Séminaire

Département des sciences de l'imagerie médicale et des radiations

MODELING THE IMPACT OF VISCOSITY ON FRICKE GEL DOSIMETER RADIOLYSIS: A RADIATION CHEMICAL SIMULATION APPROACH

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The Fricke gel dosimeter, based on ferrous sulfate in a hydrogel, enables 3D mapping of radiation dose by oxidizing Fe2+ to Fe3+ upon irradiation. This study explored how Fricke yield, G(Fe3+), changes with viscosity and radiation type. Using the Monte Carlo track chemistry code IONLYS-IRT, simulations were conducted with protons of 300 MeV (low LET, ~0.3 keV/µm) and 1 MeV (high LET, ~25 keV/µm). Diffusion coefficients of radiolytic species, including Fe2+ and Fe3+, were systematically adjusted to represent gels of varying viscosities. Results showed that increasing viscosity restricts Fe3+ diffusion, enhancing spatial stability but lowering G(Fe3+), which reduces dosimeter sensitivity, especially under high-LET radiation. Additional simulations with reduced sulfuric acid concentration (0.05 M vs. 0.4 M) revealed that G(Fe3+) values converge at ~100 s regardless of LET. Overall, the findings demonstrate the usefulness of Monte Carlo modeling in optimizing Fricke gels to balance accuracy, sensitivity, and spatial dose distribution integrity.