

AbstractID: 1859 Title: The use of MAGIC Gel as a Radiation Dosimeter for Protons and Heavy ions

Abstract:

Radiation dosimetry is an important aspect of three-dimensional treatment planning for clinical radiation therapy. Numerous methods for determination of two-dimensional dose distributions exist, such as ion chambers and radiochromic films, but only recently three-dimensional dosimeters have been developed. MAGIC gel (methacrylic and ascorbic acids with copper) has the advantage of being prepared under normoxic conditions.

MAGIC gels (9% solution) were prepared and exposed to protons (Loma Linda University, LLU), ^{56}Fe , ^{28}Si , ^{22}Ti and ^{12}C (Brookhaven National Laboratory) during three separate experimental runs (2001-2003). After exposure, gels were shipped back to LLU for analysis. MRI analysis was performed on a 4.7T Bruker system. T2 (TR/TE: 5000/12 ms, 10 echos) images were acquired and postprocessed to generate T2 maps. R2 ($1/T2$) values were obtained from a region of interest in the center of the gel (~200 pixels). Optical density (OD) values were obtained from an Alpha Imager 2000. Statistical analysis was performed using the Student t-test (SigmaStat).

All radiation types showed a linear dose response curve over the dose range tested (0.5 - 15 Gy). The R2 slope of the curve varied with the radiation type, following an increasing slope: protons < ^{56}Fe < ^{22}Ti < ^{28}Si . An opposite relationship was observed with the optical measurements, but awaits additional analysis. Furthermore, the OD analysis appeared to be less sensitive method than MRI. The MAGIC gel was also tested with a rodent head.

Use of MAGIC gels was demonstrated to be suitable for 3D-dose verification of clinical and experimental irradiation protocols.