Polysaccharides-based complex materials with conductive properties as biomedical scaffold

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Résumé

With the aging of the population, the replacement of tissues by prosthesis or artificial devices has become of primary importance. The development of innovative biomaterials was based on two essential features. The first is linked to drug or protein eluting materials or implants that induce healing effects in addition to their regular task such as support material. The second feature is the design of material with well-defined mechanical properties. Recently, another interesting feature arose in the design of biomaterials, i.e. their electrical property. The conductivity of tissues (ventricular muscle, nerve, lung, cardiac, and skeletal muscle) lies in an ordered manner in between 0.01 et 0.8 S/m (Wiley Encyclopedia of Biomedical Engineering, Copyright & 2006 John Wiley & Sons) and conductive polymers cover this range of conductivity. Conductive biomaterials are a member of a new generation of "smart" biomaterials that allow direct transference of electrical, electrochemical and electromechanical stimuli to cells. Poly(3,4-ethylenedioxythiophene):poly(styrene sulfonate) (PEDOT:PSS), a biocompatible conjugate polymer, has been reported as an ideal substrate for the growth and electrical stimulation of osteogenic cells. 3D PEDOT:PSS scaffolds are usually obtained using processes either tedious or requiring specific devices. In this work, we developed new conductive 3D materials based on compact polyelectrolyte complexes. 3D porous materials, named compact polyelectrolyte complexes (CoPECs), were obtained by complexation of chitosan and hyaluronic acid induced by a simple salinity change. PEDOT was then polymerized on the surface of the pores (40 μm diameter size) and led to an enhancement of the fibroblasts colonization of the 3D material.

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