Bacterial inactivation using corona discharges applied in water

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Cold plasmas, including the corona discharges, are already used to inactivate bacteria on surface or to decontaminate gases [1]. Apply these discharges on water is more difficult because the electric field intensity must be higher and prevent corona to arc transition. Nevertheless, previous preliminary studies showed the efficiency of theses corona discharges on bacterial decontamination [2] [3] [4].
Abou-Ghazala *et al.* [5] have shown that these discharges applied in water caused a greater reduction in *Escherichia coli* than *Bacillus subtilis*. Moreover, they have shown that these discharges are inefficient on spores.
The present work is a study of the effects of corona discharges applied in contaminated water with *Escherichia coli* or *Bacillus subtilis* var niger (under vegetative and spore form).
We used a Marxbank generator delivering pulses of 200 ns with a voltage of 60 to 90 kV.
Contrary to Abou-Ghazala *et al.* [5], our results show a greater reduction in *Bacillus subtilis* var niger under vegetative form than *Escherichia coli*. The mechanisms seem to be different on these two strains: a chemical mechanism in *B. subtilis* and probably a physical mechanism in *E. coli*.
This study reveal that *B. subtilis* var niger under spore form is sensitive to these discharges. Indeed a reduction of 4 $\log_{10}$ is observed after 10000 discharges (80 kV, 4 Hz, 200 ns). This reduction seems to be due, at least in part, to shock waves induced by these corona discharges in water.

Acknowledgments: This work was supported by a grant from DGA (REI n° 2009.34.0002).

References

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