *Journal of Food Science*, 58, p. 190-192.

Wrolstad R.E., Skrrede G., Lea P. and Enersen G., 1990. Influence of sugar on anthocyanin pigment stability in frozen strawberries. In: *Journal of Food Science*, 55, p. 1064-1065, 1072.

Zafrilla P., Valero A. and García-Viguera C., 1998. Stabilization of strawberry jam colour with natural colorants. In: *Food Science and Technology International*, 4(2), p. 99-105.