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Improving surface properties and porosity of electrospun scaffolds for cartilage tissue engineering

Ângela Semitela[1, *], André F. Girão[1], Carla Fernandes[1], António Completo[1] and Paula A.A.P. Marques[1]

[1]*TEMA, Mechanical Engineering Department, University of Aveiro*

[*] *234 370 830, angela.semitela@ua.pt*

Polycaprolactone (PCL) electrospun scaffolds have long been used for cartilage tissue engineering applications due to their biocompatibility, biodegradability, good mechanical properties and easy processability. However, their inherent hydrophobicity prevents cell adhesion and cell proliferation. On the other hand, natural polymers, such as gelatin, have been reported to support cell adhesion due to its hydrophilic character and the presence of cell recognition sites. Another common limitation of PCL electrospun scaffolds is their inherent small pores, which can hinder cell migration. The introduction of a sacrificial agent on the scaffolds, such as polyethylene glycol (PEG), which can be co-electrospun with the polymer of interest, has been reported to overcome this limitation. The sacrificial polymer is then dissolved away in water, resulting in an electrospun scaffolds with increased porosity. The present work combines these approaches to improve the surface properties and the scaffolds' porosity that will benefit cell adhesion, migration and proliferation. Thus, a new series of electrospun scaffolds composed of PCL, gelatin and PEG sacrificial particles were fabricated and characterized on their chemical composition, wettability, topography and biocompatibility using an articular cartilage progenitor cell line. According to the results obtained, the addition of gelatin led to an increased hydrophilicity of the scaffolds, which resulted in better cell adhesion and proliferation. The introduction of PEG sacrificial particles enlarged the pore size of the scaffolds to values comparable to the cell diameter and allowed cell migration through the scaffold.

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Corresponding Author: Ângela Semitela
angela.semitela@ua.pt
TEMA, Mechanical Engineering Department, University of Aveiro
234 370 830

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