

Characterization of radiation induced polymer in dosimeter gel used for radiotherapy dose measurements.

When a monomer solution of acrylamide and bis-acrylamide is mixed with gelatin and after irradiation evaluated by MRI, a linear relationship between the absorbed dose and $1/T_2$ is achieved. The reason why this linear relationship is observed is not well understood and the aim of this study was to perform measurements in order to study the intrinsic behavior of the gel.

Solutions and gels were prepared, using D_2O instead of H_2O in order to suppress the signal from water. After irradiation NMR self-diffusion measurements were performed on the irradiated samples as well as on non-irradiated. In addition, 1D 1H -spectrum was used to compare the samples.

In order to investigate the amount and composition of free monomer, gel samples were irradiated to different absorbed doses and thereafter let to soak in a 'infinite' water reservoir. After soaking the water-solution was removed and freeze-dried. Quantification of the white powder obtained was done gravimetrically and by NMR.

The NMR self-diffusion measurements showed that there was no change in self-diffusion of water, indicating that the gel structure is relatively invariant as the applied dose is increased ($D_{\text{water}} = 1.5E-9 \text{ m}^2\text{s}^{-1}$ independent on dose).

From the measurements performed on freeze-dried samples it was found that a significant amount of acrylamide, bis-acrylamid and gelatin was present in the water phase and that the total amount decreased as the dose was increased. In addition, relative fractions of the components changed drastically with the applied dose.