

Quantification of free radicals species generated by He cold atmospheric plasma jet in different liquid media

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Short and long live Reactive Oxygen and Nitrogen Species (ROS and RNS) can be generated through the interaction of plasma with liquids. [1] In the present work, free radicals generated by Helium plasma jet in water and biological media (whit and without Fetal Calf Serum (FCS)) were quantified by electron paramagnetic resonance (EPR), fluorometric and colorimetric analysis. Results clearly show the formation of ROS such as hydroxyl radical, superoxide anion radical and singlet oxygen. The major species produced by our Helium plasma jet were identified as nitric oxide, hydrogen peroxide and nitrite-nitrate.

1. Introduction

Plasma Activated Medium (PAM) has shown interest in recent years in cancer treatment and present minimal toxicity for normal tissues [2]. Stored at the right temperature, PAM remains stable several days after their preparation [3].

The observed cytotoxicity effect of PAM is due to the presence of long lifetime ROS and RNS and oxidized biological compounds in PAM.

In the present work the identification of aqueous species formed in PAM and quantitative investigations of ROS, RNS were performed and compared in the case of Milli-Q® water and culture media without and with FCS. EPR, fluorometric and colorimetric analysis were used to identify and quantify free radicals generated by helium plasma jet.

2. Results

Using DMPO as a spin trap for hydroxyl radical, liquids were exposed to plasma for different time (Fig 1).

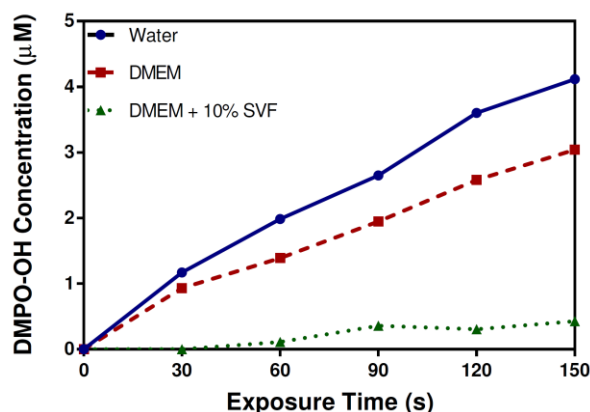


Fig 1. DMPO-OH concentration in water, DMEM+/- 10% FCS as a function of helium plasma jet exposure time.

Results showed that OH• is produced in larger concentration in water than in biological culture media. This can be explained by the oxidizing presence of biomolecules like amino acids, vitamins and proteins.

Hydrogen peroxide (H₂O₂) concentrations in PAM were quantified using a fluorometric Hydrogen Peroxidase Assay kit (Sigma-Aldrich Co., Ltd). In contrast to OH radical H₂O₂ concentration increase linearly but does not depend on the media (Fig 2).

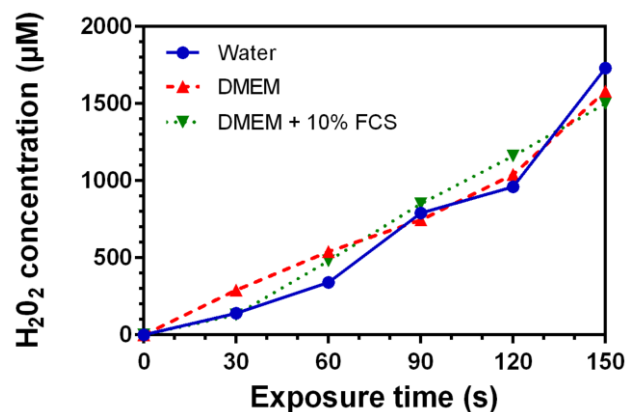


Fig 2. Variation of the concentration of hydrogen peroxide in media as a function of He plasma jet time exposition.

This result indicates that hydrogen peroxide is produced in the plasma jet and transferred in liquids.

3. References

- [1] Sun P. *et al*, *Appl Phys Lett*, **98**, (2011) 021501
- [2] Judée F. *et al*. *Plasma Med.* **6**, (2016) 15823
- [3] Judée, F. *et al*. *Sci. Rep.* **6**, (2016) 21421