8th International Conference on Plasma Medicine
June 14~19, 2020 / Songdo Convensia, Incheon, Korea

Eradication of *Staphylococcus aureus* and *Pseudomonas aeruginosa* biofilms by means of O_3 or NO_x- enriched atmospheres

Alina Bisag[1], Cristiana Bucci[1,2,3], Filippo Capelli[1,6], Vittorio Colombo[1,4,5,6], Matteo Gherardi[1,4,6], Pasquale Isabelli[1], Romolo Laurita[1,4,6], Elisa Mezzofanti[6], Nikta Oveisi[6]
Alma Mater Studiorum, University of Bologna

[1] Department of Industrial Engineering, [2]Department of Medical and Surgical Sciences, [3]Department of Pharmacy and Biotechnology, [4]Industrial Research Centre for Advanced Mechanics and Materials, [5]Interdepartmental Centre for Agri-food Industrial Research,
[6] AlmaPlasma s.r.l
E-mail:romolo.laurita@unibo.it

Abstract

Surface dielectric barrier discharge (SDBD) can activate air promoting an ozone- or NOx-enriched atmosphere as a function of the surface power density [1]. It is know that these reactive oxygen and nitrogen species (RONS) enriched atmospheres can be used for the eradication of biofilm [2], but few works focus on the correlation between the concentrations of RONS and the antibiofilm efficacy of the cold atmospheric plasma (CAP) treatment. In this work, an integrated approach to investigate the efficacy of a CAP assisted eradication of biofilm has been used, coupling the chemical analysis of the gas phase to the antimicrobial activity, both in term of microbial load reduction and morphological analysis of the biofilm. The kinetics of the concentration of O_3 and NO_2^- produced by a SDBD were obtained by means of time resolved UV/VIS optical absorption spectroscopy. *Staphylocossus aureus* (Gram+) and *Pseudomonas aeruginosa* biofilms were exposed to O_3- or NOx- enriched atmospheres (Fig.1). All plasma treatments showed a high anti-bacterial effect (LogR> 3,5) on both *S.aureus* and *P. aeruginosa* biofilms, induce cell and biofilm damages. In the case of *S. aureus*, the efficacy depended on operating mode: NO_x regime showed a higher Log R than O_3 regime. Focusing on *P. aeruginosa*, a complete eradication of the biofilm can be achieved using both the O_3-and NO_x-enriched regime. Finally, chlorhexidine, a chemical commonly used for the eradication of biofilms, has been used as positive control, resulting to be less efficient in the biofilm eradication compared to the plasma treatments.

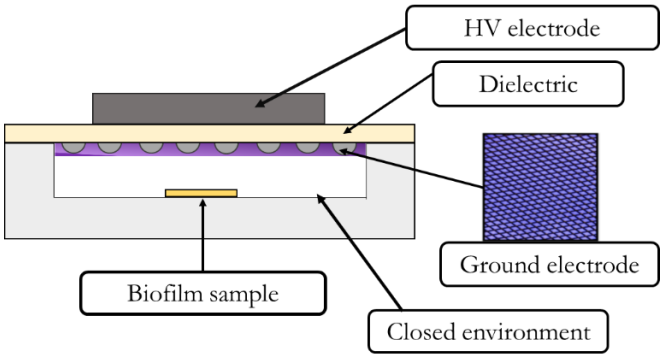

Fig.1 Schematic of the plasma source during the treatment of biofilm

References

[1] E. Simoncelli *et alii*, *Plasma Sources Science and Technology* 28 (2019)
[2] Rutger Matthes *et alii… PLoS ONE* 8,7,e70462 (2013)