

AbstractID: 3857 Title: Characterization and Real-time Optical Measurements of the Ionizing Radiation Dose Response for a New Radiochromic Medium

Purpose: Radiochromic films, generally used for two-dimensional dose verification, have lately been considered for point-based real-time *in vivo* dosimetry. They have some advantages, including near water-equivalency, over dosimeters used currently. In a recent study, GafChromic[®] MD-55 showed reasonable performance, but some issues remained unresolved. A new film, GafChromic[®] EBT, has potential to overcome those issues and is investigated.

Method and Materials: An optical fibre-based setup, capable of real-time measurements, was used to detect the increase in optical density over 630-640 nm range of the EBT film during and after exposure (6 MV X-rays, Varian 2100 EX).

Results: Change in optical density for EBT film, measured at the end of exposure to 1.9 Gy, was 7.7 times greater than that of MD-55 film. EBT also exhibited less post-exposure darkening, with a 12.5% increase over 18 hours, compared to 25% for MD-55. Change in optical density during exposure for EBT film was non-linear with time or dose. This was not due to a shift of the wavelength of maximum change in absorbance, which was stable at ~636 nm during the entire exposure to 9.52 Gy. Increasing the spectral window over which optical density calculations were performed had little affect on the non-linearity. The EBT film exhibited a small dose rate dependence for optical density measurements during exposure: standard deviation of change in optical density immediately at the end of a 9.52 Gy exposure increased from 0.9% to 1.8% when a six-fold variation in dose rate was introduced.

Conclusion: GafChromic EBT film has potential as a radiation dosimeter, including real-time applications, due to its increased sensitivity, decreased post-exposure darkening and spectral stability, but signal non-linearity needs to be investigated further. *This work was funded in part by National Institutes of Health / National Institute on Aging (R21/R33 AG19381).*

Conflict of Interest (only if applicable):