STUDY OF LiF:Mg,Ti AND $CaSO_4$:Dy DOSIMETERS TL RESPONSE TO ELECTRON BEAMS OF 6 MeV APPLIED TO RADIOTHERAPY USING PMMA AND SOLID WATER SIMULATORS

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Introduction: Clinical electron beams are used to treatment of superficial malignant tumors.This application requires a precise and accurate dosimetry of the electron beams to obtain great accuracy in the absorbed dose delivered in the tumor. A variation of ± 5% is determining the risk of recurrence or sequel (Nelson et al, 2010). The purpose of dosimetry in radiotherapy is to determine the absorbed dose by calibrating the radiation beam.(Metcalfe, Kron and Hoban, 2007). The small size and the large usefull dose range are the advantages to using thermoluminescent dosimeters for this purpose. Furthermore, it is possible the direct measurement of doses under some conditions in which other forms of dosimetry is not possible (Cameron, Suntharalingam and Kenney 1968). Measurements using tissue equivalent phantoms for dosimetry of clinical beams used in radiotherapy presents better accuracy in results than measurements in air (McKeever, 1985). This study aims to evaluate the TL response of $CaSO_4$: Dy produced at IPEN and LiF: Mg, Ti dosimeters to 6 MeV clinical electron beam using PMMA and solid water phantoms.

Materilas and Methods:

Dosimetric materials:

- 200 $CaSO_4$:Dy TLDosimeters;
- 200 LiF:Mg,Ti (TLD-100)

Equipments:

- Cubic plate phantoms (30 x 30 x 30 cm^3) of PMMA and solid water;
- Furnace Vulcan model 3-550 PD;
- TL reader Harshaw model QS 3500.

The dosimeters were previously separated according to their TL sensitivity in to groups of 5 detectors that were irradiated positioned at the depth of maximum dose in the different phantoms with 6MeV electron doses of 100mGy, 500mGy, 1Gy, 5Gy and 10 Gy using an accelerator Clinac 2100C Varian of the Hospital Albert Einstein: field size 10x10 cm^2, source-phantom surface distance 100 cm; depth of maximum dose 1.2 cm. The TL readings were carried out between 24 and 32 h after irradiation. Each presented value represents the average of the 5TL responses and the error bars the standard deviation of the mean.

Results and Discussion:

The dose-response curves of $CaSO_4$: Dy and LiF: Mg, Ti dosimeters to the two different phantoms are presented in Figures 1(a) and (b).

Figure 2 presents the averagee sensitivity of each dosimeter type and phantom material to 6MeV electrons.

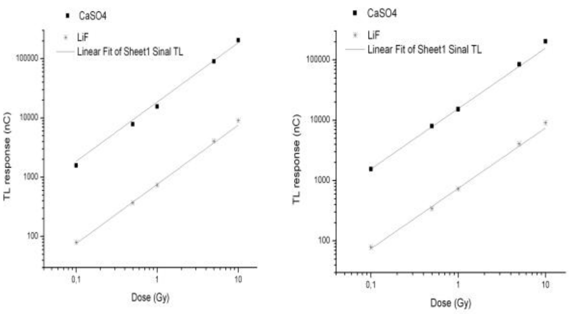

Figure 1: (a) TL dose response curve using PMMA phantom; (b) TL dose response curve using Sólid Water Phantom.

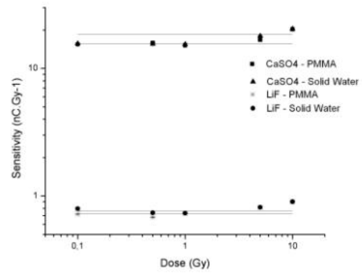

Figure 3: Avarage sensitivity of TLDs using PMMA and Sólid Water Phantom.

Conclusion:

The dose-response curves presents linear behaviour in the electron dose range from 0.1 to 5 Gy. TL dosimeters irradiated using PMMA phantom presents TL response that ranges from 0,5 to 8 % smaller than that obtained using solid water phantom, depending on the dose applied.

$CaSO_4$:Dy dosimeters presents TL sensitivity 21 times greather than LiF:Mg,Ti TL dosimeter. $CaSO_4$: Dy TL dosimeter produced at the Institute for Energy and Nuclear Research/IPEN can be a alternative dosimeter to be applied to clinical electron beams dosimetry.

References:

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