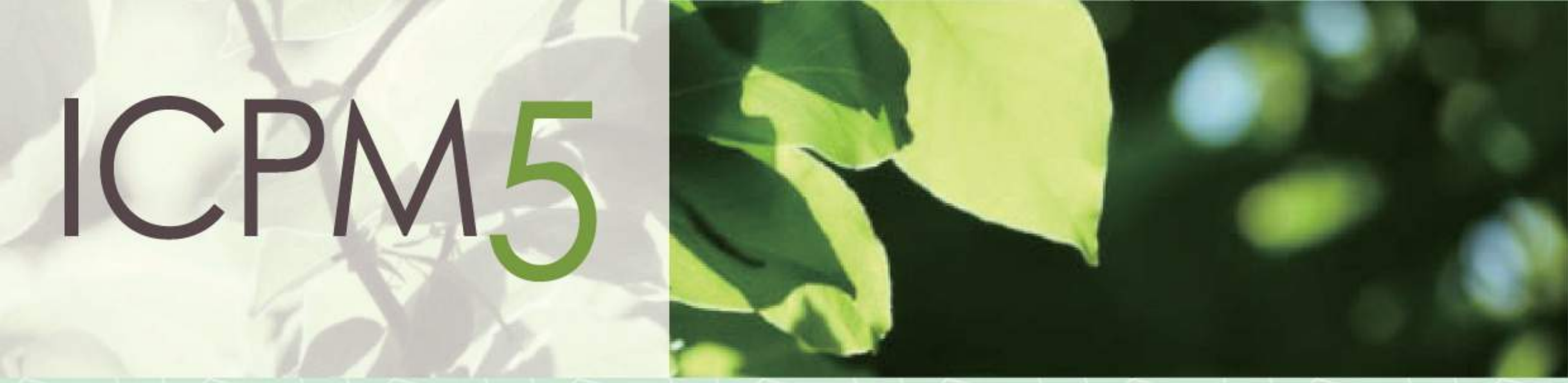

5th International Conference on Plasma Medicine (ICPM5)

Book of Abstracts

Nara, Japan

May 18-23, 2014

5th International Conference on Plasma Medicine
(ICPM5)

- Abstract Book -

May 18, 2014, Published

Chair
Center for Atomic and Molecular Technologies, Osaka University
Satoshi Hamaguchi
E-mail：hamaguch@ppl.eng.osaka-u.ac.jp

Secretariat
Polaris Secretaries Office Co., Ltd.
http://www.officepolaris.co.jp

Interaction of Ambient Air Corona Discharges with Aqueous Solutions and Simple Biomolecules

Carly E. Anderson[1], Zdenko Machala[2], Douglas S. Clark[1], David B. Graves[1]

[1] *University of California Berkeley, Berkeley, 94720, USA*
[2] *Comenius University, Bratislava, 84248, Slovakia*
E-mail: ceanderson@berkeley.edu

Non-thermal atmospheric pressure plasma devices are gaining increasing attention for medical applications wherein the delivery of reactive nitrogen and oxygen species (RONS) is desired [1], [2]. Numerous studies have shown the importance of RONS in biological systems, from the inactivation of bacteria [3] to the intricacies of cell signaling pathways [4].

While RONS are known to be important in biological systems, less is known about the conditions under which specific reactive species are transported to or formed in the liquid phase. Further study of the fundamental interactions between gas phase plasma (and the species generated) and liquids (typically aqueous solutions) is needed. Understanding the mechanisms by which reactive species are formed in the liquid phase will aid in the rational design of plasma devices for treating aqueous systems or tissues, and may enable the delivery of tailored cocktails of reactive species.

In this study, we focus on the interaction between atmospheric pressure air corona discharge of both polarities and an aqueous electrode (either distilled water or phosphate buffer solution with a submerged wire to ground). The geometry of the corona discharge allows direct contact between the air plasma and aqueous solution (above a submerged electrode), and also produces a slight convective air flow (ionic wind) which aids in the transport of gaseous species into the solution. The bactericidal effects of a similar device have been previously demonstrated [5]. The reactive species present in the treated aqueous solution are identified (ozone, nitrites, nitrates, hydrogen peroxide) and their mode of generation discussed (formed directly in the liquid or partitioning across the gas/liquid interface).

We also examine the effect of the reactive species generated on aqueous solutions of simple biomolecules (amino and nucleic acids). The reactive species present in solution and their effects on small biomolecules were probed using techniques including UV-vis absorption spectroscopy, Fourier transform infrared (FTIR) spectroscopy, and electrospray ionization mass spectrometry (ESI-MS). These results will serve as a platform to investigate the effects of direct discharges on peptides and other biomolecules in aqueous systems.

The authors would like to acknowledge Dr. Anthony Iavarone[1] for his assistance in obtaining high resolution mass spectra of the amino and nucleic acids treated in this study. This work was supported by the Department of Energy, Office of Fusion Science Plasma Science Center.

References

[1] S. Kalghatgi, et. al., *PLoS One* (2010), **6**, 1, 16270.
[2] D. B. Graves, *J. Phys. D. Appl. Phys.* (2012), **45**, 26, 263001.
[3] M. Naïtali, J.-M. Herry, E. Hnatiuc, G. Kamgang, and J.-L. Brisset, *Plasma Chem. Plasma Process.* (2012), **32**, 4, 675–692.
[4] T. A. Reiter, *Redox Rep.* (2006), **11**, 5, 194–206.
[5] Z. Machala, L. Chladekova, M. Pelach, *J. Phys. D. Appl. Phys.* (2010), **43**, 222001.