10th Central European Symposium on Plasma Chemistry
21st International Conference on Plasma Physics and Applications

Bucharest, Romania, 1-5 September 2025

Book of Abstracts

Edited by: Daniela Dobrin, Monica Magureanu, Bogdana Mitu, Veronica Satulu

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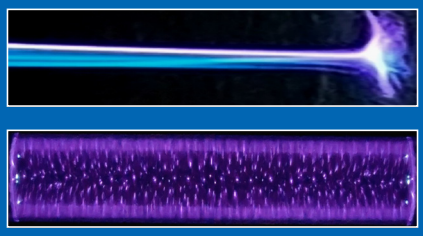

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Surface activation and biofilm removal on polymeric tubing by atmospheric pressure plasma

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The technique aimed to achieve uniform atmospheric pressure plasma treatment of inner and/or outer surfaces of polymeric tubes and other hollow bodies was developed by combining basic features of the Surface Dielectric Barrier Discharge (SDBD) and the plasmas in contact with liquids. This technique leverages the unique properties of SDBD generated at the interface of a liquid electrode, ambient air, and a dielectric tube, to uniformly treat inter/outer polymeric surfaces relevant to medical tubes and devices. The SDBD discharge was operated at atmospheric pressure with a 10-20 kV, ~31 kHz sinusoidal high-voltage waveform.

PTFE tubes were analyzed before and after plasma treatment to assess changes in surface properties and antimicrobial effects. The modifications on the polymer surface were analyzed using a combination of advanced techniques, including Water Contact Angle measurements, Scanning Electron Microscopy, Confocal Laser Microscopy, and X-ray Photoelectron Spectroscopy. The plasma system design allows for a controlled plasma ring moving along the tube's outer or inner wall, ensuring uniform exposure critical for complex geometries.

Antimicrobial efficacy was evaluated by testing plasma treatment against 48-hour *E. coli* biofilms formed inside the tubes. Bacterial reduction was quantified via plate counting and flow cytometry assays. Results demonstrated significant biofilm inactivation, with efficiency dependent on power input, treatment duration, and plasma ring velocity.

This work demonstrates the potential of water-based SDBD plasma for simultaneous surface activation and biofilm removal on polymeric tubing. Optimization of process parameters offers tailored treatment strategies for medical and industrial applications requiring sterile, functionalized polymer surfaces.

Keywords: SDBD, plasma, polymer, biofilm

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