Modification of hydrogel-based biomaterials by atmospheric pressure plasma to enhance tissue regeneration

C. Labay[1,2], I. Hamouda[1,2], M.-P. Ginebra[1,2], C. Canal[1,2]

[1] Biomaterials, Biomechanics and Tissue Engineering Group, Dpt. Materials Science and Metallurgy, Technical University of Catalonia (UPC), c/ Eduard Maristany 10-14, 08019 Barcelona, Spain

[2] Barcelona Research Center in Multiscale Science and Engineering, UPC, Spain

E-mail: cedric.labay@upc.edu

Hydrogels are highly hydrated natural, synthetic or semi-synthetic networks of cross-linked polymer chains whose features such as biocompatibility and *in vivo* biodegradability, in many cases, make them great candidates for the design of advanced biomaterials. Hydrogel-based biomaterials, have already been implemented in different clinical areas and in wound dressings [1]. Cold atmospheric pressure plasma (APP), including plasma jets or needles, can be used as an effective tool to promote tissue regeneration in wound healing. APP formed in air generates reactive oxygen and nitrogen species (RONS) whose effects on organism stimulate antibacterial behavior and tissue regeneration as a function of the generated concentration. Many wound healing medical devices such as plasters, patches, etc. include hydrogels as components.

APP treatment of biomedical hydrogels could confer them specific features promoting tissue regeneration and therapeutic process. The aim and novelty of this work rests upon the adaptation and the optimization of the methods to quantify RONS usually employed in plasma-treated liquids to alginate hydrogels. Herein, by using different types of APP, we demonstrate that the generation of various species of RONS in hydrogels, such as nitrites and hydrogen peroxides, and their concentration can be tuned by the modulation of the working conditions of plasma treatment. This will be a crucial feature to be able to control the dose of RONS in the hydrogel-based biomaterials and thus its therapeutic effects.

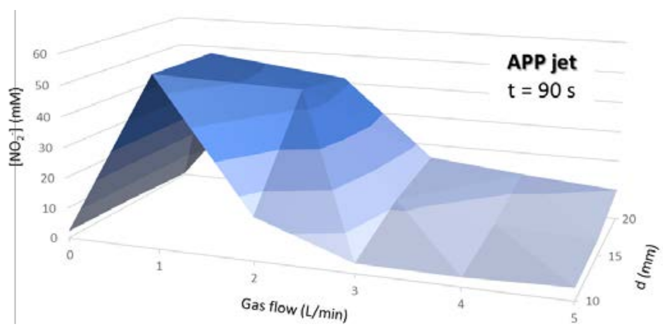

Fig. 1. Influence of gas flow and electrode distance on the [NO_2^-] generated in alginate hydrogels by APP.

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References

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