Evaluation of polymer gels using Monte Carlo simulations

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The use of Monte Carlo simulations in dosimetry is a well established area of research, and several correction factors, for ionization chambers, are evaluated with these simulations. Some simulated values are considered even more reliable than the experimental measurements. Besides these uses with ionization chambers, Monte Carlo simulations may also be employed in the development and characterization of new dosimetric materials, as polymer gels. Polymer gels are largely employed in radiotherapy dosimetry to mimic human tissue [1,2]. New polymer gels were studied in order to better represent different organs or tissues, to provide more reliable results, or even to use different measurement techniques. The objective of this study is to evaluate the dosimetric properties of polymer gels, in relation to its mass-energy absorption coefficients, energy response and tissue equivalence. For this purpose the MCNPX Monte Carlo code was utilized. Four different materials, employed in radiotherapy dosimetry were evaluated in this work: MAGAS (methacrylic acid gelatine gel with ascorbic acid), MAGAT (methacrylic acid gelatine and tetrakis), AMPS (2-Acrylamido-2-MethylPropane Sulfonic acid) and MAGIC (Methacrylic and Ascorbic acid in Gelatin Initiated by Copper). For all simulations carried out, the values were within an acceptable uncertainty and in accordance to the expected results.

Keywords: Monte Carlo simulation, dosimetry, gel polymers.

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