

## CHARACTERIZATION OF LUMINESCENT DOSIMETERS FOR STERILE INSECT TECHNIQUE

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**Introduction:** The Sterile Insect Technique, or SIT, is an environment-friendly insect pest control method, and uses gamma rays or X-rays to sterilize insects, remaining sexually competitive but cannot produce offspring. The dose control during the SIT procedures is essential for the quality of the irradiated product or material. Insects that receive too low a dose are not sufficiently sterile and those that receive too high a dose may be uncompetitive. There are few dosimetric systems used for the dose control during the irradiation procedure. The aim of this paper is to characterize the Optically Stimulated (OSL) responses of  $\text{Li}_2\text{B}_4\text{O}_7:\text{Cu}$ , Ag, synthesized by Nuclear Energy Department of Federal University of Pernambuco, and the response of the MTS-N, TLD dosimeter to be used for SIT dosimetry.

**Material and method:** Pellets of  $\text{Li}_2\text{B}_4\text{O}_7:\text{Cu}$ , Ag, MTS-N ( $\text{LiF}:\text{Mg},\text{Ti}$ ) and alanine were used for this study. The  $\text{Li}_2\text{B}_4\text{O}_7:\text{Cu}$ , Ag are OSL dosimeters synthesized by DEN/UFPE, with a diameter of 4 mm and 1 mm in thickness. The MTS-N are TL dosimeters produced by the Institute of Nuclear Physics (INP) in Kraków, Poland, and the alanine pellets were obtained from Aerial, France. The batch of pellets used had a mean mass of  $38.2 \pm 0.1$  mg, mean diameter of  $4.0 \pm 0.05$  mm.

For calibration of the dosimeters, they were irradiated in a MDS Nordion GammaCell, model 220, with  $^{60}\text{Co}$  source, previously calibrated with ionization chamber, with doses in the range from 10Gy to 100Gy. The response of the  $\text{Li}_2\text{B}_4\text{O}_7:\text{Cu}$ , Ag dosimeters was measured using a homemade OSL Reader, under constant illumination intensity mode (CW) with blue LEDs with peak emission at 458 nm using a 380 nm filter pack during 30 s and a channel time of 0.1 s. The TL dosimeters were read in a Harshaw 3500 TL reader with heating rate of 15 °C/s, and the EPR alanine dosimeters were read in a Bruker EPR model 5000. To compare the response of the luminescent dosimeters

with the alanine, that is a reference dosimeter, the holder shown in Figure was used. This holder has three parts and in each one it is possible to include three dosimeters. The holder was irradiated with 65 Gy, that is the dose used to irradiate and sterilize the insects.

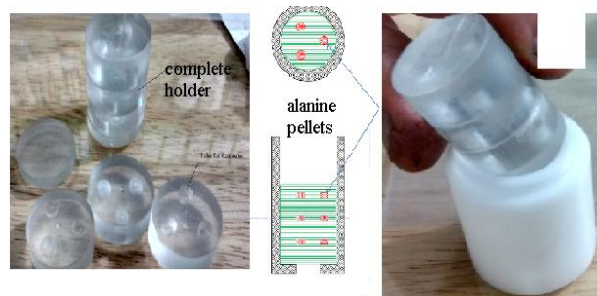


Figure 1: Image of the holder used for the irradiation of the dosimeters.

**Results:** Table 1 presents the results obtained with the three types of dosimeters. Student's t-test was applied to evaluate the hypothesis that the results obtained with the three types of dosimeters are similar and the data showed that with 99% confidence the hypothesis is accepted, that is, the results of the three types of dosimeters are similar.

Table 1: Results of the dose estimated with the three types of dosimeters, expressed in Gy. The values correspond to the mean  $\pm$  s% obtained with the three samples in each holder part.

Part of the Holder	$\text{Li}_2\text{B}_4\text{O}_7:\text{Cu}$ , Ag	MTS-N	Alanine
I - upper	64.5 $\pm$ 14	60.0 $\pm$ 4.3	66.4 $\pm$ 1.2
II - middle	54.0 $\pm$ 4.1	60.0 $\pm$ 1.8	63.4 $\pm$ 0.12
II - lower	57.0 $\pm$ 5.1	63.0 $\pm$ 10	61.9 $\pm$ 0.12

**Conclusions:** It is possible to conclude that the OSL  $\text{Li}_2\text{B}_4\text{O}_7:\text{Cu}$ , Ag and the TL MTS-N can be used for the dose control during the SIT irradiation procedure.