Plasmid DNA degradation induced by a plasma microjet

Claire Douat[1], Pierre-Marie Girard[2], Michel Fleury[1], Gérard Beauville[1], Vincent Puech[1]

[1] *Laboratoire de Physique des Gaz et des Plasmas, CNRS and Univ. Paris Sud, Orsay, France*
[2] *Institut Curie,UMR 3348 CNRS and Univ. Paris Sud, Orsay, France*
E-mail: claire.douat@u-psud.fr

Figure 1 : *Picture of a plasma jet interacting with plasmid DNA solution placed in an Ependorf tube.*

Recently, interest in plasma micro-jet at atmospheric pressure has increased due to their interesting advantages as their low temperature and the creation of reactive species. Various applications are planed and particularly in the biomedical field [1] (odontology, dermatology, cancer research,…). In order to understand what it is the real impact of this plasma on biological structures we exposed this plasma jet on plasmid DNA.

Our discharge consists of concentric tubular electrodes separated by a dielectric cylindrical structure. The device is made of a dielectric tube with an inner diameter of about 1 mm. A grounded electrode is wrapped around the external side of the dielectric, while a high voltage electrode is glued inside the tube. Pure helium is flowing through the inner electrode at a flow rate in the range 500–1000 cm^3/min. High voltage pulses (3-6 kV) are applied between the electrodes at a repetition rate frequency of 20 kHz. This jet is set up vertically with the gas flowing downwards for interacting with plasmid DNA solutions put inside microwells or Ependorf tubes (figure 1). In each micro well there was 200 µL of buffer solution with a DNA concentration of 20mg/L.

Different buffer solutions have been used in order to identify their influence on the DNA degradation. It will be shown that the nature of the buffer solution did not change the nature of DNA damages. The only difference was the treatment times required to get a given amount of damages. Moreover, it will be shown that these damages resulted from a direct interaction of DNA with the plasmajet without participation of by-products from the buffer solution. Analysis of the damages through specific enzymes (Fpg, Nth and Ape1) revealed that most of the damages were direct single and double strand breaks, while the oxidation of the amino-acid bases was of minor importance.

References

[1] M. Laroussi and X. Lu, *Appl. Phys. Lett.* 87, 112902 (2005)