



In vitro calcification of chemically functionalized carbon nanotubes

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Mots-clés	Biominingeralization [8], Calcification [9], Carbon nanotubes [10], Hydroxyapatite [11], Woven bone [12]
Résumé en anglais	<p>Bone is composed of two phases. The organic phase is made of collagen fibrils assembled in broad fibers acting as a template for mineralization. The mineral phase comprises hydroxyapatite (HAP) crystals grown between and inside the collagen fibers. We have developed a biomimetic material using functionalized carbon nanotubes as scaffold to initiate in vitro mineralization. Biomimetic formation of HAP was performed on single-walled carbon nanotubes (SWCNTs) which have been grafted with carboxylic groups. Two types of nanotubes, HiPco(R) and Carbon Solutions(R), were oxidized via various acidic processes, leading to five different groups of carboxylated nanotubes, fully characterized by physical methods (thermogravimetric analysis, attenuated total reflectance infrared spectroscopy and X-ray photoelectron spectroscopy). All samples were dispersed in ultra-pure water and incubated for 2 weeks in a synthetic body fluid, in order to induce the calcification of the SWCNTs. Scanning electron microscopy (SEM) and energy-dispersive X-ray analysis studies showed that Ca(2+) and PO(4)(3-) ions were deposited as round-shaped nodules (calcospherites) on the carboxylated SWCNTs. Fourier transform infrared and Raman spectroscopic studies confirmed the HAP formation, and image analysis made on SEM pictures showed that calcospherites and carboxylated SWCNTs were packed together. The size of calcospherites thus obtained in vitro from the HiPco(R) series was close to that issued from calcospherites observed in vivo. Functionalization of SWCNTs with carboxylic groups confers the capacity to induce calcification similar to woven bone.</p>
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