International Journal of Cancer Therapy and Oncology
www.ijcto.org

Energy dependence of polymer gels in the orthovoltage energy range

Yvonne Roed[1, 2], Ramesh Tailor[2], L Pinksy[1], Geoffrey Ibbott[2]

[1]*Department of Physics, University of Houston, Houston, TX, USA.*
[2]*Department of Radiation Physics, UT MD Anderson Cancer Center, Houston, TX, USA.*

Received March 19, 2014; Published Online April 08, 2014

[Presented at the Young Investigator's Symposium at the 2014 Annual Meeting of Southwest Chapter of American Association of Physicists in Medicine (AAPM) in San Antonio, Texas, USA]

Conference Proceeding

Abstract

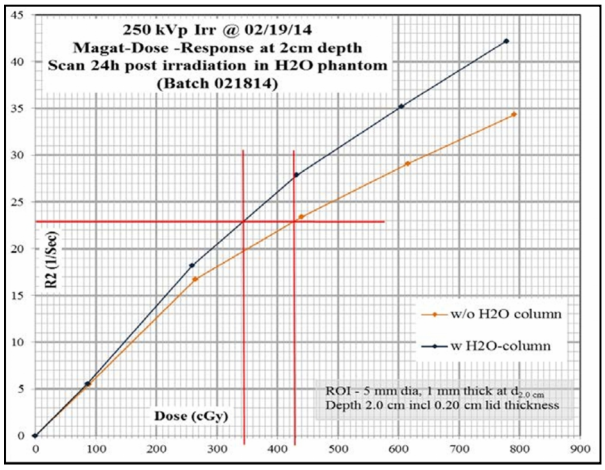
Purpose: Ortho-voltage energies are often used for treatment of patients' superficial lesions, and also for small- animal irradiations. Polymer-Gel dosimeters such as MAGAT (Methacrylic acid Gel and THPC) are finding increasing use for 3-dimensional verification of radiation doses in a given treatment geometry. For mega-voltage beams, energy dependence of MAGAT has been quoted as nearly energy-independent. In the kilo-voltage range, there is hardly any literature to shade light on its energy dependence.

Methods: MAGAT was used to measure depth-dose for 250 kVp beam. Comparison with ion-chamber data showed a discrepancy increasing significantly with depth. An over-response as much as 25% was observed at a depth of 6 cm.

Results and Conclusion: Investigation concluded that 6 cm water in the beam resulted in a half-value-layer (HVL) change from 1.05 to 1.32 mm Cu. This amounts to an effective-energy change from 81.3 to 89.5 keV. Response measurements of MAGAT at these two energies explained the observed discrepancy in depth-dose measurements. Dose-calibration curves of MAGAT for (i) 250 kVp beam, and (ii) 250 kVp beam through 6 cm of water column are presented showing significant energy dependence.

Presenting author: Yvonne Roed; Department of Physics, University of Houston, Houston, TX, USA.

Cite this article as:
Roed Y, Tailor R, Pinksy L, Ibbott G. Energy dependence of polymer gels in the orthovoltage energy range. *Int J Cancer Ther Oncol* 2014; **2**(2):020232. **DOI**: 10.14319/ijcto.0202.32



Calibration: Six jars with 60 ml of gel each were prepared and each jar was irradiated to certain dose levels in a water phantom with the lid of the jar flush with the water surface. 24h post irradiation the jars were measured with the 4.7T Bruker MR scanner and relaxation times (T2) of circular ROIs of area 0.79 cm^2 at 2 cm depth were determined. The obtained relaxation rates were plotted against the known doses resulting in a dose response curve with an exponential fit through the data point.

Depth Dose: Depth dose measurements of MAGAT were also performed in a water phantom to ensure full backscatter. The jars were positioned again positioned so that the lid was flush with the water level. A known dose was given to the lid. Relaxation times (T2) at different depths were determined and converted to dose values, normalized to the dose at the surface. These data were compared with previously measured ion chamber depth dose values. A discrepancy between the

ISSN 2330-4049

two detectors becomes more apparent with deeper depths.

Energy Dependence: The two calibration curves for (i) 250 kVp beam and (ii) 250 kVp beam through 6 cm of water column show a discrepancy. Data points are only connected to help guide the eye.

 ISSN 2330-4049