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APPLICATION OF THE OSL DOSIMETRY TECHNIQUE IN THE IDENTIFICATION OF IRRADIATED FOODS, SUCH AS CONDIMENTS AND SPICES

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ABSTRACT

The use of ionizing radiation in food preservation is considered a well-established technique, so many countries, including Brazil, now allow the use of irradiated foods. Many methods have been tested for dosimetry and identification of irradiated foods including thermoluminescence, electron paramagnetic resonance, and others based on microbiological changes and in viscosity, and which requires a sample processing. The technique of optically stimulated luminescence (OSL) presents an advantage over other methods mentioned: The samples may be used without the need for a prior processing. This work aims to study the OSL properties of condiments and spices irradiated, in order to verify the possibility of the application of the OSL technique in identifying and dosimetry of irradiated foods. The samples used were of four kinds of spices: cumin, oregano, white pepper and black pepper. All samples were subjected to gamma irradiation from a Co60 source with dose values of kerma in air of 100 Gy to 35 kGy. The samples of cumin presents the OSL signal, however, is only possible to identify whether the condiment was irradiated or not. The sample of oregano also presents the OSL signal, and for this condiment is possible to identify addition to its irradiation, the value of dose. The black pepper and white pepper samples don´t presents the OSL signal. The results obtained in this study indicate the possibility of using the OSL technique for the identification and dosimetry of irradiated foods.

1. INTRODUCTION

A considerable part of the world's food is wasted by storage problems, preservation and transport. In addition, there are the social and economic costs due to illnesses caused by contamination of food by bacteria, parasites, viruses and toxins. The use of ionizing radiation in food preservation is considered a well-established technique, so many countries, including Brazil, now allow the use of irradiated foods.

In Brazil, the regulation of the use of radiation in food is made by Resolution - RDC No. 21 of 26 January 2001 of ANVISA (National Agency for Sanitary Vigilance in Brazil), which states that any food can be irradiated since observed the minimum and maximum dosage applied and that any irradiated food should be properly labeled, even when the irradiated product is used as an ingredient in another food.

Thus, it is necessary the existence of suitable methods to identify whether foods have been irradiated or not, and estimating dose applied to food. Furthermore, the development of methods for identification of irradiated foods avoids a new irradiation of the food, allow control of the absorbed dose, verify the application of the minimum dose necessary to attend

the microbiological requirements, and contribute to the control of the international market for irradiated foods.

Many methods have been tested for dosimetry and identification of irradiated foods including thermoluminescence, electron paramagnetic resonance, and others based on microbiological changes and in viscosity, and which requires a sample processing. The technique of optically stimulated luminescence (OSL) presents an advantage over other methods mentioned: The samples may be used without the need for a prior processing.

This work aims to study the OSL properties of condiments and spices irradiated, in order to verify the possibility of the application of the OSL technique in identifying and dosimetry of irradiated foods.

2. EXPERIMENTAL METHODS

2.1. Sample Irradiation

The samples used were of four kinds of spices: cumin, oregano, white pepper and black pepper. All samples were subjected to gamma irradiation from a Co60 source with dose values of kerma in air of 100 Gy to 35 kGy.
These samples spices were irradiated in plastic tubes involved in aluminum foil to protect samples from light.

2.2. OSL Reader

All samples were stored in dark condition and at room temperature (20°C) before and after irradiation.
The samples were separated into aliquots of 8 mg for the oregano, 30 mg for the cumin and pepper white and 20 mg for the black pepper. These aliquots were deposited on plates of 8 mm in diameter and coated with a film of silicone oil.
The measurements of OSL signals were performed by a reader RISO TL/OSL-DA-15B using blue light as stimulus in continuous mode and with a lighting time (data acquisition) of 20 s. Five aliquots were measured for each sample. The OSL signal is integrated from 0s to 20 s.

3. RESULTS AND DISCUSSION

3.1. OSL Signal

The black pepper and white pepper samples no presents the OSL signal (Figs. 1 and 2 respectively), even for very high doses, such as 15 and 20 kGy.
The samples of cumin and oregano presents OSL signal, The OSL curves of cumin and oregano are shown in Fig. 3 and Fig. 4 respectively.

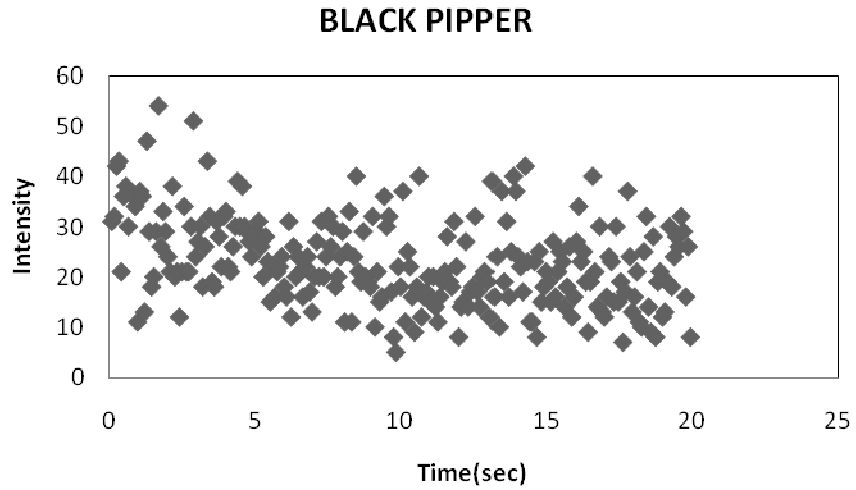

Figure 1 – OSL glow curve for black pepper with dose value of 15 kGy.

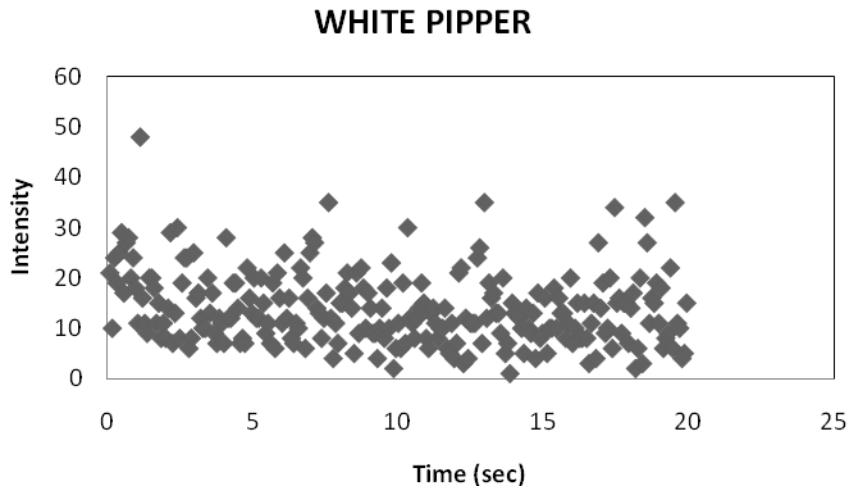

Figure 2 – OSL glow curve for white pepper with dose value of 15 kGy.

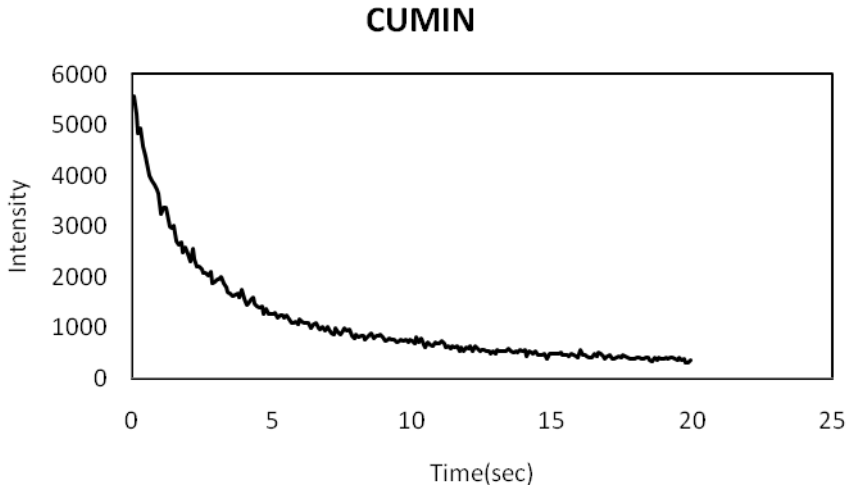

Figure 3 – OSL glow curve for cumin with dose value of 1kGy.

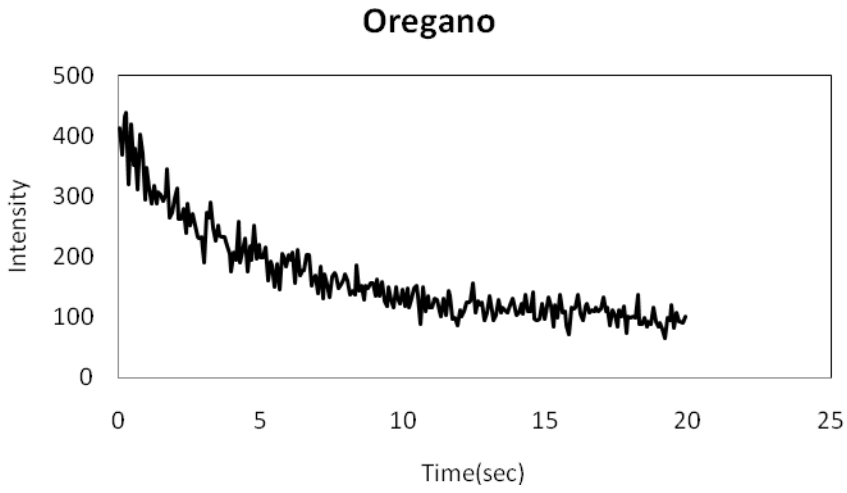

Figure 4 – OSL glow curve for oregano with dose value of 1kGy.

3.2. OSL signal response versus dose

The OSL response as a function of the absorbed dose from 100 Gy to 35 kGy for cumin and oregano was investigated. The Figs 5 and 6 show the plots of OSL versus D for cumin and oregano, respectively.

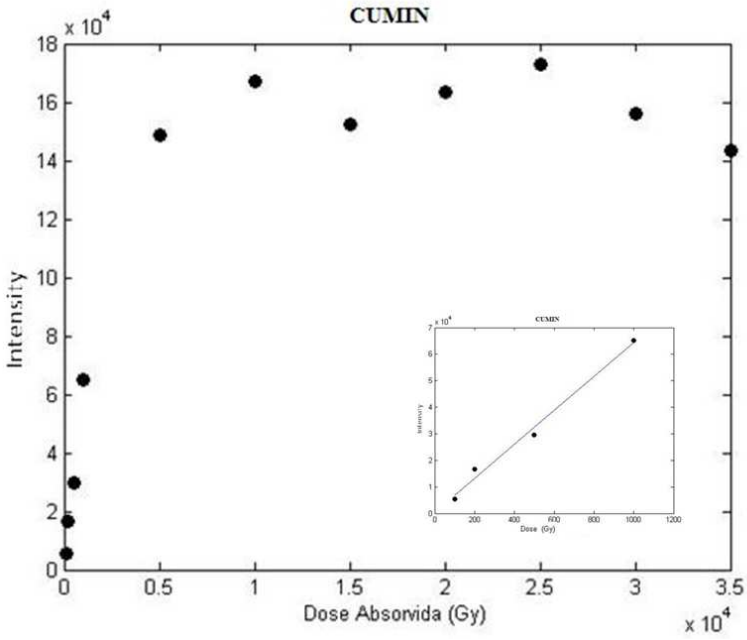

Figure 5 – OSL intensity of cumin as function of dose.

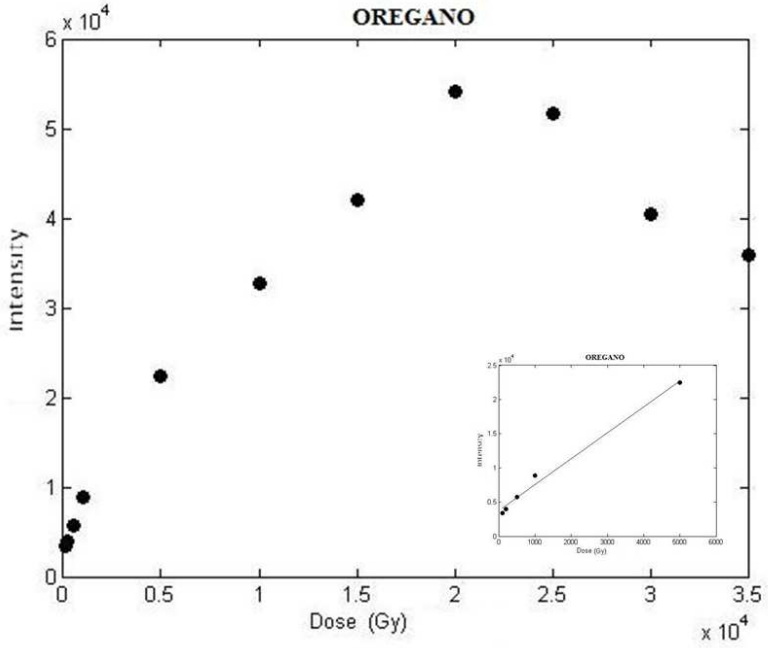

Figure 6 – OSL intensity of oregano as function of dose

From Fig. 5 it can be seen that for the cumin, the OSL signal increases linearly with dose value in the range from 100 Gy to 5 kGy, and from the value of 5 kGy, the OSL signal saturates with dose .

In the case of oregano (Fig. 6), the OSL signal is linear in the range from 100 Gy to 1 kGy, assuming a sub linear behavior up to 20 kGy. No saturation of the signal occurs, however, from the dose of 20 kGy, there is a decay of the OSL signal.

3.3. OSL Intensity Versus Mass

The OSL response as a function of the sample mass for cumin and oregano was investigated. The Fig. 7 shows the OSL emission as a function of the mass sample for cumin. The OSL signal increases linearly with the mass of the sample.

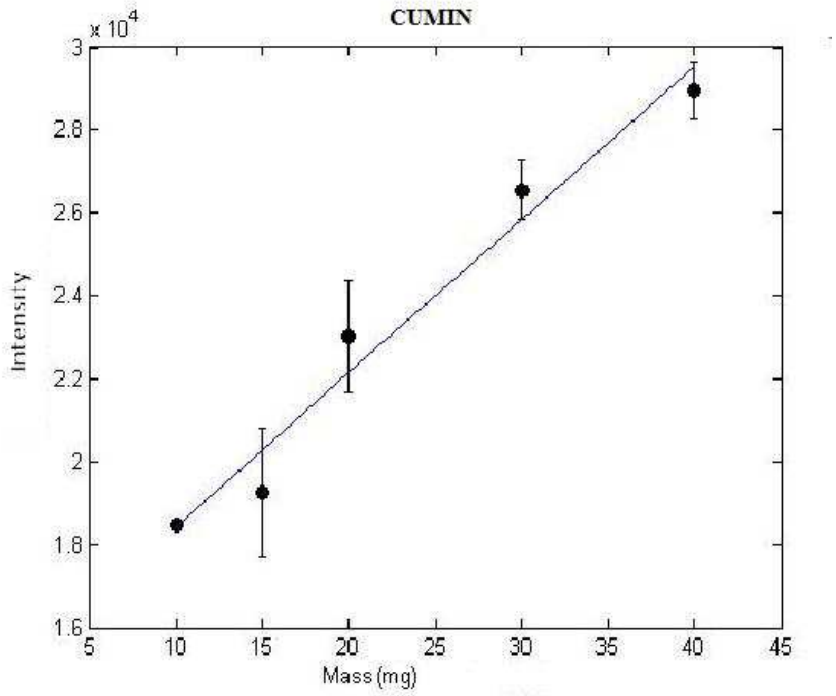

Figure 7 – OSL emission as function of the sample mass for cumin.

The same occurs with oregano (Fig. 8).

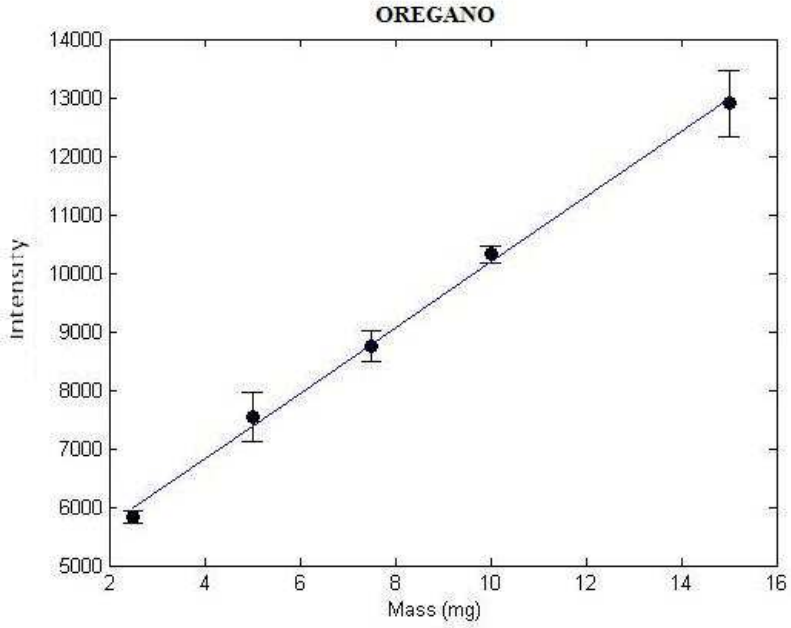

Figure 8 - OSL emission as function of the sample mass for oregano.

4. CONCLUSIONS

The samples of cumin presents the OSL signal, however, is only possible to identify whether the condiment was irradiated or not, since their saturation in dose of 5 kGy is a value smaller than the dose of 10 kGy used in the irradiation process of condiments and spices. The sample of oregano also presents the OSL signal, and for this condiment is possible to identify addition to its irradiation, the value of dose, since the signal of OSL remains linear with the dose up to 20 kGy. The black pepper and white pepper samples don´t presents the OSL signal.

The results obtained in this study indicate the possibility of using the OSL technique for the identification and dosimetry of irradiated foods.

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