Production of atomic nitrogen in (100-x)%Ar-x%N_2 flowing afterglows at reduced pressure. Implications for the sterilization of the medical instrumentation.

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Reduced pressure (1-20 Torr) flowing afterglows are able to selectively produce large amounts of atomic species at room temperature and for low cost. As, in this pressure range, these extremely reactive species can homogeneously diffuse in volumes of a few tens of liters, flowing afterglows appear to be a promising alternative to the high temperature autoclaving for the sterilization of the medical instrumentation.

In our previous works, we have demonstrated the possibility to obtain a complete sterilization (i.e. a 6 log reduction of an initial bacterial concentration) by exposure to a pure nitrogen flowing afterglow [1-3]. In this case, the key parameter is the concentration of the nitrogen atoms in the operating chamber. The same inactivation rate can be reached either at room temperature with a high microwave power (P_{MW} = 300 W) injected in the discharge [3], or for an operating temperature of 60°C with a lower injected microwave power (100 W) [2].

In the present paper, we have tried to increase the absolute concentration of the nitrogen atoms in the late afterglow by the use of (100-x)%Ar-x%N_2 mixtures. The first part will be devoted to the optimisation of the N-atoms concentration with the operating parameters of the flowing afterglow : nitrogen percentage, pressure, total gaz flow rate, injected microwave power. In the second part, inactivation rates obtained with Ar/N_2 mixtures will be presented and compared to the one previously obtained in pure nitrogen.

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References

[1] Cousty S., Villeger S., Sarrette J.P., Ricard A., Sixou M., Eur. Phys. J. Appl. Phys. (2006), **34,** 143–146.
[2] Villeger S., Sarrette J.P., Rouffet B., Cousty S., Ricard A., Eur. Phys. J. Appl. Phys. (2008), **42,** 25–32.
[3] Sarrette J.P., Cousty S., Clément F., Canal C., Ricard A., Plasma Process. Polym. (2011), doi: 10.1002/ppap.201100096.