Study of TL response and intrinsic efficiency of thermoluminescent dosimeters to 15 MV clinical photons beams using a liquid water phantom

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The objective of radiotherapy dosimetry is, by calibrating the radiation beam, to determine the absorbed dose delivered to the patient, since in this type of therapy a variation of ±5% is crucial in the risk of sequel or recurrences. The small size, high sensitivity and wide range of useful dose are some advantages in using the thermoluminescent dosimeters for this purpose. This paper aimed to compare the performance of $CaSO_4$:Dy dosimeters produced by *Instituto de Pesquisas Energéticas e Nucleares (IPEN)* with LiF:Mg,Ti and microLiF:Mg,Ti dosimeters commercially available and commonly used in radiotherapy dosimetry. The dosimeters were exposed to 15 MV photon beams using a linear accelerator of *Hospital Israelita Albert Einstein (HIAE*) with absorbed doses between 0.1 to 10 Gy. The detectors were positioned at the depth of maximum dose (5cm) in a liquid water phantom and the irradiation parameters (field size and source-phantom distance) were that recommended by the Technical Reports Series nº398 (TRS 398) of IAEA (International Atomic of Energy Agency). Dosimetric properties such as dose-response, TL average sensitivity and intrinsic efficiency were evaluated. The dose-response curves of both dosimeters presented a linear behavior in the dose range studied. For doses above 10 Gy there is a tendency towards supra-linearity. The $CaSO_4$:Dy dosimeters showed TL average sensitivity approximately 26 and 287 times higher than LiF:Mg,Ti and microLiF:Mg,Ti respectively. $CaSO_4$:Dy presents intrinsic efficiency 71% higher than LiF:Mg,Ti and 94% higher than microLiF:Mg,Ti to 15 MV photons beam and liquid water phantom. Considering that the $CaSO_4$:Dy dosimeters present the same TL behavior of LiF:Mg,Ti and microLiF:Mg,Ti and with the advantage of higher sensitivity and intrinsic efficiency, we can conclude that it can be a new tool in radiotherapy dosimetry.

KALMÁN, I. (2001) Report IAEA-SM-272/31, pg. 85.

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