

Effects of glass and backscatter on measurement of absorbed dose in radiotherapy polymer gel dosimetry

In MRI radiotherapy gel dosimetry a method used to produce a calibration curve of relaxation rate against absorbed dose consists of injecting glass vials, pre-filled with nitrogen, with polyacrylamide gel (PAG) (Baldock 1998). The PAG filled vials are then irradiated using ionising radiation before imaging with MRI. Due to the vials being pre-filled with nitrogen, a nitrogen 'gap' remains in the vial of PAG during irradiation. The perturbation effects on the radiation field due to the glass vial and the lack of scatter due to the nitrogen gap were quantified. Monte Carlo modelling of three geometries was undertaken using MCNP4B for 1×10^7 photon histories. The geometries were (1) a glass vial half-filled with gel with a nitrogen gap, (2) a gel with a nitrogen gap but with the glass vial removed and (3) a gel with both nitrogen gap and glass vial removed. In each case the gel was at a depth of 5 cm water with an SSD of 100 cm and a field of diameter 10 cm. The maximum energy was 6 MeV. Within an uncertainty of 0.8% there was no difference in the three calculated absorbed doses indicating the influence of the glass and lack of scatter was negligible.