AbstractID: 1783 Title: Silver fluorescent x-ray yield and the dose rate constant measured by a high-resolution Ge spectrometer for three 125I radioactive seeds

The physical characteristics of the photons emitted by a low-energy brachytherapy seed are strongly dependent on the seed's construction. Aside from the differential attenuation and scattering caused by the encapsulation material, the production of fluorescent x-rays, arising from the photoelectric interaction of the photons emitted by the radionuclide with the embedded materials, can significantly alter the dosimetry properties of the seed. In this work, the photon energy spectra and dose rate constant of three ^{125}I seeds that contain silver in its seed construction (model LS-1 seed by Draximage, model 12501 seed by Intenational Isotope, and model 6711 seed by Nycomed Amersham) were measured by using a low-energy high-resolution Ge spectrometer (calibrated against the NIST traceable standard sources). It was found that the 12501 seed has a silver fluorescent x-ray yield (normalized to the ^{125}I-K_α peak) similar to that of the 6711 seed (0.272 vs. 0.257 for Ag-K_α and 0.067 vs. 0.061 for Ag-K_β), while the LS-1 seed has a much lower silver fluorescent x-ray yield (0.082 vs. 0.257 for Ag-K_α and 0.020 vs.0.061 for Ag-K_β). It was shown that the difference in silver fluorescent yields is the primary cause of different dose rate constants: 0.967, 0.970, and 1.010 cGy $h^{-1}U^{-1}$, respectively, determined for the 12501, 6711, and LS-1 seeds. The dose rate constants determined from the measured photon energy spectra were found in good agreement, within ±2%, with the values measured by TLD for all three seeds.