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# INVITED LECTURE - Chemical dosimetry for BNCT mixed radiation field and conformal radiotherapy

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Gel dosimeters allow in-phantom verification of the absorbed dose spatial distribution in conformal radiotherapy treatments. Particularly advantageous are Fricke gel dosimeters in form of layers that can be analysed with very simple instrumentation, give precise results if properly calibrated and offer particular advantages in the mixed neutron-gamma fields of boron neutron capture therapy (BNCT).
Fricke gel layer dosimeters are based on ferrous sulphate solution (Fricke solution) containing Xylenol-Orange, infused in 3mm-thick gel matrix. The measurable effect produced by ionising radiation is a change in the wavelength of visible light absorbance. The dosimeters are imaged with a CCD camera system before and after irradiation, and the measured difference of optical density around 585nm wavelength is proportional to the absorbed dose. The good tissue equivalence of such dosimeters, consisting in a dilute water solution, and the independence of their response on photon energy in the range of interest for radiotherapy, constitute valuable characteristics for appropriate in-phantom dosimetry in conformal radiotherapy. Moreover, the layer geometry has allowed the development of a calibration procedure that enable achieving very high precision (within 3%).
The layer geometry of such gel detectors is particularly convenient also in BNCT dosimetry. In fact, a method for imaging the various dose components has been proposed and widely applied, based on couples of gel-dosimeters having a suitable difference in their isotopic composition. Thanks to layer geometry, neutron transport is not sensibly affected by such a gel matrix variation because it is mainly determined by the tissue-equivalent phantom around dosimeters. Therefore, it is possible to measure the spatial distribution of the dose due to the charged particles generated by B-10 reactions with thermal neutrons, of the gamma dose due to background and to photons emitted in the reactions of thermal neutrons with hydrogen and also of the dose due to the fast component of the epithermal neutron beam.

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