AbstractID: 1780 Title: Energy Dependece of a New TLD System for the Characterization of Low Energy Brachytherapy Sources

A new LiF TLD system has been developed for the characterization of low energy brachytherapy sources such as ^{125}I and ^{103}Pd (effective energy 29.7 keV and 21.6 keV, respectively). This dosimetry system allows measurements of dose distributions directly in water, thus minimizing the complications introduced by the customary use of Solid Water™ as a phantom material. The energy dependence correction factor, K_E, of the LiF TLD system in low energy photon beams (20 keV to 30 keV x-rays) relative to ^{60}Co γ rays has been studied experimentally through ion chamber measurements and theoretically by use of Burlin's cavity theory and MCNP 4C. The experimental finding was that the K_E of the TLD-100 powder capsule (1.4 mm diameter by 6.0 mm length) on average decreases from 1.0 for ^{60}Co γ rays to 0.756 ± 0.036 for the 20 keV to 30 keV x-rays. The theoretical K_E values determined using cavity theory and MCNP code were 0.706 and 0.701 ± 0.029 %, respectively. The Monte Carlo simulation showed that the total dose contribution due to photon interactions in the glass encapsulation material was not significant (0.6 %). The assumption that the TL response of the LiF powder is proportional to absorbed energy may account for the discrepancies between theoretical and experimental results. This low energy radiation study provided a better understanding of the dosimetry system behavior and also enabled a more accurate calibration relative to ^{60}Co γ rays.

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