Alginate nanofibers with tunable biodegradability for regenerative medicine

Hadi Hajiali[1,2,*], José A. Heredia-Guerrero[1], Athanassia Athanassiou[1], Elisa Mele[1,3]

[1] *Smart Materials, Nanophysics, Istituto Italiano di Tecnologia (IIT), via Morego 30, 16163 Genoa, Italy.*
[2] *DIBRIS, University of Genoa, via Opera Pia 13, 16145, Genoa, Italy.*
[3] *Department of Materials, Loughborough University, Loughborough, Leicestershire, LE11 3TU, UK*

[*] E-mail: hadi.hajiali@iit.it

The electrospinning technique has the unique capability to create nanofibrous scaffolds that mimic the native tissue structure and are attractive for regenerative medicine [1,2]. Here, we show the use of sodium alginate, a natural polymer, for the production of electrospun nanofibers with adjustable biodegradability rate. Controlling the biodegradation of alginate nanofibers under physiological conditions is an indispensably important step in tissue engineering and drug delivery. Sodium alginate fibers are in fact readily soluble in aqueous environments, and therefore cross-linking procedures are necessary to increase their stability and structural integrity. Several approaches have been proposed to this aim, in particular, reactions with glutaraldehyde (GTA) and Ca^{2+} ion. For instance, the use of GTA poses numerous problems due to the release of toxic compounds during the degradation of the nanofibers in the body. Our approach is based on the modification of the chemical structure of the alginate nanofibers by acidification of carboxylate groups and formation of poly(alginic acid). The resulting nanofibrous scaffolds exhibit high biocompatibility, as proved by *in-vitro* assays. Therefore, we developed a novel strategy to increase the water stability of alginate nanofibers, preserving their morphology and no cytotoxicity [3]. In this way, we tuned the biodegradation rate of the nanofibers, making them promising for biomedical applications.

References

1. H. Hajiali, S. Shahgasempour, M. R. Naimi-Jamal, H. Peirovi, *Int J Nanomedicine*, **2011**, 6, 2133-2141.
2. H. Hajiali, E. Mele, I. Liakos, I.S. Bayer, A. Athanassiou, *Journal of Tissue Engineering and Regenerative Medicine*, **2014**, 8, 504-505.
3. H. Hajiali, J. A. Heredia-Guerrero, I. Liakos, A. Athanassiou, E. Mele *Biomacromolecules* **2015**, 16 , 936–943..