ELECTROSPUN PVA-GRAPHENEOXIDE-PEDOT:PSS NANOFIBERS FOR WOUND HEALING

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ABSTRACT

Nanotechnology has been broadly acknowledged in scaffold development for wound healing applications. Nanofibers-based scaffolds are highly valued for its mechanical and biological properties. Nonetheless, nanofibers composed of different nanofillers posed an enormous challenge in emulating the architecture of the extracellular matrix. In our study, we have capitalised the unique property of graphene oxide (GO) and poly(3,4- ethylenedioxythiophene)-poly(styrenesulfonate) (PEDOT:PSS) as nanofillers. Polyvinyl alcohol (PVA), PVA-GO and PVA-GO-PEDOT:PSS composites were electrospun into nanofibers of varying morphological, structural, and mechanical properties. The resulting nanofiber films were analysed using FESEM imaging, FTIR spectroscopy, and Raman spectroscopy. The morphology of resultant nanofibers revealed no evidence of beading and the nanofiber diameters were normally distributed with reasonably low variance (n = 50). The average diameter of PVA nanofibers was 248 ± 51 nm, which increased to 270 ± 94 nm when GO was added, and to 275 ± 140 nm when PEDOT:PSS was incorporated into the electrospun solution. Upon soaking in PBS, PVA nanofibers showed pores formation, while no pores were visible in PVA-GO and PVA-GO-PEDOT:PSS nanofibers. As for FTIR spectra, we observed broadening of -OH bond and shift to higher wavelength in both solution and nanofibers. Additionally, Raman spectroscopy analysis showed splitting and shifting of D band (1362 and 1409 cm^{-1}) and G band (1504 and 1586 cm^{-1}) in PVA-GO-PEDOT:PSS nanofibers. As for PVA- GO nanofibers, we observed shifting of D band (1311 cm^{-1}) and G band (1593 cm^{-1}), with no evidence of band splitting. Our study indicates that PVA-GO-PEDOT:PSS nanofiber has similar tensile strength measurement to native skin, while exhibiting a combination of a unique property of PVA, GO and PEDOT:PSS. Hence, we deduce that PVA-GO-PEDOT:PSS nanofiber can serve as an initial template for further modifications and subsequently used to promote wound closure.

Keywords: Electrospinning, PVA-graphene oxide, PEDOT:PSS, nanofibers, wound healing

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