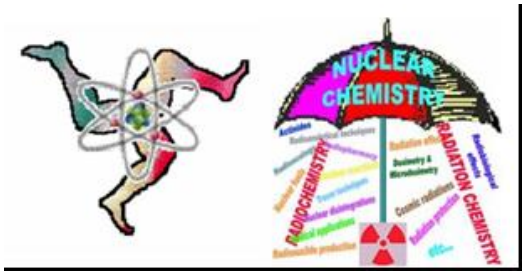

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Measurements of the spatial distribution of each dose component in tissue exposed to an epithermal neutron beam for BNCT

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In tissue exposed to high-flux epithermal neutron beams, the reactions mainly responsible for the absorbed dose in tissue are those with hydrogen and nitrogen, that is 1H(n,γ)2H (σ = 0.33 b), whose γ-rays of 2.2 MeV can travel many centimetres through tissue, and 14N(n,p)14C (σ = 1.81 b), whose emitted protons of about 0.6 MeV have short range in tissue, giving local dose deposition. The fast neutron component of epithermal neutron beams, gives a not negligible contribution to the absorbed dose mainly due to elastic scattering with hydrogen nuclei. If the isotope 10B is selectively accumulated in tumour tissue, the reaction with thermal neutrons 10B(n,α)7Li (σ = 3837 b) causes localised energy absorption in cancerous cells; this is exploited by boron neutron capture therapy (BNCT). It is mandatory to separate the various dose contributions, owing to their different biological effectiveness.

The dosimetry method based on Fricke-Xylenol-Orange-infused gels in form of layers has shown noticeable potentiality for in-phantom or in-free-beam dose distribution measurements in the high fluxes of thermal or epithermal neutrons. In fact, a method has been developed that gives the possibility of obtaining the spatial distribution of each dose component. The discrimination of the various dose contributions is achieved by means of pixel-to-pixel manipulations, with suitable algorithms, of pairs of dose images obtained with gel-dosimeters having different isotopic composition. It is possible to place large dosimeters, detecting in such a way large dose images, because the layer geometry of dosimeters avoids sensitive variation of neutron transport due to the gel isotopic composition.

Various measurements, both in phantom and in free-beam, have been carried out at the collimator of the epithermal column of the LVR-15 research reactor in Řež (CZ), which is suitably designed for BNCT treatments.

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