

FRESH AVOCADO PULP (*PERSEA AMERICANA* MILL.) STORED UNDER MODIFIED ATMOSPHERE USING VACUUM, CO₂ AND N₂ IN LOW DENSITY POLYETHYLENE BAGS.

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Abstract

Avocado cultivars Hass, Bacon, Fuerte and Gwen, grown in the Quillota Valley, Chile, during 1994 season, were harvested at two maturity levels, measured by oil content. The fruit was ripened in a chamber at 13-15 °C until 2-3 kg pressonometer value (2 cm² end) was reached, peeled, sliced or smoothed and stored at 1 ± 0.1 °C in low density polyethylene bags, at 40% vacuum; 100% CO₂; 80% CO₂ - 20% N₂ and 100% N₂ atmosphere during 7, 14, 21, 28, 35 and 42 days. The cultivar and the maturity level had important effect in the quality of fresh pulp maintained in cold storage. Gwen cultivar had the best quality of the product 80% CO₂ - 20% N₂ was the best gas combination to maintain a good quality of avocado pulp in storage.

1. Introduction

Avocado flesh is normally consumed as fresh product in paste, halves or slices. In Chile the avocado products became more consumed, especially in restaurants, cafeterias and fast food stores. The supply of avocado products ready to use is very important, in order to save labor hand and costs.

The avocado flesh quality is mainly affected by the cultivar and the maturity level of the fruit (Hatton and Campbell 1959, Olaeta and Undurraga 1995). Modified atmosphere, using vacuum, CO₂ and N₂ in low density polyethylene bags, can reduce the enzymatic browning and microbial spoilage, maintaining the quality of avocado flesh pulp (Arpaia 1988; Olaeta et. al. 1995.). The effect of cultivar and the maturity level on the quality of fresh avocado pulp stored under modified atmosphere using vacuum, CO₂ and N₂ is reported in this paper.

2. Material and methods

The avocado cultivars Fuerte, Hass, Bacon, Negra de la Cruz, Edranol and Gwen, grown in the Quillota Valley, Chile during the 1993 - 1994 season were harvested using oil content (tables 1 and 3). The fruit of the cultivars named above, were ripened in a chamber at 13 - 15 °C until 2 - 3 k firmness (2.0 cm², end) was reached. Each cultivar fruit was hand peeled, and half of it was cut in slices. The rest of the fruit was blended and reduced to smooth uniform pulp. The flesh color of each cultivar was measured using Minolta C-200 colorimeter and the results expressed

in L, a, b., values. The pulp was treated with 0,2% ascorbic acid and 0,6% citric acid mixture incorporated in the pulp, and the slices were immersed in a 0,3% ascorbic acid and 0,4% citric acid solution during 5 min. to prevent browning (Olaeta, J.A. and Rojas C. 1987).

2.1. Assay I: gas treatments.

Bacon and Hass cultivars samples were packed in 300g low density polyethylene bags, treated with vacuum, CO₂ and N₂ (table 2), and stored at 1 ± 0.1 °C during 7, 14, 21, 28 and 35 days.

2.2. Assay II: maturity levels.

Bacon, Hass, Edranol, Fuerte, Negra de la Cruz and Gwen cultivars samples, in each maturity level (table 3), were packed in 300 g low density polyethylene bags, treated with 80% CO₂ - 20% N₂ mixture, and stored at 1± 0.1 °C during 7, 14, 21, 28 and 35 days.

After each storage period, in both assays, color (Minolta C-200), pH and acidity were measured and samples were subjected to a sensory evaluation panel of 10 members to judge flavor, color and general desirability using hedonic scale 1= Extremely undesirable and 7= Extremely desirable.

3. Results

3.1. Assay I: gas treatments.

In both cultivars, better quality products during 35 days storage period were reached using 80% N₂ - 20% CO₂ and 90% N₂ - 10% CO₂ gas mixtures, in slices and pulp, Hass cultivar also reach good quality products with only 40% Vacuum treatment. After that period of time the samples became dark. During 35 days storage period, samples packed in 100% CO₂ gas treatment, increased the acidity and developed an effervescent taste.

3.2. Assay II: maturity levels.

The original color of cultivars Gwen, Edranol and Hass remained during 35 days of storage. Fuerte, N. de la Cruz and Bacon cultivars became darker after 21 days of storage. The best quality color in all storage periods, was reached by Gwen and Hass cultivars (fig 1). In Bacon cultivar, better general desirability was found in avocado pulp using lower maturity level but in general, the maturity level did not affect the general desirability in the rest of the cultivars, both in slices or pulp (tables 4 and 5). After 35 days of storage, pulp of the Fuerte, Gwen and Edranol cultivars had the best general desirability and were well accepted by the sensory evaluation panel. The rest of the cultivars maintained good general desirability until 21 days of storage (table 4). In slices, during the storage period, the fruit became softer and affected the general desirability. After 28 days of storage best quality product was obtained by the cultivars Gwen and Edranol (table 5).

4. Discussion

The antioxidants used to prevent browning did not affect significantly the taste avocado pulp nor slices in all the cultivars treated.

The best gas combination to store avocado pulp and slices were 80% N₂ – 20% CO₂ and 90% N₂ - 10% CO₂, also good quality products were obtained at only 40% vacuum.

Gwen and Edranol cultivars had the best general quality products after 35 days of cold storage period. Also Hass cultivar had good quality until 28 days of storage, the rest of the cultivars maintained their quality by 21 days of cold storage or less.

As a general conclusion, the storage of avocado pulp or slices, at cold storage in low density polyethylene bags using vacuum or modified atmosphere, as a Gamma IV product, was a good processing method to preserve avocado pulp of proper cultivars and maturity levels.

5. References

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Table 1 - Oil content of avocado fruit cultivars used in assay 1

Cultivars	Maturity level	%
Hass	12-14	
Bacon	12-14	

Table 2 - Gas treatments used in assay 1

Treatments	
1	40% Vacuum
2	100% CO ₂
3	100% N ₂
4	90% N ₂ +10%CO ₂
5	80%N ₂ +20%CO ₂

Table 3 - Oil content of avocado fruit cultivars used in assay 2

Cultivars	Maturity level %	
	I	II
Hass	12-14	15-18
Bacon	10-12	15-16
N.de la Cru	12-13	18-19
Fuerte	13-16	17-22
Gwen	9-11	12-14
Edranol	12-14	15-22

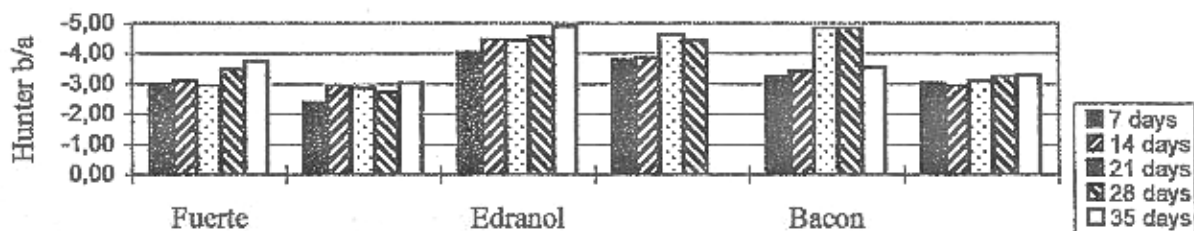


Figure 1 - Effect of storage on color development in avocado pulp(maturity I)

Table 4 : Effect of maturity on general desirability of fresh avocado pulp.

Days of storage.	Maturity level											
	Hass		Bacon		N.Cruz		Fuerte		Gwen		Edranol	
	I	II	I	II	I	II	I	II	I	II	I	II
7	5.30	5.40	4.50	5.10	5.20	5.60	4.56	4.60	5.05	4.55	4.65	5.10
14	5.00	4.70	3.90	4.60	4.60	4.70	4.40	4.55	4.40	4.80	4.65	4.90
21	4.80	4.50	3.60	4.40	4.30	4.10	3.60	3.60	4.85	5.55	4.60	4.60
28	3.40	4.20	3.00	3.70	3.20	3.30	4.40	4.93	5.40	5.43	4.78	4.44
35	3.80	3.90	2.60	3.30	-	-	5.58	5.38	4.25	4.25	4.89	5.10

1= Extremely undesirable 7= Extremely desirable

Table 5 : Effect of maturity on general desirability of fresh avocado slices.

Days of storage.	Maturity level											
	Hass		Bacon		N.Cruz		Fuerte		Gwen		Edranol	
	I	II	I	II	I	II	I	II	I	II	I	II
7	5.20	5.10	4.40	5.20	6.00	6.00	4.78	3.83	5.10	4.05	5.07	5.53
14	4.80	5.30	4.60	5.30	5.00	5.50	3.60	4.25	4.42	5.60	4.90	4.90
21	5.00	5.20	5.10	4.40	4.20	4.30	4.05	4.30	4.60	5.10	5.30	5.06
28	4.80	5.00	4.20	3.30	3.10	3.50	4.48	4.15	5.18	5.95	5.60	4.78
35	3.90	4.80	3.40	3.30	-	-	4.39	3.85	3.60	4.50	5.26	5.05
42	4.00	4.40	-	-	-	-	4.43	2.70	-	-	-	-

1= Extremely undesirable 7= Extremely desirable