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# Effect of CA-storage on the physical and sensorial quality of 'Rocha' pear

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## Introduction

Increasing production area and demand of *Pyrus communis* L. cv. Rocha, a Portuguese pear cultivar possessing excellent and unique organoleptic properties and good storability, have urged attempts to optimize its storage conditions under CA. 'Rocha' pear is indeed characterized by a white, smooth, granular, sweet, not acid and very juicy pulp. Pears are usually harvested between August and mid-September, so appropriate postharvest storage conditions are required in order to preserve fruit quality attributes over a period up to nine months. For this variety of pear, scarce information is available pertaining to recommended CA-storage gas composition, and the factors that influence quality loss thereof. The goals of this study were thus to determine the effects of storage time, time of exposure to open air at room temperature and gas composition on quality parameters of Rocha pears.

## Materials and methods

### *Experimental conditions*

Pears (cv. 'Rocha') were harvested in Portugal, at a stage of commercial maturity, in August 1998; they were then stored at 0 - 0.5 °C and 90 - 95 % RH in air (NA) or under CA. Four CA storage conditions were tested: 2 %(v/v) $O_2$ + 0.5 %(v/v) $CO_2$; 2 %(v/v) $O_2$ + 1.5 %(v/v) $CO_2$; 3 %(v/v) $O_2$ + 0.5 %(v/v) $CO_2$; and 3 %(v/v) $O_2$ + 1.5 %(v/v) $CO_2$. After 4, 7 and 9 months of storage, fruits were removed from each storage condition, and allowed to ripen in air at room temperature (19 - 20 °C). As time at room temperature elapsed, 10 pears from each storage condition were selected at random and evaluated in terms of colour (hand-held, tristimulus reflectance) and firmness (puncture test, with an 8 mm probe). Sensorial analysis was performed by 6 days after exposure to open air at room temperature. Panelists were asked to score, in a 9 cm-unanchored scale, colour, firmness, juiciness and sweetness of pear samples corresponding to each storage condition.

### *Statistical analysis*

The influences of storage time ($X_1$), time in open air at room temperature ($X_2$), and concentrations of oxygen ($X_3$) and carbon dioxide ($X_4$) in the CA were empirically modelled according to the following second order polynomial, using as dependent variables Hunter's a* value ($Y_1$), Hunter's b* value ($Y_2$) and firmness ($Y_3$):

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_{11}X_1^2 + b_{12}X_1X_2 + b_{13}X_1X_3 + b_{14}X_1X_4 + b_{22}X_2^2 + b_{23}X_2X_3 + b_{24}X_2X_4 + b_{33}X_3^2 + b_{34}X_3X_4 + b_{44}X_4^2 \quad (1)$$

The experimental data were fitted by Eq. (1) using $F \geq 0.005$ as criterion of significance for the adjustable parameters. An analysis of variance (ANOVA) was performed to evaluate the influence of the storage conditions on the sensorial attributes; Duncan's multiple range test was employed to pinpoint significant differences.

## Results and discussion

Hunter's a* value decrease with storage time; said decrease was more notorious from the 4th to the 7th month of storage, and became negligible from the 7th to the 9th month of storage. When fruits were exposed to air at room temperature, the a* value increased in pears at all storage conditions. Those changes were confirmed by the negative value of $b_1$ and the positive value of $b_{22}$ (Table 1). The concentration of $O_2$ was an important factor, which interacted with storage time and might have determined color variation in pears. As reported elsewhere (Banks *et al.*, 1997) the most benefits on decreasing color changes achieved by CA would derive from reduced $O_2$; elevated $CO_2$ would contribute little there to.

Firmness changes were highly influenced by time of storage and time in open air at room temperature. The firmness in pears from all conditions increased slightly from the 4th to the 7th month of storage, and decreased sharply thereafter. This influence was characterized by a positive value of $b_1$ and a negative value of $b_{11}$ (Table 1). Firmness decreased in pears from all storage conditions during the time of exposure to open air at room temperature (negative value for $b_{22}$) a result that was confirmed by the sensorial tests (which did not unfold significant differences in terms of firmness). Sensory analysis reveled that the fruits stored in air were more yellow and less sweet than those stored under CA; fruits were also firmer and whiter by 4 than by 9 months of storage.

## References

Banks, N.H., Jeffery, P.B. and Mackay, B.R. 1997. Responses of colour changes and softening to $O_2$ and $CO_2$ in 'Braeburn' apples. In: Mitcham EJ, editor, CA'97 Proceedings volume 2: Apples and Pears. Postharvest Horticulture Series 16. Department of Pomology, University of California. p 36-41.

Table 1: Second-order polynomial model for 'Rocha' pears, as a function of the relevant independent (coded) variables, and associated estimators of parameters

| Variable | Model* | Parameter | Estimated value ± confidence interval (95%) | Units | $R^2$ |
|---|---|---|---|---|---|
| a* value | $Y_1 = b_0 + b_1X_1 + b_3X_3 + b_{11}X_1^2 + b_{13}X_1X_3 + b_{22}X_2^2 + b_{33}X_3^2 + b_{34}X_3X_4$ | $b_0$ | -0.2 ± 0.5 | dimensionless | 0.80 |
| | | $b_1$ | -0.6 ± 0.2 | month$^{-1}$ | |
| | | $b_3$ | -0.4 ± 0.1 | (% v/v)$^{-1}$ | |
| | | $b_{11}$ | 0.04 ± 0.01 | month$^{-2}$ | |
| | | $b_{13}$ | -0.014 ± 0.002 | month$^{-1}$ x (%v/v)$^{-1}$ | |
| | | $b_{22}$ | 0.013 ± 0.002 | day$^{-2}$ | |
| | | $b_{33}$ | 0.019 ± 0.004 | (%v/v)$^{-2}$ | |
| | | $b_{34}$ | 0.14 ± 0.03 | (%v/v)$^{-2}$ | |
| Firmness | $Y_3 = b_0 + b_1X_1 + b_{11}X_1^2 + b_{22}X_2^2 + b_{23}X_2X_3 + b_{24}X_2X_4$ | $b_0$ | 14.4 ± 7.1 | N | 0.92 |
| | | $b_1$ | 16.4 ± 2.4 | N x month$^{-1}$ | |
| | | $b_{11}$ | -1.4 ± 0.2 | N x month$^{-2}$ | |
| | | $b_{22}$ | -0.66 ± 0.05 | N x day$^{-2}$ | |
| | | $b_{23}$ | 0.08 ± 0.02 | N x day$^{-1}$ x (%v/v)$^{-1}$ | |
| | | $b_{24}$ | -0.5 ± 0.2 | N x day$^{-1}$ x (%v/v)$^{-1}$ | |

* including only the statistically significant parameters