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LOW TEMPERATURE PLASMA JET OPTIMIZATION FOR CANCER TREATMENT

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Recently the low temperature atmospheric pressure plasma jets (CAPS) are widely used for the inhibition of the solid tumor growth, and in particularly with a combination with nanoparticles [1]. In this work, to maximize the effect of the CAPJ treatment on the different cancer cell lines, the optimization of the plasma jet device was done for the sinusoidal and positive pulsed voltage discharge initiation. The different modes of discharge operation were analyzed in the experiment and fluid model numerical simulations. The efficacy of chosen regimes was confirmed in our bio experiments with cancer cell lines (A549, MX7, A431 etc). The viability of the cancer cells was analyzed with MTT assay 24 hours after the CAPJ exposure. It was shown that the viability of cancer cell depends on the choice of the mode of the discharge operation. In physical experiment and simulations, the optimization of CAPS regimes was done with an analysis of the self-organization of voltage – streamer propagation frequencies, which sets the total effect of the bio target treatment [2,3]. In fact, an increase of the voltage amplitude and frequency causes a nonmonotonic increase of the plasma-target interaction. The temperature of the zone of CAPJ contact with the target can rapidly increase and burn the bio tissue. So the safety conditions should be monitored. We also study the dynamics of the NPs penetration on the cancer cells in vitro and the effect of nanoparticle presence inside the cells on their viability after CAPS treatment. In Figure 1, the plasma device, simulation domain and mouse treatment with CAPJ are shown.

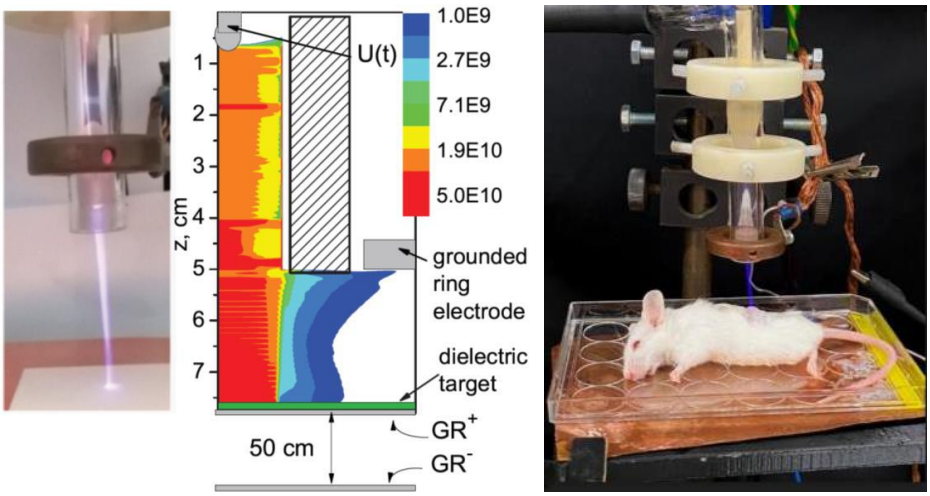

Fig.1. Experimental device and fluid model calculation domain with the ion density distribution when the streamer touches the dielectric target, GR+ and GR− correspond to the cases with the grounded electrode beneath the target and the grounded electrode 50 cm apart from the target. Sleeping mouse with tumor during CAPJ treatment.

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