GAS FLOW EFFECT ON E. COLI AND B. SUBTILIS BACTERIA INACTIVATION IN WATER USING A PULSED DIELECTRIC BARRIER DISCHARGE


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Nonthermal plasmas generated by capacitive discharges are a promising technological alternative to bacterial inactivation both on surfaces and in liquids\(^1\). Plasma applications to the purification of water have been tested extensively and yet, the central mechanism of bacterial inactivation remains unknown. This report presents an experimental study of the inactivation in water of two representative classes of bacteria, Gram negative *Escherichia coli* and Gram positive *Bacillus subtilis*, using pulsed dielectric barrier discharges (PDBD) in a coaxial arrangement. To this purpose, an adjustable plasma source supplies 25 kV/500 Hz pulses, 30 µs long, at atmospheric pressure, with total energy consumption estimated about 100 mJ/pulse. The inactivation effect of a PDBD on these types of microorganisms has been previously studied in dependence on an oxygen gas flow mode (null, continuous and modulate). The results have showed a significant bacterial reduction rate from 10\(^8\) to 10\(^3\) cells/mL with *E. coli* and from 10\(^7\) to 10\(^3\) cells/mL with *B. Subtilis*, constituting a ~4 log reduction at relatively high concentrations. The inactivation effectiveness is substantially similar in both kinds of bacteria at equivalent cell concentrations although some data suggest a greater susceptibility of the Gram negative *E. coli* to plasma exposure. Finally, plasma diagnostics was carried out using OES whereby the OH radical and reactive oxygen species formation rates in solution were found and the level of ozone produced by the discharge was monitored. Radicals and reactive oxygen species seem to be dominant biocidal agents during the process although the precise role of these requires further research.


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