In vivo treatment of cells with plasmas in liquids

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Recently the application of plasmas for medical purposes has become a reality. Most of the plasmas currently used are created in flowing gas, usually helium or argon, at atmospheric pressure. Here however the discharge is created in an isotonic saline solution and response of MDAMB-231, a human breast cancer cell line, to plasma production within that solution is investigated. The results are compared to the effects of X-ray irradiation on the cells.

Plasma discharges operated in liquid environment are usually operated in non-conducting liquids with applied voltages of over several kV. Here the use of conductive liquid means that applied voltages of a few 100 V is sufficient and the plasma is created in a relatively welldefined vapourised region. Devices of this type are now being widely used as electrosurgical scalpels. Here however we use an asymmetric coaxial electrode assembly with small powered electrode with surface area of about 1mm2, driven at 325 V with a duty cycle of about 1 to 1000 and pulsed at ~1 Hz [2,3] to study the response of MDAMB-231 cells, to plasma production within DMEM growth media with added FBS and glucose, in which the cells are held for another hour post treatment before the medium is replaced.
We find evidence of both, decreased cell viability and DNA damage within the cells. Measurements indicate that the behaviour of both the cell survival rate and the strand breakages as function of the time of exposure to plasma follow the same functional relationship as that when they are exposed to low doses of 160 kVp X-rays.

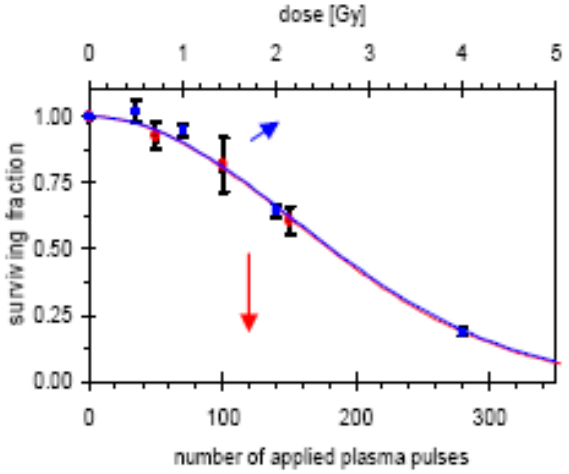

Figure 1. The surviving cell fraction following low dose plasma and X-ray exposure,

References

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[3] Schaper L, Graham W G and Stalder K R Plasma Sources Sci. Technol. 20 (2011) 034003