

POLYMER CROSS-LINKING AND SENSITIVITY ENHANCEMENT IN NORMOXIC POLYMER GELS USED FOR THREE-DIMENSIONAL DOSIMETRY

Purpose: To discuss the relation between cross-linking and sensitivity enhancement in normoxic polymer gels in a dose range suitable for intensity modulated radiotherapy, based on considerations related to actual sensor preparation methods and a theoretical description of the optical behavior of irradiated polymer gel when dose maps are obtained through optical CT.

Materials and Methods: Two set of samples of MAGIC gel (9% in weight of methacrylic acid) were prepared at 37°C and 45°C and irradiated with a ^{60}Co and 6 MV photon beams to doses in the range from 0.1 to 5 Gy. The samples were scanned in an optical CT. Non-irradiated samples were also scan. A theory based on the number of sites for water solvation, which takes into account polymer cross-linking, is introduced in order to explain the observed changes in the optical density. The slope of the polymer gel response to dose is a measurement of sensitivity and it is analyzed for the actual experimental conditions as well as those for the optimum in connection to cross-linking phenomena.

Conclusions: The analysis showed a proper monotonic behavior for the polymer gel response and maximum sensitivity when cross-linking occurs in an important fraction in the preparation process.