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Atmospheric pressure plasma processing of biomaterials

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Thanks to peculiar advantages such as ease of operation and reduced equipment costs, atmospheric pressure plasma (or cold atmospheric plasma – CAP) technology is encountering an ever-increasing interest for material processing applications, both in the industrial and biomedical fields. Some potentialities of this technology will be highlighted in this work, presenting results in the frame of specific practical applications requiring different plasma processes to be enabled.

Surface activation for the production of membranes capable of selectively capturing mesenchymal stromal/stem cells (MSC): CAP was used to introduce carboxyl groups on polybutylene terephthalate (PBT) fibrous membranes to enable the bioconjugation of anti-CD10 antibodies, which can selectively interact with the surface marker CD10+ expressed by Mesenchymal Stromal Cells (MSCs). MSCs captured in this way can later be detached and employed in tissue engineering applications.

Cross-linking of gelatin films for buccal drug delivery: CAP was used to crosslink gelatin, a water soluble, biocompatible polypeptide employed in a variety of biomedical applications, avoiding the use of other crosslinking agents such as genipin [1]. CAP treatment induced an improved adhesion of the biomaterials to the buccal mucosa and did not induce structural changes in the econazole, the molecule used in the biomaterials as model drug. The treated biomaterials showed the capability of inhibiting Candida albicans growth in vitro.

Polymer deposition and nanoparticle synthesis: CAP was used for the production of a nanostructured coating, composed by silver nanoparticles (AgNPs) embedded in a plasma polymerized HMDSO (ppHMDSO) matrix, to reduce bacterial proliferation, biofilm adhesion and clot formation onto a blood-contacting biomaterial. The performance of the coatings was assessed both in vitro and in vivo on mice.

Finally, some strategies that can be employed to better understand the fundamental mechanisms happening during the aforementioned processes will be presented and discussed.

References

[1] L. S. Dolci *et alii*, *Colloids and Surfaces B: Biointerfaces*, **63**, 73–82, (2018).