

Apoptosis Induction on Fibroblast Cells by Atmospheric Pressure Plasma Treatment Using Nanosecond Pulsed Power Generator

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Apoptosis induction by atmospheric pressure plasma treatment is a promising technique for medical application such as tumor treatment, minimally invasive surgery and alternative to chemotherapy [1-2]. The control methodology and the mechanisms of the apoptosis induction using plasma treatment is still not clear due to the complex behavior in plasma-biological interaction. The target of our research therefore is the understanding of the mechanism of interaction between plasma and living organisms. The influence of atmospheric pressure plasma treatment on murine fibroblast cell lines (NIH3T3) is researched as a first step.

The short pulsed high voltages with 6-nanoseconds of pulse width are ignited by the inductive energy storage type pulsed power generator using semiconductor opening switches [3], and applied to the plasma needle type electrode with gas flow control in order to generate non-thermal plasma and prevent the electric field effects such as membrane charge.

In figure 1, the cell lines decrease with the duration of the plasma treatment on pure O₂ gaseous. On the other hand, He plasma enlarge number of the cells with the treatment duration and gain of 47% with 10 seconds treatment. A part of cell lines with O₂ plasma shrinkages and represents apoptosis treatment using TUNEL kit in figure 2. The apoptosis concentrically appear with centering just below the plasma electrode. These results indicate the plasma treatment included the electrically-charged particles, radicals and UV, works on the cell lines.

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References

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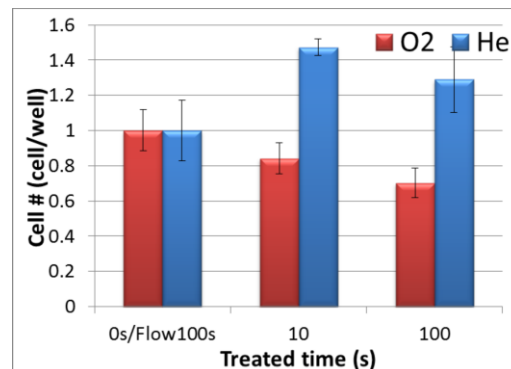


Figure 1: living cells treated by O₂/He plasma.

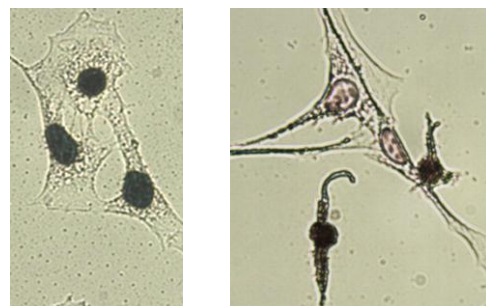


Figure 2: Apoptosis detection using TUNEL kit (left: positive control, right: O₂ plasma).