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COLORIMETRIC ANALYSIS OF EDIBLE FLOWER OF *TROPAEOLUM MAJUS* PROCESSED BY IONIZING RADIATION

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ABSTRACT

Edible flowers are increasingly being used in culinary preparations, being also. These highly perishable products should be grown without using any chemical pesticide. Irradiation treatment might be the answer to these problems, ensuring food quality, increasing shelf-life and disinfestation of foods. *Tropaeolum majus* L. (nasturtium) flowers are widely used in culinary preparations, The purpose of this study was to evaluate the dose-dependent effects of gamma and electron beam irradiation (doses of 0, 0.5, 0.8 and 1 kGy) on edible flowers using colorimeter (Konica Minolta Chroma Meter CR-400), were used samples of *T.majus* in orange, the petals of the flowers were used for the chromaticity value. The samples of irradiated processed showed no significantly difference when compared to the control sample.

1. INTRODUCTION

Edible flowers are used in culinary preparations to enrich the sensory and nutritional qualities of food for hundreds of years. Flowers have been the use in countless preparations: sauces, jelly, syrup, vinegars, oil, tea, ice cubes, salads, starters, drinks and desserts [1-2].

The main objective of their use in foods is to add beauty to the dish and attribute color and taste represent the most important criteria of quality of edible flowers. Color is one of the major attributes which affects the consumer perception of quality. Some cultures consume flowers as food for centuries, being an old tradition. Furthermore, science has now come to prove that the beneficial molecules present in the flowers could have positive impact in human health [1-2-3].

Nasturtium flowers annual plant has richly collared red, orange, and yellow flowers, with the orange ones are the most common. These flowers have strong spicy flavor watercress and are great in salads, sauces and stuffed [1-4].

The extent of post-harvest storage, preserving the quality of the flowers, will benefit the industrial development as well as the health of consumers. Edible flowers are highly

perishable products and must be free from diseases and insect pests, which represents a challenge because they must grow without the use of any chemical pesticide [5-6]. Food irradiation is a method that can be used for the extension of shelf life of perishable commodities, disinfestation of the insects and food safety [7].

Doses of ionizing radiations do not cause any significant alteration on the sensory properties of food. Safety and efficiency of food irradiation have been approved by several authorities such as International Atomic Energy Agency - IAEA, Food Agriculture Organization - FAO and World Health Organization – WHO [7-8].

Appearance is a sensory characteristic of the food, composed from color, brightness and shape. Color is related to the fresh quality foods, becoming the first criteria applied to its acceptance or rejection by consumers [9].

The purpose of this study was to evaluate the dose-response effects of gamma and electron beam irradiation (0, 0.5, 0.8 and 1 kGy) on the color of nasturtium flowers.

2. MATERIAL AND METHODS

2.1 Sample

Samples of fresh edible flowers of *Tropaeolum majus* L., commercialized inside polyethylene bags (FIG.1) were purchased from a local market in São Paulo, Brazil. Flower petals presenting phenotype orange were used.

Figure 1: *Tropaeolum majus* L.

2.2 Irradiation

2.2.1. Gamma irradiation

The samples were irradiated at Nuclear and Energy Research Institute - IPEN/CNEN (São Paulo, Brazil), using a ^{60}Co source Gammacell 200 (Nordion Ltd., Ottawa, ON, Canada), at room temperature, with a dose rate of 1.258 kGy/h, at doses of control, 0.5, 0.8 and 1 kGy. Harwell Amber 3042 dosimeters were used to measure the radiation dose.

2.2.2. Electron beam irradiation

Samples were irradiated at Nuclear and Energy Research Institute - IPEN/CNEN (São Paulo, Brazil), using an electron beam accelerator (Dynamitron, Radiation Dynamics Inc., Edgewood, NY, USA), at room temperature. The applied doses were 0.5 kGy (dose rate: 1.11 kGy/s, energy: 1.400 MeV, beam current: 0.3 mA, tray speed: 6.72 m/min), 0.8 kGy (dose rate: 1.78 kGy/s, energy: 1.400 MeV, beam current: 0.48 mA, tray speed: 6.72 m/min) and 1.0 kGy (dose rate: 2.23 kGy/s, energy: 1.400 MeV, beam current: 0.6 mA, tray speed: 6.72 m/min).

2.3. Colorimetric analysis

To measure the colorimetric of petals of edible flowers this study we applied the methodology described with some adjustments [10].

The colorimetric analysis used was colorimeter Chroma Meter CR-400 (Konica Minolta Camera Co. Osaka, Japan). The colorimeter was calibrated with standard calibration white plate (CR-A43) and configuration L * a * b * where L: luminosity (relative darkness or lightness) an value of L* = 100 represents pure white and L* = 0 represents pure black; a* is chromaticity coordinate (+a*:red; -a*:green) and the b* is chromaticity coordinate (+ b*:yellow; -b*:blue).

The analyses were performed in triplicate and the colorimeter was positioned in a vertical manner in the middle of each petal to ensure equal measurement conditions. Was used as standard control group (0 kGy), in order to obtain consistent results.

2.4 Statistical Analysis

The results of the color were submitted to analysis of variance (ANOVA) at a significance le vel of 95% ($P < 0.05$). The means comparisons were used Tukey test for analyses of color.

3. RESULTS AND DISCUSSION

The colorimetric analysis of *Tropaeolum majus* petals are shown in FIG. 2 and 3, according to the irradiation source. We can see that the irradiated samples remained with the same control sample characteristics.

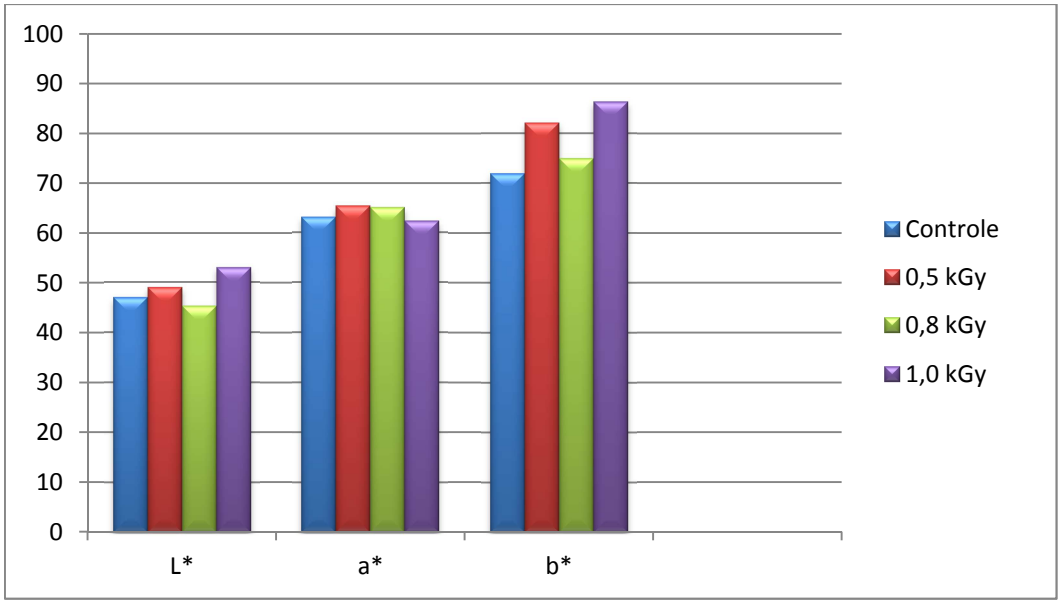

Figure 2. *Tropaeolum majus* petals analysis processed *by* ^{60} CO

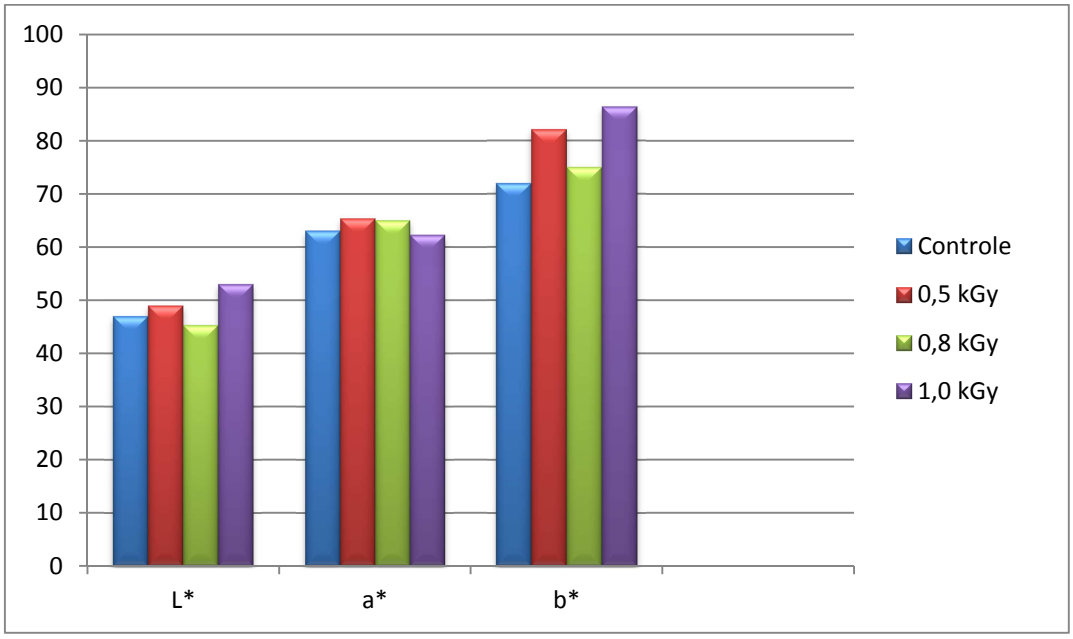

Figure 3. *Tropaeolum majus* petals analysis processed *by* electron beam

Results presented for the analyzed parameters (L *, a * and b *) was observed favoring the characteristics compared to the control, when there was a decrease was not significant, independent the radiation processing.

3. CONCLUSIONS

According to the tests set out in this work, it is concluded that food processing radiation does not compromise the sensory attributes present in *Tropaeolum majus*. Therefore food irradiation proved to be a viable technology to preserve the quality of edible flowers.

Among the applied dose, the dose 1.0 kGy showed better conservation characteristics compared with the control group, which affirm the use of electron accelerators, since there is seen a global trend in the application of this technology in food preservation.

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