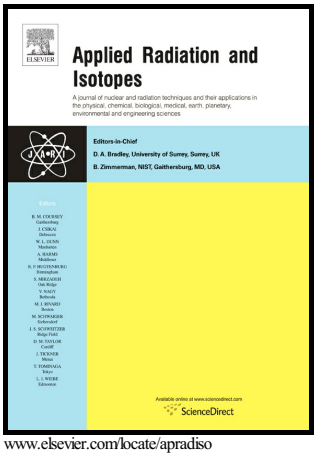

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Nanoscale dose deposition in cell structures under X-ray irradiation treatment assisted with nanoparticles: an analytical approach to the relative biological effectiveness

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Abstract

In this study, an analytical model for the assessment of the modification of cell culture survival under ionizing radiation assisted with nanoparticles (NPs) is presented. The model starts from the radial dose deposition around a single NP, which is used to describe the dose deposition in a cell structure with embedded NPs and, in turn, to evaluate the number of lesions formed by ionizing radiation. The model is applied to the calculation of relative biological effectiveness values for cells exposed to 0.5 mg/g of uniformly dispersed NPs with a radius of 10 nm made of Fe, I, Gd, Hf, Pt and Au and irradiated with X-rays of energies 20 keV higher than the element K-shell binding energy.

1. Introduction

In recent years, the use of nanoparticles (NP) in medicine has been growing rapidly. In particular, recent advances in nanotechnology have provided new opportunities for the use of NPs to further increase radiation therapy efficacy (Ngwa et al., 2014). Given that radiation therapy is not a selective antitumor treatment; the main challenge for the use of this therapy is the damage to the healthy tissue surrounding the tumor. Hence, the goal of combining radiation therapy with NPs is to increase its therapeutic efficacy by increasing the differential effect between healthy and tumor tissue (Retif, et al., 2015).