Graphene Oxide Reinforced Gelatin–Poly(Vinyl Alcohol) Biomaterials as Scaffolds for Bone Tissue Engineering

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Abstract

Tissue engineering sector has defined complex requirements on the biomaterials to be used for scaffold fabrication. In regard to intricate bone tissue development mechanism features related to morphology, structure, and mechanic as well as supporting cells interaction are demanded [1]. Key contributors to biomaterials development for application in bone tissue engineering field is mirrored by polymers. Both synthetic and biopolymers exhibit their benefits and drawbacks while the combination into composite materials is an useful strategy to overcome the disadvantages and enhance the beneficial features. Although synthetic polymer-biopolymer based composites are distant from complex bone tissue engineering requirements and by coupled them with advanced nanoparticles such as graphene or graphene derivatives seems to be the key approach [2-3]. In the present work we explore the fabrication of new graphene oxide reinforced gelatin–poly(vinyl alcohol) (Gel-PVA/GO) porous scaffolds by coupling freeze-thawing with freeze-drying techniques. Materials were characterized in regard to structural and morphological features by Fourier transform infrared spectrometry (FT-IR), X-ray diffraction (XRD), Raman spectroscopy, transmission electron microscopy (TEM), X-ray microtomography (microCT) and scanning electron microscopy (SEM). Conversely, mechanical tests against compressive stress and *in vitro* cytotoxicity analysis were performed in order to assess if the fabricated scaffolds meet the needs of bone tissue engineering applications. Structural analysis by FT-IR, XRD, Raman spectroscopy and TEM revealed the occurrence of non-bond interactions between GO and the two polymers, which promote the formation of unique molecular structuration. In regard to scaffolds morphology both microCT and SEM highlighted on the influence of GO in adjusting pores size and shape. Mechanical tests measurements showed an improvement of materials compressive strengths by 97 – 100 % with the addition of 0.5 – 3 wt% GO. Eventually, cytotoxicity and cells viability assessments suggested Gel-PVA/GO composite scaffolds met the requirements for further *in vivo* testing and tissue engineering applications [3]. **Acknowledgements** This study was funded by a grant of the Romanian National Authority for Scientific Research, Executive Agency for Higher Education, Research, Development and Innovation; project number PN-II-PCCA-140/2012, EEA Grants project number 12/12.07.2014.

References

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