

<https://doi.org/10.70200/RX202401060P>

APPLICATION OF FREE RADICAL SCAVENGERS IN HUMAN LUNG CANCER CELLS IRRADIATED WITH PHOTONS AND CARBON IONS

Vladana Petković^{1*}, Otilija Keta¹, Miloš Đorđević¹, Giada Petringa², Pablo Cirrone², Ivan Petrović¹, Aleksandra Ristić Fira¹

^{1*}*Vinča Institute of Nuclear Sciences, National Institute of the Republic of Serbia, University of Belgrade, Belgrade, Serbia, vladana@vin.bg.ac.rs*

²*Istituto Nazionale di Fisica Nucleare, INFN-LNS, Catania, Italy*

Ionising radiation damages DNA directly, or indirectly, causing water radiolysis and formation of free radicals. Indirect irradiation effects could be diminished in the presence of free radical scavengers, such as dimethyl sulfoxide (DMSO). Such conditions would allow the evaluation of direct radiation effects and provide a better understanding of cellular response to irradiation-induced damages. The goal of this study was to investigate the effects of low (γ -rays) and high linear energy transfer (LET) radiation (carbon ions) in non-small lung cancer cells HTB177. Cells were pre-treated with DMSO and irradiated with ^{60}Co γ -rays and 62 MeV/u carbon ions, with doses ranging from 1-5 Gy. Results obtained by clonogenic survival and γ -H2AX foci assay showed that DMSO increased cell survival and decreased number of DNA damages, which points to radioprotective effect of DMSO. The contribution of direct and indirect radiation effects was estimated by the degree of protection (DP) in presence of DMSO. The values of DP rose in a concentration-dependent manner in all irradiated samples. In cells irradiated with γ -rays, 35% of damages were caused directly, while 65% of lesions could be attributed to indirect radiation actions. In presence of carbon ions, contribution of direct effects was 49%, while 51% of damage resulted from indirect radiation effects, showing that free radicals attain an important role in both low and high LET irradiations. The obtained results showed that DMSO can be used as a free radical scavenger to examine the direct and indirect effects on human cancer cells. The numerical Monte Carlo simulations allow modelling of direct and indirect irradiation actions in cancer cells with photons and hadrons. Therefore, this data will be used for validation and further improvement of numerical simulations in comparison to the data collected on different cell lines and irradiation energies, with the goal to improve therapeutic protocols.