INFLUENCE OF COLD ATMOSPHERIC PLASMA TREATMENT ON BACTERIAL AND EUKARYOTIC CELLS

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In our work we present the results of an experimental study of the effect of non-isothermal low-temperature microwave argon plasma under atmospheric pressure, generated by the developed medical plasmatron, on bacterial and eukaryotic cells at various regimes of plasma generation. We obtained the modes of plasma generation (including exposure, the gas flow rate, the electrode gap and the distance to the cells treated in vitro), at which a pronounced bactericidal effect in the absence of toxic effects on human eukaryotic cells was achieved.

To study the bactericidal effect of argon microwave plasma generated by a modified power source, we used microorganisms most frequently contaminating the wound surfaces: Gram-positive Staphylococcus aureus ATCC 25923 and Gram-negative Pseudomonas aeruginosa Pa103 which have a multiple antibiotic resistance. As a result, it was found that the Gram positive S.aureus was more resistant to the effects of plasma and Gram-negative P.aeruginosa showed greater sensitivity.

To determine the possible toxic effects of low-temperature plasma (LTP) for eukaryotic cells we used cell types that form the wound surface and participating in the closure of wound defects: a cell line of human fetal lung fibroblasts with properties similar to dermal fibroblasts, and immortalized human keratinocytes HaCaT. The study cytotoxicity we used xCELLigence (Roche) system, allowing tracking the rate of proliferation and cell death in real time in 96-well plates. To study the possible toxic effects of LTP we chose modes, which showed the greatest efficiency in experiments with pathogens. It has been found that plasma treatment in these conditions did not have a toxic effect, and in 120 hours after plasma exposure cell death was not observed.

Thus it is shown that the low-temperature plasma generated by the developed power source can have a strong bactericidal effect against multi-antibiotic resistant microorganisms, and be non-toxic to the eukaryotic cells at the same time.