Calibration of Gammacell irradiator for irradiation of radiotherapy polymer dosimetry gels

A Gammacell is a facility used in research for irradiating specimens. It consists of a central chamber surrounded by a number of Co-60 rods. Such a facility has potential use in the irradiation of radiotherapy polymer dosimetry gels for the purposes of investigating their dose responses. A methodology was developed to calibrate a Gammacell using a PTW 0.125 cm^3 Semiflex ion chamber (Type M31002) and IQ4 electrometer. The absorbed dose was measured with the ion chamber for eight different irradiation times. Seven measurements were made at each irradiation time. The relationship between absorbed dose and irradiation time was linear with an R value approximating 1, a P value of 10^{-13} and a standard error of estimate in the absorbed dose of 0.03 Gy for an absorbed dose range up to 20 Gy. This demonstrates that a Gammacell may be used to irradiate polymer dosimetry gels to known absorbed doses with a high accuracy. The three-dimensional absorbed dose distribution in the chamber of the Gammacell was subsequently determined using a polymer dosimetry gel filled phantom manufactured according to the method published previously (Baldock, 1998).