Title: **Electroactive nanofibrous scaffolds enhancing skin wound regeneration**

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In regenerative medicine, scaffolds are used to simulate the extracellular matrix. Scaffolds electrical stimulation has attracted attention to promote regeneration. Polypyrrole is an electrically conductive polymer which has also been described as antibacterial.
Given these premises, the aim of the present study was the design and the manufacturing of 4D scaffolds based on polycaprolactone (PCL) and zein (Z) nanofibers, coated with polypyrrole (PPy), to promote skin regeneration.
PCL-Z blends in a ratio 10:1 were prepared in acetic acid 96% v/v and subjected to electrospinning. Afterwards, the fibrous scaffolds were coated with different loadings of PPy. Fibers were immersed into an aqueous solution containing pyrrole in a range from 0.015 M to 0.09 M. Then an aqueous solution of $FeCl_3$ in a range between 0.03 M and 0.18 M was added as an oxidant agent to induce pyrrole polymerization which was successful when pyrrole and $FeCl_3$ concentrations were above 0.03 and 0.06, respectively.
The morphological and dimensional analyses were carried out by scanning electron microscopy. Regular and homogenous nanofibers were obtained with PPy particles adhering to the surface, which were more noticeable for PCLZ-PPy3 and PCLZ-PPy4. The presence of PPy particle were also confirmed by AFM analysis. Mechanical properties were evaluated on dry and hydrated samples proving that the hydration process did not affect the scaffolds resistance. Contact angle was evaluated to assess wettability of the scaffolds and the results showed that the coating induced a decrease of wettability. Moreover, scaffolds cytotoxicity was evaluated, and the results demonstrated that the fibers were biocompatible.
This study allows to successfully develop PPy coated PCL-Z nanofibers which should be an innovative scaffold enhancing wound healing. Further investigations are on-going to prove scaffolds electrical conductivity and assess i*n-vitro* cell proliferation and adhesion and antibacterial properties.

Acknowledgments:
This work was partially funded by Horizon Europe project FORCEREPAIR - “Smart and multiFunctional 3D printable prO-Regenerative biologiCal matrix modulating mEchanotRansduction as advancEd theraPy to treAt skIn chRonic wounds” under the grant agreement No. 101092243

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