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ABSORBED DOSE OF PULSED PERIODIC X-RAY RADIATION GENERATED BY A PLASMA ACCELERATOR ON MODEL BIOLOGICAL STRUCTURES *)

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In radiological effects on cancer cells, the determining factor is the type of ionizing radiation and its dose characteristics. When using gamma radiation, its spectral composition depends on the source used and cannot be changed. X-ray tubes make it possible to change the limiting quantum energies within a limited range due to variations in the accelerating voltage.

In this work, a plasma generator of bremsstrahlung and characteristic radiation operating on the principle of gyromagnetic autoresonance (GA) in a magnetic mirror trap with a variable field profile was used as a source for influencing pathological cell cultures [1,2]. The radiation is generated by the interaction of high-energy plasma bunches with the solid-state target material (Ta, Mo, W).

The plasma accelerator makes it possible to irradiate model biological samples with X-ray radiation with a tunable spectrum in the energy range from 50 to 500 keV. The aim of the work was to determine the absorbed dose of X-ray radiation when exposed to squamous cell carcinoma of the head and neck FaDu and Cal27 cell lines. The irradiated cells were analyzed using an MTT test to determine the total metabolic activity of the cells and assess their survival after exposure.

The specified X-ray generator allows the samples to be exposed in a pulse-periodic mode with the possibility of a wide variation in the integral exposure time (depending on the pulse duration, duty cycle and accelerator operating time).

A detailed study of the spectral and angular distributions of X-ray radiation and radiological parameters in the sample placement area has been carried out. The spatial distribution of the absorbed dose at the location of the containers with model samples has been determined. The absorption in the material of polypropylene containers and the nutrient medium of cell cultures was taking into account. The empirical calibrations performed made it possible to accurately determine the absorbed dose directly in biological samples.

The results of preliminary experiments showed the influence of the spectral composition of radiation and absorbed dose on the metabolic activity of the irradiated cells. More detailed studies will allow us to select the operating modes of the generator and the radiation characteristics that will have greatest impact on sells metabolic activity of the samples.

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Reference

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