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Evaluation of Overall Properties and Cytotoxicity of PEO/rGO Scaffolds for Potential Use in Tissue Engineering

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Electrospinning provides an attractive means of producing micro/nanoscale polymeric fibers because of its simplicity, reproducibility, and scale-up possibilities. Electrospun polymeric scaffolds mimic natural three-dimensional extracellular matrix (ECM), which is composed of complex fibrous structures with porous architectures, and thus, can be used to promote cell, tissue, and/or organ growth. The incorporation of 2D graphene/reduced graphene oxide (rGO) nanofillers into polymeric nanofibrous composites increase mechanical strength and electrical and thermal conductivities. In this study, polyethylene oxide (PEO) based scaffolds containing from 0.1 to 20 wt% rGO were obtained by electrospinning. Morphological, thermal, and electrical properties of the scaffolds were characterized by SEM, Raman spectroscopy, XRD, DSC and electrical measurements. The obtained results show a good dispersion of rGO at lower concentrations, and a drastic reduction in the fiber diameter with increasing nanofiller concentration up to 20 wt%. The morphology of the scaffolds was significantly affected by the presence of nanofiller. XRD and Raman analysis revealed delamination of the graphene layers, and exfoliation of rGO was detected for the samples with rGO concentration lower than 1 wt%. Significantly reduced electrical resistivity of the scaffolds was detected above the percolation threshold of nanofiller (7.4 wt% rGO). The biocompatibility of the scaffolds was tested by determination of the viability of epithelial colon cancer cells, and the results have shown an evident trend of increasing cell viability as rGO concentration increases.

Keywords: Nanofibrous scaffolds, Reduced graphene oxide, Polyethylene oxide, Electrospinning, Cytotoxicity