Inactivation of various microorganisms with the N_2-O_2 discharge flowing-afterglow

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Sterilization of medical devices (MDs) by gaseous plasmas is an alternative solution to conventional sterilization techniques based on heat, ionizing radiation and chemicals (O_3, ethylene oxide, H_2O_2, etc.). The temperature of our flowing-afterglow system being lower than the glass-transition temperature of most polymers, it is therefore possible to use it to disinfect/sterilize thermo-sensitive MDs. As concerns exposure to ionizing radiation from radioactive sources, it induces changes in the bulk of the materials, this technique further requiring a large and secured dedicated building, resulting in high costs. In the case of chemical treatment, it is generally necessary to ventilate the treated MDs for a few hours because they remained impregnated with toxic residues. In contrast, the plasma disinfection/sterilization systems that are developed in our laboratories do not generate toxic residues, thus needing no venting, which reduces total operation time. It is therefore safe for both the patient and the operator. It should not cost more than standard chemically-driven sterilizers. In this presentation, we describe the operation of the N_2-O_2 flowing afterglow discharge, at reduced pressure (p = 5 Torr), where the plasma is maintained by a surfatron, powered by a microwave generator delivering 120 watts at 2.45 GHz. We shall focus on the study of the optimization of the UV radiation intensity (200-400 nm), which is the main biocidal agents, though the role of particles (radicals, ions…) cannot be excluded [1, 2]. Figure 1 shows, as an example, the survival curves of various bacterial spores subjected to our flowing-afterglow system.

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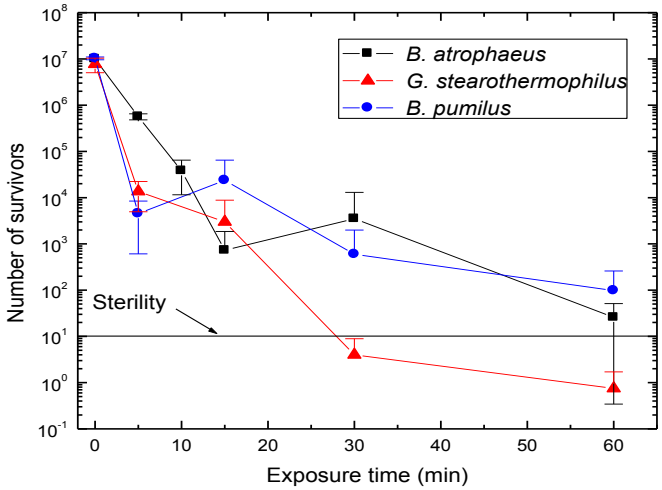

Figure 1: *Survival curves of dried spores (B. atrophaeus, G. stearothermophilus and B. pumilus) deposited on polystyrene Petri dishes and exposed to the N_2–O_2 flowing afterglow.*

References

[1] P. Levif, J. Séguin, M. Moisan and J.Barbeau J. Phys. D: Appl. Phys. (2011), **44**, 405201
[2] K. Boudam and M. Moisan J. Phys. D: Appl. Phys. (2010), **43,** 295202