AbstractID: 7114 Title: Preliminary investigations of a leucomalachite green hydrogel for three-dimensional radiation dosimetry

Purpose: To develop a radiochromic hydrogel dosimeter based on the conversion reaction of leuco-triphenyl-methane dye to coloured dye.

Method and Materials: A systematic examination of surfactants revealed that Triton X-100 provided adequate solubility to keep leucomalachite green dissolved in 4% gelatin hydrogels. The gel dose response was increased by lowering the pH and by adding trichloroacetic acid. A cylindrical one litre volume sample was irradiated with a 12 MeV electron beam (Varian Clinac 2100C) to a dose of 30 Gy and scanned with a commercial optical cone beam CT scanner (Vista™, Modus Medical Devices Inc.).

Results: The most radiation sensitive gel formulation contained: 4% gelatin, 6 mM Triton X-100, 15mM trichloroacetic acid and 0.1 mM leucomalachite green. A dose response of 0.005 $cm^{-1}Gy^{-1}$ was determined from irradiation of gel-filled 1 cm pathlength polymethymethacrylate cuvettes and measurement of the optical attenuation improved at a wavelength equal to 633 nm. Comparison of the central axis gel attenuation coefficients normalized at depth of maximum dose (d_{max}) with TG21-corrected ion chamber data, demonstrated agreement in the buildup region up to d_{max}. However, the gel over-responded at greater depths.

Conclusion: Leuco dyes can be dissolved to provide transparent, colourless hydrogels by employing surfactants such as Triton X-100. The current gel formulation has a dose response approximately 20 times lower than the ferrous xylenol orange system. It is suggested that photochemistry arising from the UV light generated by the Triton X-100 scintillation fluorescence and the Cerenkov process are possible causes of a radiochromic artifact measured with electron beams.

Conflict of Interest: Two of the authors (KJ, JB) have a licensing agreement with Modus Medical Devices Inc. concerning the commercialization of Vista™.