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Effect of Temperature on the Quality of Vacuum Packed Pecans[1]

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ABSTRACT

Mahan, Desirable, Stuart, Delmas, and Schley pecan varieties were stored under vacuum for six months at -18, 0, 10, and 21°C. Quality was evaluated by chemical and organoleptic panel tests. Rancidity, moisture content, flavour, colour, texture, and product acceptance of the pecan kernels were significantly deteriorated at high storage temperatures, 10°C and 21°C. This might have been due to accelerated chemical reactions.

Percentage of oil and texture of stored kernels had not been influenced by the different storage temperatures used in this study. This was, probably due to the relatively short period of storage under vacuum.

INTRODUCTION

The pecan, *Carya illinoensis* Wag., industry has reached a stage where more attention must be given to providing the consumer with a year-round supply of high quality nuts. This can be done by improving and extending the storage life of pecans (8,9). Temperature is the most important single factor associated with the keeping quality of pecans. Deterioration of quality was not reported so great during cold weather as during warm weather (9). Godkin (5) reported an acceleration of rancidity in pecans when temperature was increased. As the pecans dried out at high temperature, loss of flavour, increased darkening, and development of brittleness were accompanied by increasing rancidity (4,5). This experiment was conducted to study the effect of different storage temperatures on the keeping quality of pecans, stored under vacuum.

MATERIALS AND METHODS

Mahan, Desirable, Stuart, Delmas, and Schley pecan varieties were used in this study. The nuts were mechanically shelled and were kept in polyethylene bags to prevent loss

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of moisture. Samples were canned under 25 pounds per square inch vacuum, and were stored at −18°C, 0°C, 10°C, and 21°C. Six months later, the keeping quality was evaluated by colour, texture, flavour, % oil, % moisture, rancidity, and product acceptance. Methods used were as follows:

1. Colour The Gardner sensitivity automatic colour-difference meter, model AC-1 was used (1). Colour was evaluated by exposing two kernels of each sample to the light of the colour difference meter (1).
2. Texture Texture of the kernels was determined by L.E.E. Kramer Shear Press, Model SP-12 IMP (1).
3. Oil % Oil was extracted by the ether extraction method, using Soxhlet apparatus, for 16 hours (1,2,6,7).
4. Moisture % Percent of moisture was determined by a dehydration of samples in vacuum oven (2,7).
5. Rancidity Rancidity was directly evaluated as per cent free fatty acids, expressed as oleic acid (2). Rancidity was determined by simple titration (1).
6. Product acceptance Using organoleptic panel test the following scoring system was employed to express product acceptance, in regard to flavour, colour, and texture.

9. like extremely
8.
7. like slightly
6.
5. neither like nor dislike
4.
3. dislike slightly
2.
1. dislike extremely

Data of the chemical analysis and of the organoleptic panel test were statistically analyzed, using analysis of variance, and duncan multiple range test.

RESULTS AND DISCUSSION

Results of this experiment are presented in Table 1. Moisture content, rancidity, flavour, colour, texture, and product acceptance of pecan kernels were significantly affected by different storage temperatures (Table 1). Development of rancidity was accelerated as storage temperature was increased. However, at 21°C rancidity was statistically higher than at lower temperatures, at 0.05 level of probability. This was probably due to accelerated rate of chemical reactions. The effect of high storage temperature, 21°C, on the acceleration of rancidity, was accompanied by a loss of moisture. Pecans stored at −18°C contained more moisture than those at 0°C or above. However, this can probably be explained by the condensation of moisture on the samples when subjected to room temperature. Loss of moisture of pecans at high temperatures has been previously reported by other workers (4,5).

Quality indices tested organoleptically showed a deterioration in flavour, colour, texture, and product acceptance of pecans when storage temperatures where increased beyond −18°C or 0°C (Table 1).

Moreover, colour evaluation, using the colour difference meter showed similar results. The darkenning of colour of pecan kernels at high storage temperatures might be due to enhanced oxidative chemical reactions.

Table 1 Effect of temperature on Pecans' quality.

Temp. (°C)	Means									
	% Moisture	% Oil	Sh. R.	% FFA	Flavor[1]	Color[1]	Texture[1]	Product Acceptance[1]	Rd	a/b
−18	3.04 a	62.72 a	5.27 a	0.08 b	7.12 a	6.80 a	7.52 a	7.04 a	13.82 a	0.24 d
0	2.85 b	63.38 a	5.18 a	0.09 b	6.92 a	6.28 ab	7.44 a	6.80 a	12.91 b	0.26 c
10	2.87 b	63.38 a	5.23 a	0.11 b	5.36 b	5.96 b	6.64 b	5.48 b	11.66 c	0.31 b
21	2.84 b	63.24 a	5.18 a	0.22 a	3.88 c	4.20 c	5.80 c	3.72 c	10.39 d	0.36 a

a, b, c, d are significantly different at 0.05 level of probability.
[1]Organoleptic panel scores.
Rd = light reflectance. Color of kernels is inversely related to Rd value.
a, b are rectangular coordinates of light. Color of kernels is directly related to a/b ratio.
Sh.R. = Shear response
F.F.A. = Free Fatty acids.

The percentage of oil, and the shear response, as a measure of texture, had not been influenced by the different storage temperatures used in this study. This might have been due to the relatively short period of storage and/or due to the storage under vacuum which extended the shelf-life of pecans (10).

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