Effect of controlled atmosphere packaging on overall quality of wonderful pomegranate

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INTRODUCTION

The cold storage of fruits is a key step to guarantee the product quality. However, temperatures below 5°C could cause chilling injury, browning, husk pitting and discoloration of pomegranates. Controlled atmosphere could help to delay the loss of quality and thus extend the shelf life of fresh fruit due to a reduction in respiratory activity, ripening, softening, incidence of physiological disorders and pathogen growth (Palou *et al*., 2007).

OBJECTIVE

The objective of this work was the assessment of two controlled atmosphere conditions (5 % O_2 - 5 % CO_2 and 5 % O_2 - 10 % CO_2) on pomegranate overall quality under cold storage (0 and 5 °C) during 75 days.

MATERIALS AND METHODS

Selection and cleaning stage
(Sodium hypochlorite 200 ppm x 3 min)

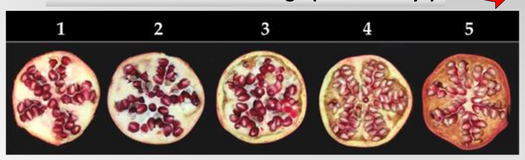
Controlled atmosphere treatments and cold storage

Treatment	Gaseous concentration O_2 (%) + CO_2 (%)	Storage Temperature (°C)
21+ 0 0°C	21+0	0
21+ 0 5°C	21+0	5
5+5 0°C	5+5	0
5+5 5°C	5+5	5
5+10 0°C	5+10	0
5+10 5°C	5+10	5

Evaluation each 15 -30 +2 days

- Weight loss (%)
- Color (L, H* y C*)
- Total soluble solids (TSS)
- Titritable acidity (citric acid %)
- Chilling injury visual evaluation (scale 0-5)

Evaluation after cold storage (each 15 days)



Visual scale of chilling injury in pomegranate mesocarp. 1: without damage, 2: slight, 3: moderate, 4: severe, 5: very severe.

RESULTS

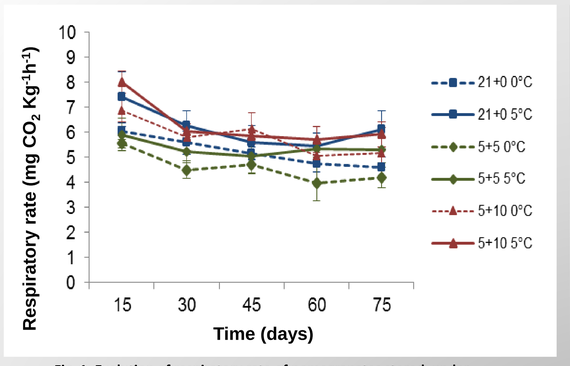


Fig. 1: Evolution of respiratory rate of pomegranates stored under controlled atmosphere for 75 days at 5 ° C.

The respiratory rate of pomegranates decreased at lower storage temperatures, showing the effect of this parameter on fruit metabolism with values ranging from 4-6.9 mg CO_2 $kg^{-1}h^{-1}$ and 4-8 mg CO_2 $kg^{-1}h^{-1}$ at 0 and 5 °C, respectively (Fig.1).

The gaseous combination 5% O_2 + 5% CO_2 had the lowest respiration rates with values ranging from 4 to 5.6 mg CO_2 kg^{-1} h^{-1} (0 °C) and 5.9 to 5.1 mg kg^{-1} CO_2 h^{-1} (5 °C).

The husk color was not affected by the different atmospheres and storage temperatures (p>0,05), with lightness (L), saturation (C) and tone (Hab) of 42-56, 40-54 and 27-41, respectively. No significant differences were observed in lightness and tone of mesocarp until day 60 + 2. At day 75 + 2 the treatment 5% CO_2 + 10% O_2 showed the lowest lightness and tone values (Fig. 2 and 3). In addition, fruit was best preserved with lower concentrations of CO_2 (5% O_2 + 5% CO_2 and 21% O_2 + 0% CO_2). These data showed a significant effect of gaseous combinations on the appearance of pomegranates.

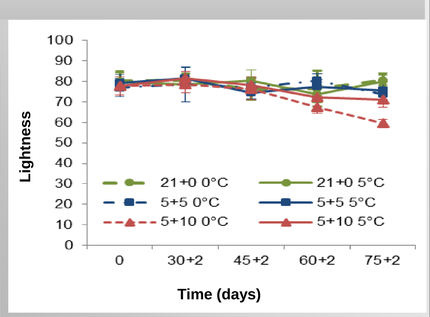


Fig.2. Pomegranate mesocarp lightness evolution during controlled atmosphere storage at 0 y 5 °C.

No differences were observed between treatments in trititable acidity (1.1-2%) and total soluble solids (12-16%) during storage.

The storage at higher temperatures caused an increase in weight losses with treatments 5% O_2+5% CO_2 and 21% O_2+0% CO_2 showing the lower and higher weight losses, respectively (Fig.4).

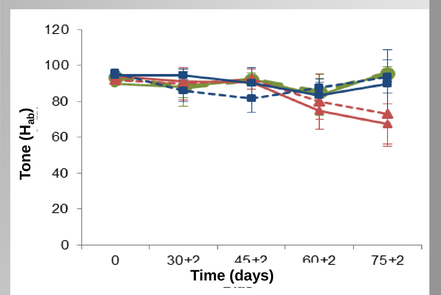


Fig. 3: Pomegranate mesocarp tone evolution during controlled atmosphere storage at 0 y 5 °C.

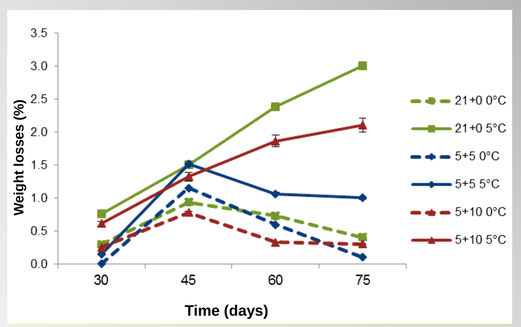


Fig. 4: Pomegranate weight losses during controlled atmosphere storage at 0 y 5 °C.

Table 1. Chilling injury of pomegranates stored under controlled atmosphere at 0 y 5 °C. 1: without damage, 2: slight, 3: moderate, 4: severe, 5: very severe.

Treatments	Pomegranate mesocarp chilling injury (%)							
	30+2 (days)		45+2 (days)		60+2 (days)		75+2 (days)	
	%	injury[1]	%	injury	%	injury	%	injury
21+0 0°C	67 b[2]	2	44 b	2	100 a	2	67 b	2
21+0 5°C	0 d	1	0 d	1	67 b	2	33 c	2
5+5 0°C	33 c	2	33 c	2	67 d	2	67 b	2
5+5 5°C	0 d	1	0 d	1	33 c	2	33 c	2
5+10 0°C	100 a	3	100 a	3	100 a	4	100 a	4
5+10 5°C	0 d	1	0 d	1	100 a	2	67 b	2

The chilling injury of pomegranates was observed after 30 days in fruit stored at 0 °C. This disorder was more evident in treatment 5% O_2 + 10% CO_2 with 100% of the fruit with moderate damage. While treatments 5% O_2 + 5% CO_2 and 21% O_2 + 0% CO_2 showed mild chilling injury with 33 and 67% of pomegranates damaged, respectively. Fruit stored under 5% O_2 + 5% CO_2, presented only a 33% of the fruit with slight damage at the end of storage (Table 1).

CONCLUSIONS

→The controlled atmosphere technology allows to extend the shelf life of cold stored pomegranates until 60+2 days with slight changes in overall quality, weight loss and color (lightness, saturation and hue).

→ Results showed the feasibility of controlled atmosphere to preserve pomegranates specially when 5% O_2 + 5% CO_2 treament was applied during storage at 5 °C.

REFERENCES

Palou, L., Crisosto, C. H., & Garner, D. (2007). Combination of postharvest antifungal chemical treatments and controlled atmosphere storage to control gray mold and improve storability of 'Wonderful'pomegranates. *Postharvest biology and technology*, *43*(1), 133-142.

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