SPECTROCOLORIMETRIC STUDY OF THE IRRADIATION DOSE EFFECT ON THE COLOR PROPERTIES OF *SPIRULINA PLATENSIS* POWDER★

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The aim of the paper is to study the influence of the electron beam irradiation on the colorimetric characteristics of *Spirulina platensis* powder. After electron beam treatment, the samples of *Spirulina* powder showed a shift of the color as the increase of the irradiation dose, indicating the global modification of some chemical species and their concentration.

Key words: alga, e-beams, color, modification.

1. INTRODUCTION

Color is an important characteristic for alimentary products and nutritional supplements. Visual perception of color can be characterized by the three variables hue, lightness and chroma [1]. Using these attributes to describe the color of a food, it can accurately identify the specific color of the respective product and used it as a quality parameter.

Spirulina platensis is edible microalga which can be exposed to electron beam (e-beam) treatment in order to decontaminate it from microbiological point of view [2]. Spectrocolorimetric analysis of *Spirulina* powder could be a suitable mean to identify if it suffered any alteration due to the processing or storage period and how significant is it. As in literature, there are no reports generally related to the colorimetric aspects of *Spirulina*, our target is to study how color properties of *Spirulina* powder are influenced by e-beam irradiation.

2. EXPERIMENTAL

Dry powder of *Spirulina platensis,* imported by Hofigal S. A., was used in the experiments.

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The samples were treated in plastic bags with doses of up to 40 kGy. Treatment with accelerated electron beams was carried out using a linear electron accelerator facility of 6 MeV mean energy, at room temperature and ambient pressure. The accelerator generates electron beam pulses duration of 4 μs, mean energy of 6 MeV and peak intensity of 75 mA, at repetition rate of 50–100 Hz.

The spectrocolorimetric analysis of samples was preformed by a portable spectrocolorimeter MiniScan XE Plus and expressed in CIELCH colorimetric system in which: L* – lightness, C* – chroma, h – hue. The data were processed using the Microcal Origin v 5.0 software.

3. RESULTS AND DISCUSSION

The color luminous intensity of *Spirulina platensis* is medium with value of 41.2%. When this powder is exposed to the e-beams, it is affected as the increase of the irradiation dose (Fig. 1). This means that the color becomes lighter than that of control sample and suggests that the pigment content of *Spirulina* is influenced by action of the e-beam.

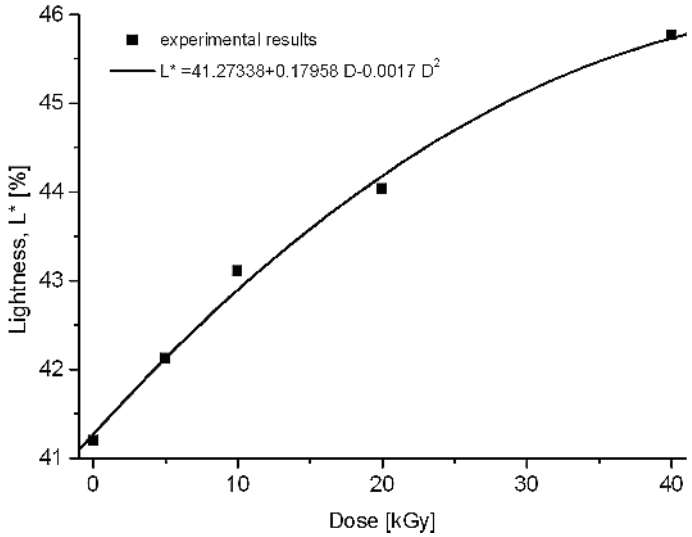

Fig. 1 – Lightness of *Spirulina* before and after irradiation.

Chromaticity describes the vividness or dullness of a color. The irradiation of *Spirulina* causes an increase of its chromaticity with the irradiation dose so that the color gets more vivid (saturated) (Fig. 2), especially at higher doses (> 10 kGy).

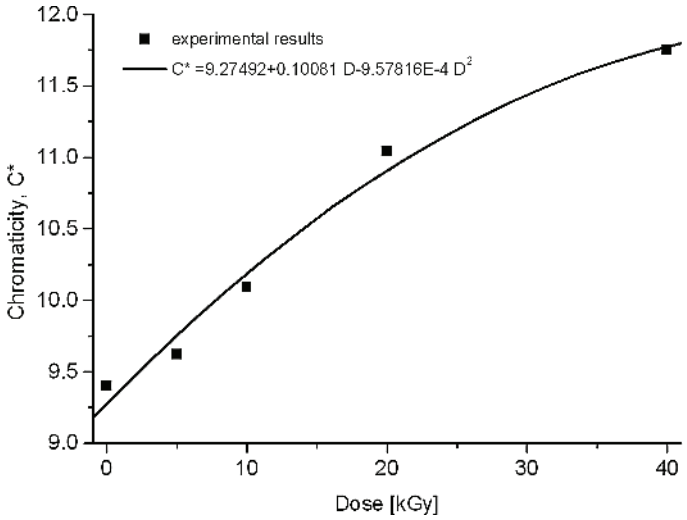

Fig. 2 – Chromaticity of *Spirulina* before and after irradiation.

Hue of a color is how we perceive a thing color – red, orange, green, blue, etc. The color hue of *Spirulina* is green-yellow; it shifts to green-blue which is indicated by the increase of the hue angle with the irradiation dose (Fig. 3).

Total difference of color shows the variations among the colorimetric parameters (lightness, chromaticity and hue) of a sample and control one, and it is a criterion for quality evaluation at industrial level.

The limits that we considered for the perception of the total color difference are:

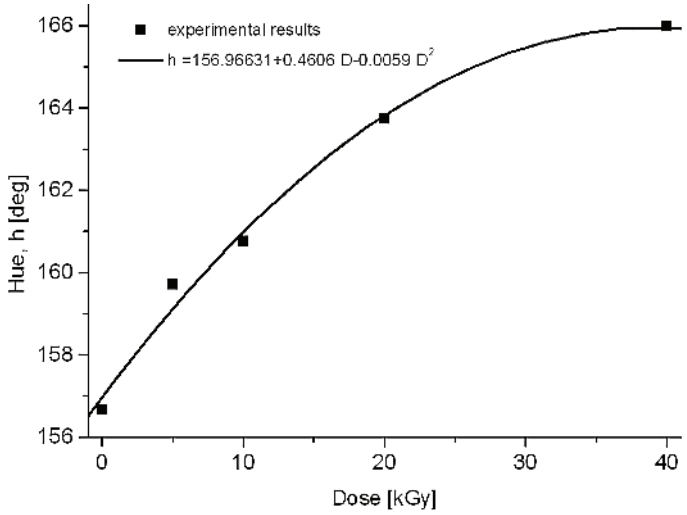

Fig. 3 – Hue angle of *Spirulina* before and after irradiation.

- < 0.2 – no measurable difference
- 0.2–0.5 – no visible difference
- 0.5–2 – visible but acceptable
- 2–5 – visible and not acceptable
- 5 – not acceptable

Spirulina platensis could be exposed to the e-beam treatment with doses up to 20 kGy because even it suffers visual changes in its chemical species and their concentration, these changes being acceptable from colorimetric point of view (Fig. 4). *Spirulina* is affected from colorimetric point of view at higher doses than 20 kGy, having unacceptable changes of its composition.

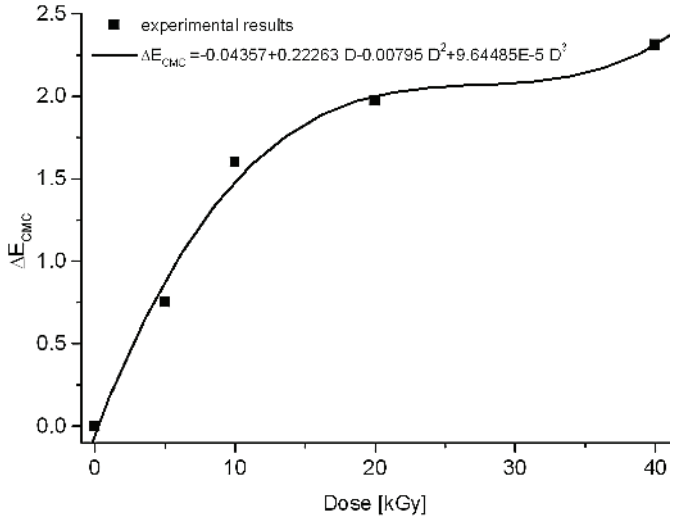

Fig. 4 – Total color difference of *Spirulina* powder.

4. CONCLUSIONS

The color parameters of *Spirulina* increase with the irradiation dose increase indicating the global modification of some chemical species and their concentration. Irradiation of *Spirulina platensis* powder with doses higher than 20 kGy causes unacceptable changes in its composition.

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