MICROPLASMA GENERATION OF REACTIVE OXYGEN SPECIES FOR BIOLOGICAL APPLICATIONS

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Reactive oxygen species (ROS) seem to play an important role in several biological systems, and could generate oxidative damage to a variety of biological targets. Fundamental studies examining the cellular components targeted by different ROS generated in low-temperature plasmas are, thus, quite interesting and very promising for biomedical applications. Among other cellular targets, DNA is of particular importance, due to its key role in cell survival and reproduction.

In this context, we have developed arrays of microcathode sustained discharges (MCSD) for the production of ROS at atmospheric pressure. The remarkable stability of MCSD has allowed us to operate DC glow discharges, free from the glow-to-arc transition, at high gas pressure. As a result, large amounts of singlet oxygen and ozone have been obtained in He/O2/NO mixtures at atmospheric pressure[1]. In fact, singlet oxygen densities higher than 7 10^{16} cm^{-3} have been efficiently produced, resulting in singlet oxygen fluxes above 70 mmol/h. Besides that, these arrays of MCSD, allowing the production at atmospheric pressure of singlet oxygen and ozone densities between 10^{13} and 10^{16} cm^{-3}, with an easily tunable ratio[2], appear to be very useful tools to study in details the reactivity of these ROS with DNA constituents.

In the present work, experiments were conducted strongly indicating that singlet oxygen and ozone are able to oxidize DNA. We observed that while all the nucleobases of DNA are almost indifferently and quite effectively oxidized by ozone, singlet oxygen only reacts with 2'-deoxyguanosine (dGuo), a DNA constituent. We also report that 4-OH-8-oxodGuo is produced by the singlet oxygen oxidation of dGuo, and can, therefore, be used as a singlet oxygen biomarker. Whilst our results are very significant and likely to lead to new biomedical applications, there are still many open questions. A more detailed study on the reactivity of singlet oxygen and ozone with DNA is currently in progress.

1. J.S. Sousa et al., *Appl. Phys. Lett.* **93**, 011502 (2008)
2. J.S. Sousa et al., *Eur. Phys. J.: Appl. Phys.* **47**, 22807 (2009)