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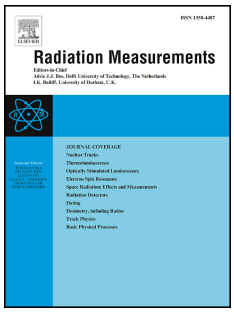

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Evaluation of Ferrous Methylthymol Blue Gelatin Gel Dosimeters Using Nuclear Magnetic Resonance and Optical Techniques

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Abstract

Signal development of irradiated Methylthymol blue (MTB) Fricke gelatin gel dosimeter was studied using nuclear magnetic resonance (NMR) in terms of the spin-spin relaxation rate (R_2) of hydrogen protons within the water molecule. The optical properties of MTB gel were also studied using a spectrophotometric technique. The gel dosimeter presents a linear response for doses up to 20 Gy with ultraviolet visible (UV-Vis) spectrophotometry and 40 Gy with NMR. For a 0.1 mM MTB concentration and dose of up to 10 Gy, the sensitivity of the gel response analyzed by a spectrophotometer is 0.077 a.u. Gy^{-1} at 620 nm with a linear coefficient of (r^2 = 0.998), while the R_2 sensitivity is 0.02 s^{-1} Gy^{-1} with a linear coefficient of (r^2 = 0.998). The sensitivity of the Fricke-MTB dosimeter was higher when compared with the Fricke-XO dosimeter. The dose rate and photon energy beams were dependent of the absorbance and R_2 dose sensitivity, as observed over the range studied. The Fricke-MTB gelatin dosimeters can be scanned at higher wave lengths than the conventional Fricke-XO gelatin formulations.