6th international conference on plasma medicine

Bratislava, Slovakia
September 4–9, 2016

icpm6

BOOK OF ABSTRACTS

Edited by Karol HENSEL, Barbora TARABOVÁ, Katarína KUČEROVÁ,
Zuzana KOVAĽOVÁ, Mário JANDA, and Zdenko MACHALA

Title: 6th International Conference on Plasma Medicine (ICPM-6)
Subtitle: Book of Abstracts
Editors: K. Hensel, B. Tarabová, K. Kučerová, Z. Kovaľová, M. Janda, and Z. Machala
Cover design: L. Jeuffrault
Publisher: KEC FMFI UK, Bratislava
Printing: Neumahr s.r.o., Bratislava, 2016
ISBN 978-80-8147-066-0

Biofilm thickness and biomass reduction after treatment with DC air corona discharges

Z. Kovalova[1, 2], M. Leroy[1], E. Odic[1], Z. Machala[2]
[1]GeePs—Group of electrical engineering—Paris UMR CNRS 8507, CentraleSupélec, Univ Paris-Sud, Sorbonne Universités, UPMC Univ Paris 06 91192 Gif-sur-Yvette, France
[2]Faculty of Mathematics, Physics and Informatics, Comenius University, 84248 Bratislava, Slovakia
e-mail: kovalova@fmph.uniba.sk

Bacteria on surfaces exist predominantly in a form of biofilm, in which microorganisms are concentrated at an interface and encased in a hydrated matrix of exopolymeric substances (EPS). Bacteria in the biofilm are protected from harsh conditions, and therefore are much more resistant than their planktonic counterparts. In order to avoid using toxic chemicals or high concentrations of antibiotics to achieve the desired decontamination efficiency in biofilms, a search for new alternative methods of decontamination is required; one of these is low-temperature plasma.

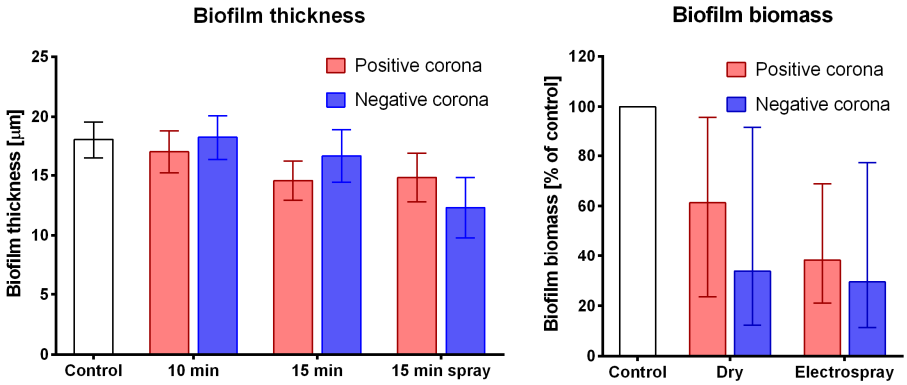

Fig. 1 Left: The biofilm thickness calculated from DAPI fluorescence integrated over the entire biofilm thickness (plotted mean ±SEM, 8≤n≤16 in each group). Right: The biofilm biomass calculated as percentage of controls (100%) from crystal violet absorbance after 15 min positive and negative corona treatment with or without water electrospray. (Median with IQR, n = 10 in each group).

DC corona discharges in air with or without water electrospray were used to decontaminate 48-hour biofilm of *Escherichia coli* BW 25113 grown on glass cover slides [1]. Thermostatic cultivation showed up to 5 $\log_{10}$ reduction in bacterial concentration within 15 min exposure to the plasma. Water electrospray enhanced the biocidal effect of discharge by 1 $\log_{10}$. Confocal laser scanning microscopy of biofilm dyed with DAPI showed thinning of the biofilm (Fig. 1, left) with increasing time of the plasma treatment and adding the water electrospray. The thickness was reduced from 18.1 µm to 12.3 µm after negative corona treatment with water electrospray. The Crystal violet assay for biofilm biomass evaluation showed decrease in the attached biomass after plasma treatment (Fig. 1, right), 61.3% and 32.7% of the biomass remained after exposure to positive and negative corona, respectively. With water electrospray, stronger biomass detachment occurred and only 38.1% and 29.5% of the biomass was attached after positive and negative corona treatment.

Low-temperature plasma has shown the ability to kill biofilms and reduce their thickness.

This work was supported by Slovak Research and Development Agency APVV-0134-12 and Comenius University grant UK/250/2015. Special thanks go to Dana Lajdová and Ľubomír Tomáška from Faculty of Natural Sciences at Comenius University in Bratislava for the assistance with CSLM.

References

[1] Z. Kovalova, et al., *Bioelectrochemistry* (in press 2016).