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PCL/Gelatin/Graphene Oxide Electrospun Nanofibers: Effect of Surface Functionalization on In Vitro and Antibacterial Response

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Abstract

The emergence of resistance to pathogenic bacteria has resulted from the misuse of antibiotics used in wound treatment. Therefore, nanomaterial-based agents can be used to overcome these limitations. In this study, polycaprolactone (PCL)/gelatin/graphene oxide electrospun nanofibers (PGO) are functionalized via plasma treatment with the monomeric groups diallylamine (PGO-M1), acrylic acid (PGO-M2), and tert-butyl acrylate (PGO-M3) to enhance the action against bacteria cells. The surface functionalization influences the morphology, surface wettability, mechanical properties, and thermal stability of PGO nanofibers. PGO-M1 and PGO-M2 exhibit good antibacterial activity against Staphylococcus aureus and Escherichia coli, whereas PGO-M3 tends to reduce their antibacterial properties compared to PGO nanofibers. The highest proportion of dead bacteria cells is found on the surface of hydrophilic PGO-M1, whereas live cells are colonized on the surface of hydrophobic PGO-M3. Likewise, PGO-M1 shows a good interaction with L929, which is confirmed by the high levels of adhesion and proliferation with respect to the control. All the results confirm that surface functionalization can be strategically used as a tool to engineer PGO nanofibers with controlled antibacterial properties for the fabrication of highly versatile devices suitable for different applications (e.g., health, environmental pollution). © 2023 by the authors.

Author Keywords

antibacterial; electrospinning; graphene oxide; nanofibers; plasma treatment; polycaprolactone

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