CHARACTERIZATION OF YTTERBIUM-DOPED SILICA OPTICAL FIBRE AS SCINTILLATOR DOSIMETER

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Introduction. Scintillator dosimeters (SD) have been a research topic by many groups over the last decade. The recent availability of a commercial system (Exradin W1 by Standard Imaging) represents a significant accomplishment. The attractiveness of SD would be furtherly enhanced by a scintillator free from any spectral superposition with the Cherenkov light, so to avoid any sensitive calibration procedure for the stem effect correction. Yb-doped silica optical fibres, thanks to their near-infrared (NIR) emission, proved to be a promising option.

Purpose. This study aims to characterize the dosimetric properties of Yb-doped fibers in radiotherapy and to compare their results with those obtained by various reference dosimeters like micro ion-chambers, the commercial SD, and diodes designed for small field dosimetry.

Materials and methods. Yb-doped fibres were prepared by sol–gel. The scintillation was detected with a laboratory-made photon counting system based on an avalanche photodiode (APD), using a long-pass filter at 950 nm. Irradiations were carried out with photons and electron beams generated by a Varian Trilogy accelerator.

Results. The NIR scintillation proved to be unaffected by the stem effect, even in unfavorable large field irradiations. The system showed a satisfactory reproducibility, good sensitivity, linear dose-rate response, independence of the signal (total counts) of dose rate and impinging beam orientation. The results were in good agreement with reference dosimeters in terms of relative dose profiles and output factors.

Conclusion. Findings pave the way to the engineering design of the system, which could be an interesting option also for real-time in-vivo dosimetry applications.

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LOW DOSE CHARACTERIZATION OF FRICKE GEL DOSIMETERS BY OPTICAL ABSORBANCE AND MR RELAXATION METHODS

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Introduction. Fricke gel dosimeters allow measurements of 3D dose distributions and can be an effective tool for dosimetry verifications in radiotherapy. Various authors have reported drawbacks of the gels affecting the accuracy in case of low dose measurements.

Purpose. This study aims at investigating such drawbacks and at establishing the conditions for an optimal use of the gels.

Materials and methods. Our dosimeters consist of gels infused with a Fricke ferrous sulphate solution combined with xylenol orange (XO). Two kinds of xylenol orange (XO) and two different gelling agents (gelatin from porcine skin and Agarose) were utilized. Gels are red out by light absorption techniques: images of absorbance in two wavelength regions (around 430 nm and 585 nm) are acquired with a CCD camera. Absorbance spectrum measurements were done with a compact spectrometry based on optical fibres. Magnetic resonance (MR) measurements of Longitudinal Relaxation Time (T1) were also performed.

Results. Different trends characterized the absorbance spectra of dosimeters obtained with different gelling agents or different XOs. Moreover, the trends were different for different absorbed doses and varied over a few hours after irradiation.

Conclusion. The variation of the absorbance spectra is consistent with various previously unexplained effects reported in literature and may explain them. The results are a valid aid for a better use of these dosimeters and warrant further studies of the changes in the Fricke gel matrices after irradiation.

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RADIATION SAFETY TRAINING IN MEDICINE

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The use of radiation in Medicine has been on the rise in many countries. A lot of diagnostic and therapeutic procedures may expose patients and staff to high radiation dose which can be reduced to low levels to ensure the safety and protection against the harmful effects of radiation exposures. The objective of this presentation is to ensure the following:

1. Implementing an effective radiation safety strategy
2. Examining the role of the hospitals in creating a radiation safety program
3. Enforcing radiation safety practice for patients, staff, physicians and visitors.
4. Providing regular radiation safety education to concerned staff
5. Identifying opportunities to improve radiation safety performance

By adhering to the principles and doctrines of radiation safety set forth by international organizations, the safety culture among radiation workers will be enhanced and the productivity as well as performance of the protocols will be optimized.

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