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Electrospun Sulfonatocalix[4]arene Loaded Blended Nanofibers: Process Optimization and In Vitro Studies
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Abstract
In the past decade, electrospun nanofibers made of biodegradable polymers have been used for different biomedical applications due to their flexible features in terms of surface area to volume ratio, pores, and fiber size, as well as their highly tunable surface properties. Recently, interest is growing in the use of supramolecular structures in combination with electrospun nanofibers for the fabrication of bioactive platforms with improved in vitro responses, to be used for innovative therapeutic treatments. Herein, sulfonatocalix[4]arene (SCX4) was synthesized from p-tert-butyl-calix[4]arene and embedded in electrospun nanofibers made of polycaprolactone (PCL) and gelatin (GEL). The supramolecular structure of SCX4 and its efficient entrapment into electrospun fibers was confirmed by NMR spectroscopy and FTIR analysis, respectively. SEM analysis supported via image analysis enabled the investigation of the fiber morphology at the sub-micrometric scale, showing a drastic reduction in fiber diameters in the presence of SCX4: 267 ± 14 nm (without SCX) to 115 ± 5 nm (3% SCX4). Moreover, it was demonstrated that SCX4 significantly contributes to the hydrophilic properties of the fiber surface, as was confirmed by the reduction in contact angles from 54 ± 1.4° to 31 ± 5.5° as the SCX4 amount increased, while no effects on thermal stability were recognized, as was confirmed by TGA analyses. In vitro tests also confirmed that SCX4 is not cytotoxic, but plays a supporting role in L929 interactions, as was validated by the cell viability of PGC15% after 7 days, with respect to the control. These preliminary but promising data suggest their use for the fabrication of innovative platforms able to bind SCX4 to bioactive compounds and molecules for different therapeutic applications, from molecular recognition to controlled drug delivery. © 2022 by the authors.

Author Keywords
electrospun fibers; gelatin; in vitro; polycaprolactone; sulfonatocalixarene

Index Keywords
gelatin, nanofiber, polycaprolactone, polycyclic aromatic hydrocarbon derivative, sulfonatocalix[4]arene, unclassified drug; animal cell, Article, carbon nuclear magnetic resonance, cell interaction, cell viability, chemical binding, chemical structure, controlled study, electrospinning, Fourier transform infrared spectroscopy, hydrophilicity, image analysis, in vitro study, mouse, NCTC clone 929 cell line, nonhuman, nuclear magnetic resonance spectroscopy, process optimization, proton nuclear magnetic resonance, scanning electron microscopy, synthesis, thermogravimetry, thermostability

Chemicals/CAS
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