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Quality and adequacy for long-term storage of dehydrated apple slices packaged in No. 10 cans

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ABSTRACT
Dehydrated food commodities can be packaged in restaurant-size No.10 cans intended for long-term storage for such uses as personal storage, emergency relief efforts and military rations. Because foods packaged for long-term storage are seldom opened soon after purchase, the quality of the product or the adequacy of the packaging could be unknown to the buyer for months or even years. The objective of this research was to compare the quality of various brands of dehydrated apple slices sold at the retail level in No. 10 cans and to evaluate the adequacy of the packaging for long-term storage.

Nine brands of dehydrated apples packaged in No. 10 cans were obtained from retail distributors in four states. All brands were labeled as being pre-treated with sulfur dioxide before permanent browning. All cans contained oxygen absorbers and were labeled as having an oxygen-free environment. A 50-member consumer panel evaluated aroma, flavor, and overall acceptability using a 9-point hedonic scale. Other observations included headspace oxygen, can seam evaluation, product color, water activity and Vitamin C content.

Hedonic scores for overall acceptability ranged from 4.6 to 5.8 with significant differences between brands. Headspace oxygen ranged from <0.01 to 2.1%. Four of the nine brands exhibited headspace oxygen levels of 2% or greater. Wide variation in can seam quality was observed, with a direct correlation between poor seams and high head space oxygen levels. No significant differences in Hunter color parameters were seen. Water activity ranged from 0.20 to 0.31. Only 5 brands listed Vitamin C content on their label, and the actual content in each brand was less than half the amount listed.

There appears to be wide variation in head space oxygen levels and can seam quality of dehydrated apples packaged for long term storage and available for sale at the retail level. Manufacturers need to ensure accurate labeling and proper packaging to optimize product quality during extended storage.

INTRODUCTION
Apples have been called the most important temperate fruit in the world (Taiwo 2001). Dehydrated apples (approx. 3% moisture) are commonly stored in No. 10 cans for long term storage purposes such as emergency relief, military rations and personal storage. Dehydrated apples have been found to retain their flavor, color, and odor for as long as three years when properly stored (Smock and Neubert 1950; Norris 1986).

Because foods packaged for long-term storage are seldom opened soon after purchase, the quality of the product or the adequacy of the packaging could be unknown to the buyer for months or even years. The objective of this research was to compare the quality of various brands of dehydrated apple slices packaged in No. 10 cans and to evaluate the adequacy of the packaging for long-term storage.

METHODOLOGY

Samples
Nine brands of dehydrated apples, packaged in No. 10 cans, were obtained from retail distributors in four states. Eight of the brands were apple slices and one was apple rings (Brand E). All the brands were stored in oxygen free environments, contained oxygen absorbers and were pretreated with sulfur dioxide. Product codes indicated the samples were less than a year old. Duplicate samples of each brand were evaluated.

Analysis

Table 1. CIE L* a* b* color values of various brands of canned dehydrated apple slices.

<table>
<thead>
<tr>
<th>Brand</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td>L*</td>
<td>55.335</td>
<td>51.415</td>
<td>47.595</td>
<td>52.015</td>
<td>46.535</td>
<td>54.755</td>
<td>46.535</td>
<td>45.835</td>
<td>45.835</td>
</tr>
<tr>
<td>b*</td>
<td>2.02</td>
<td>0.59</td>
<td>-0.425 -0.425</td>
<td>-0.425</td>
<td>-0.425</td>
<td>-0.425</td>
<td>-0.425</td>
<td>-0.425</td>
<td>-0.425</td>
</tr>
</tbody>
</table>

RESULTS

Headspace Oxygen, Can Seams, and Water Activity

Headspace oxygen was measured using the 3500 Series Headspace Oxygen Analyzer (Shimadzu Instruments, Inc., Nihonbashi, Japan). All cans were sampled using a headspace sampler (Shimadzu Corporation, Westerville, OH) to measure the following headspace dimensions: thickness, width, body height, can cover height, and seams. Seam tightness was rated on a scale of 0-100%. The seams were given an overall rating of good, fair, or poor by an experienced evaluator. Water activity was measured using an Aquapak CR-2 (Decovacs Devices, Inc., Pullman, WA).

Sensory Evaluation

Sensory analysis was conducted at the BYU Sensory Laboratory using standard procedures. Samples were served from the can, with no further preparation, in a randomized manner to a 50-member consumer panel in 4 visits. Panelists evaluated aroma, flavor, and overall acceptability using a 9-point hedonic scale.

Color

CIE L*ab* color values were measured using a Hunterlab ColorFlex Spectrophotometer (Hunter Associates Laboratory, Inc., Reston, VA) with three measurements taken on each sample.

Vitamin C

Vitamin C analysis was conducted following the method of Ruckman (1998) using an Agilent Model 1100 high performance liquid chromatography (Agilent Technologies, Palo Alto, CA) equipped with a C18 reverse phase column (Phenomenex, Torrance, CA) and a diode array detector. Determinations were carried out under subdued light.

Data Analysis

Data was analyzed for significance using Statistical Analysis System software (SAS Institute, Cary, NC). A mixed model analysis of variance (PROC MIXED) with Duncan’s Multiple Range Test was used for the sensory data. Significant differences were defined as p<0.05.

CONCLUSIONS

There appears to be wide variation in head space oxygen levels and can seam quality of dehydrated apple slices packaged for long term storage and available for sale at the retail level. Manufacturers need to ensure accurate labeling and proper packaging to optimize product quality during extended storage.

REFERENCES


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