NUMERICAL SIMULATION OF THE DIFUSION OF FERRIC IONS IN FRICKE-GEL DOSIMETERS

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Abstract. Radiation Dosimetry is a field concerned in measuring absorbed doses of radiation using different techniques. The chemical dosimetry using Fricke-Gel dosimeters allows the confirmation and a better understanding of radiotherapy treatments. This technique involves the assessment of volumes composed by irradiated ferrous sulphate solutions and the dose estimatives can be evaluated using images from optica-CT or magnetic resonance. In both cases, the time elapsed between the irradiation and the evaluation of doses is an important factor, because the ferric ions formed after the irradiation begin to move along the gel matrix causing imperfections in the obtained estimatives. In this work, the dynamics involving the ferric ions, modelled by Fick's Second Law, is investigated and solved numerically. A suitable numerical method was chosen regarding the theoretical aspects such as convergence, consistency, stability and computational eficiency to simulate the diffusion of the ferric ions in bidimensional and tridimensional enviroments under several hypothesis such as multiply connected domains and non-constant diffusion coefficients. The approximated solutions were obtained with a prefixed precision and graphical respresentations of the phenomenum are presented for a better visualization of the problem.

Keywords: Radiation Dosimetry, Fricke-Gel Dosimeter, Partial Differential Equations, Numerical Methods, Numerical Simulation

Mathematics Subject Classifications (2016): Aplications in Engineering and Life Sciences

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