KN2000

Plasma processing of scaffolds: perspectives for Tissue Engineering

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In the field of Tissue Engineering (TE), several fabrication strategies have been employed to process polymeric materials into three-dimensional (3D) scaffolds, characterized by high porosity, proper pore size, shape, surface area, stiffness and mechanical integrity. All these features, often coupled with tuneable biodegradability, are necessary for using scaffolds as replacement or temporary substitutes of living tissues[1]. The main drawback with TE scaffolds is that cell adhesion is often favoured at the scaffold peripheries, more accessible from the culture medium, respect to the core regions. Furthermore, almost all polymers employed in this field are hydrophobic, so their surface does not induce fast/strong cell adhesion and growth. By using a proper surface modification technique, it is possible to tailor the surface properties of scaffolds, improving their affinity with cells. Plasma processes have been largely used in the biomedical field to modify the surface properties of materials, in order to improve their biocompatibility, not altering the bulk. The three-dimensionality limits the capability of plasma species to access, in a homogeneous way, all the scaffolds surfaces and limits also their chemical, morphological and biological characterization. For these reasons, up to now, relatively few papers have been published about plasma modification of scaffolds[2]. The lecture will present an overview of recent plasma-based strategies applied to modify 3D TE scaffolds; more specifically, we demonstrate how proper combinations of plasma parameters and morphological properties could increase the area colonized by cells through all the scaffold thickness. [1] Hutmacher W. et al., J. Tiss. Engin. Regen. Med. 1:245-60, 2007. [2] Intranuovo F. Et al., Acta Biomater. 7 (9):3336-3344, 2011.

Keywords
plasma deposition
plasma treatment
wettability
tissue engineering
porosity