

E-beam Irradiation of “in nature” Palm: Texture and Color Evaluation

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Abstract

The palm tree (*Bactris gasipaes* Kunth) is a potential raised species with economic, for the nutritional value of its fruits that can in such way be used in the feeding human being as in the animal, and mainly, for the extraction of the palm that currently has a bigger interest in this culture. Food irradiation is a worldwide technology that aims to improve the product quality, in order to eliminate diverse microorganisms that can spoil the food. Irradiation processing, in the recommended doses, causes very few chemical alterations in foods, nutritional losses are considered insignificant and some of the alterations known found in irradiated foods is not harmful or dangerous. The objective of this work was to evaluate physical characteristics of in nature peach palm, such as color and texture, after combination of e-beam processing and refrigeration. Samples were irradiated with 0 (control), 1.0kGy and 2.0kGy using an electron beam irradiator (Radiation Dinamics Co. model JOB 188, New York, USA). Colour analysis results showed a significant change mainly with samples irradiated with 2.0kGy after 14 days of storage, while non-irradiated obtained to texture profile, non-irradiated with 1.0kGy did not show any alteration. Similar results were obtained to texture profile, non-irradiated and 1.0kGy samples did not differ each other, although 2.0kGy demonstrated lower firmness.

Keywords: Peach palm, food irradiation, color, texture.

1. Introduction

The peach palm, a native plant from the humid tropics of Latin America, has been used extensively for centuries by natives of this region [1]. It became an attractive perennial cash crop for farmers four decades ago when local and international markets opened for heart of palm. Heart of palm is extracted from several palm genera and species; however, those from the genus *Euterpe* are preferred because they are abundant, palatable, highly productive,

and they lack toxic components and grow fast. The major country exporters in order of importance are Brazil, Costa Rica, Colombia, Venezuela, and Peru [2].

Peach palm yields two food crops with commercial potential: the fruit and heart of palm. The fruit provides several nutritious, staple foods: pulp for direct consumption, flour for infant formula and baked goods, cooking oil, and ration for farm animals and fish culture [3].

The national and international gourmet markets for hearts from cultivated peach palm are growing [4], and some countries are expanding production in anticipation of continued market development (notably Costa Rica and Brazil). While significant for future economic development, this may benefit only the large scale farmers. In relatively poor regions with undeveloped infrastructures, such as the Peruvian Amazon Basin, farmers may prefer to produce the fruit rather than heart of palm because of food security concerns [5].

The flour is already on the market in parts of Central and South America, and there are plans for commercial production of animal ration. The processing of gourmet heart of palm for the international market is growing into a major agro-industry in producing countries. Heart of palm is developing into an important commercial crop, especially for the gourmet market. Fresh, dried and canned hearts-of-palm are being marketed for preparation of salads, soups, roasted chips and fillings. It is a good source of dietary fiber, and a moderate source of magnesium and iron [6; 7].

Food is one of the most important necessities in life. Fortunately, many advanced and several developing countries have abundant supplies of fresh, safe and nutritious foods. Yet, despite the many precautions and processes in place to ensure a safe food supply, microbial contamination is still a concern, even in advanced countries. There are a number of food processing tools available that provide additional protection for the foods we consume. One very promising tool is food irradiation, which is a process of imparting ionizing energy to food to reduce microorganisms [8].

Food irradiation has shown to be an effective tool to eliminate certain food borne-pathogens from food. Safety and efficiency of food irradiation has been approved by several authorities (FDA, USDA, WHO, FAO) and scientific societies based on extensive research [9; 10].

The use of radiation to extend the useful life of fresh foods in addition, food irradiation offers more opportunity for tropical countries to export native fruits by retarding the ripening process [11]. The objective this study was to evaluate the physical characteristics the peach palm *in nature*, such as color and texture, combining the radiation process by electrons accelerator and refrigeration.

2. Material and Methods

2.1 Samples

Samples from peach palm were provided by the factory “Floresta Indústria e Comércio Ltda.” located in the Ribeira Valley, Juquiá, São Paulo/SP – Brazil. Samples from the basal part (heart) the palm were used, the samples were sanitized and cut into slices with a 4.5 mm high, packed in styrofoam trays and covered with a plastic film PVC.

2.2 Irradiation

The Irradiation was carried out at room temperature at Instituto de Pesquisas Energéticas e Nucleares (IPEN) located in São Paulo, Brazil. The samples were irradiated at doses of 0, 1.0 and 2.0kGy using an electron beam accelerator (Radiation Dinamics Co. model JOB 188, New York, USA) with energy to 0.5 – 1,5MeV, beam scan width of 100cm and support speed of 6.39m/min. The doses were measured using a Cellulose Triacetate (CTA) dosimeter. After irradiation, the bags containing peach palm (irradiated and controls) were stored in a cold chamber at 8°C.

2.3 Color Analysis

The color analysis was evaluated using a bench spectrophotometer (Color Quest II, Hunter Lab, Reston, USA). The calibration module used was the specular excluded reflectance (RSEX), with a D65 light source and a 10° visual angle. The reading system used was CIELAB, represented by the following parameters: L coordinate (brightness), a chromaticity coordinate (-a green, +a red) and the b chromaticity coordinate (-b blue, +b yellow). The readings were performed randomly on samples, in triplicate.

2.4 Texture

The texture was analyzed using a texturometer (TA-XT2, Stable Micro Systems) operating with Texture Expert software, with mode and operation of compressive force, with a test speed 1 mm/s. A stainless steel needle probe P/2N (2mm thickness) was applied in the center of the food. The parameter evaluated was the maximum force of rupture, obtained

through the registry of the curve force x time. Resfriadas Heart of palm samples were analyzed after 1 hour at room temperature (25°C). 15 samples for each treatment were used.

2.5 Statistical Analysis

Results obtained from color and texture analysis were submitted to ANOVA and to the Turkey Test, to verify significant differences ($p < 0,05$) among the different processing conditions.

3. Results and Discussion

3.1 Color Analysis

Appearance is a sensory characteristic of the food, composed from color, brightness, size and shape, being the most striking the visual impact caused by the color. Color is related to the fresh quality foods, becoming the first criteria applied to its acceptance or rejection by consumers [12].

The color analyses are shown in Figures 1, 2 and 3. We could observe in Figure 1 that L parameter (brightness) did not show a statistical difference between non-irradiated and irradiated samples. However, 2.0kGy irradiated sample visually showed a darkening compared to others. Results of those samples irradiated with 1.0kGy remained closer to control sample, showing a similar color tone, even after different intervals of storage.

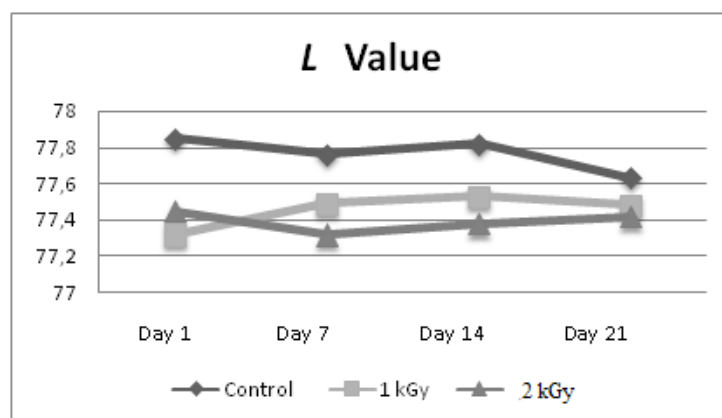


Figure 1. L Parameter (Brightness) of *in natura* peach palm samples at different storage periods (mean values).

Analyzing a parameter, it was possible to observe that peach palm samples irradiated and non-irradiated did not show a statistical difference. However, all samples showing green tone after 14 days of storage (Figure 2).

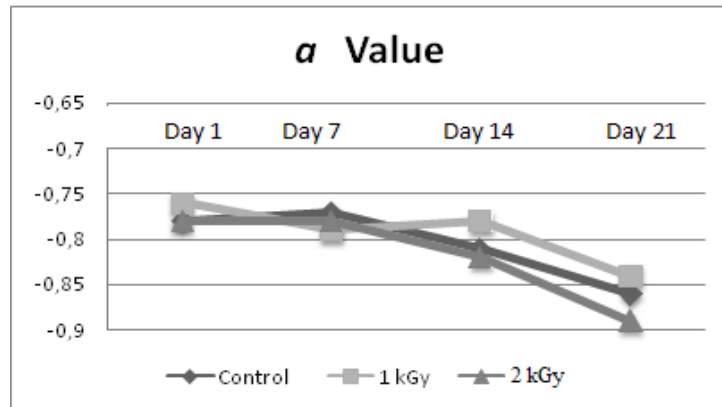


Figure 2. a Parameter (Brightness) of *in natura* peach palm samples at different storage periods (mean values).

We could observe in Figure 3 that b parameter (+ yellow; - blue) show that the irradiated sample 2.0kGy differ significantly, while the sample 1.0kGy remained with the same characteristics of the control sample.

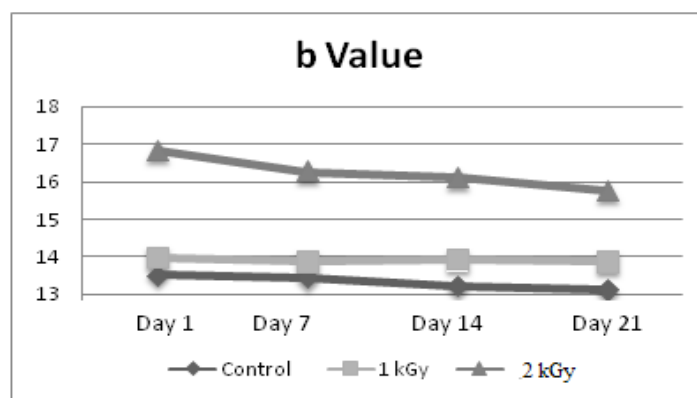


Figure 3. b Parameter (Brightness) of *in natura* peach palm samples at different storage periods (mean values).

In other studies Jin *et al* [13] evaluated the effect of ionizing radiation from electron accelerator in the color characteristics of Ginseng samples, concluding that irradiation processing did not cause significant changes in the irradiated samples with 2.0, 8.0 and 16.0kGy doses.

3.2 Texture

From the texture analysis, we could observe that non-irradiated and 1.0kGy samples did not differ each other, although 2.0kGy demonstrated lower firmness (table 1).

Table 1. Peach palm *in nature* texture analysis at different storage periods.

Doses	Texture / Force (N)			
	Day 1	Day 7	Day 14	Day 21
Control	5,3 ^a	3,2 ^a	2,5 ^a	2,5 ^a
1.0kGy	5,3 ^a	3,1 ^a	2,6 ^a	2,7 ^a
2.0kGy	5,8 ^{ab}	3,7 ^{ab}	3,4 ^{ab}	3,5 ^{ab}

Different lowercase letters accept at a 5% level of probability between the treatments and the days of storage, by the Turkey test.

Wani *et al* [11] evaluated irradiated pears and observed that during the storage the fruit firmness diminished, especially with a 2.0kGy dose, resulting in degradation of the food. On the other hand, Spyros *et al* [14], concluded that the irradiation treatment did not affect the texture of irradiated cheese, even after storage under refrigeration.

4. Conclusion

From the color analysis results we could realize a significant change on samples irradiated with 2.0kGy after 14 days of storage. Texture profile analysis also showed a significant difference in 2.0kGy irradiated samples, regardless of storage time.

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