Injectable Composite Particles for Bone Repair

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INTRODUCTION

In the era of bio- and nanotechnologies, there is still an urgent need for improved solutions for bone regeneration. Increasing attention is recently given to the development of bioinspired biomaterials to be applied by means of minimally invasive procedures. Polymer-calcium phosphate composites have gained special considerations view their compositional similarity with the natural composite forming the scaffold of hard tissues.

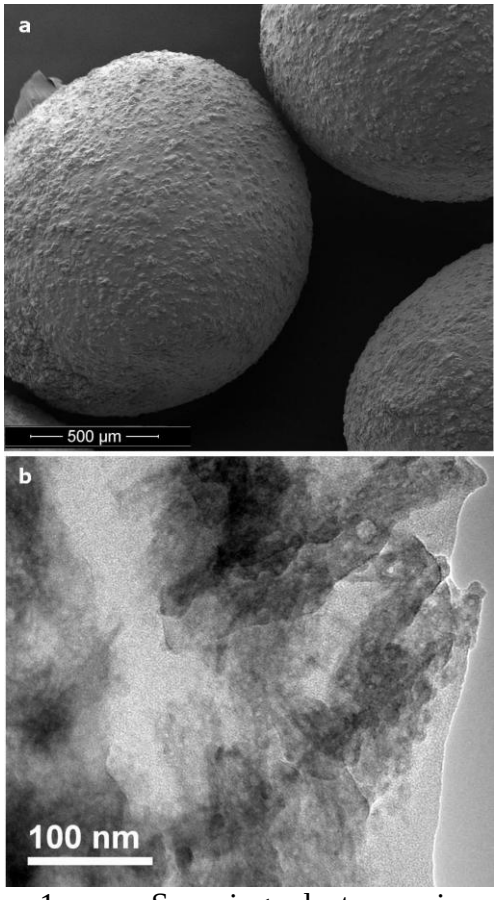

Figure 1. a – Scanning electron microscopy image of composite particles containing natural polymers and calcium phosphate mineral phase; b – transmission electron microscopy image presenting structural and morphological details of the studied composites.

EXPERIMENTAL METHODS

Nearly spherical composite particles with diameters of approximately 1 mm have been prepared starting from an organic matrix based on gelatin and alginate hydrogels (figure 1a). Nanosized hydroxyapatite has been *in situ* synthesized through the alternate incubation of the polymer scaffold into calcium and phosphate solutions. The loading degree has been modified through increasing number of incubation cycles.

RESULTS AND DISCUSSION

Different compositions have been elaborated, with various ratios between the polymers and different loading degrees with nanohydroxyapatite. The dimensional stability of the materials has been checked through swelling tests in distilled water and phosphate buffer. The success of the mineral formation has been confirmed by transmission electron microscopy, X-ray diffractions and infrared spectrometry. An intimate interaction between the inorganic phase and the organic framework has been evidenced (figure 1b). This is extremely important for the further performance of such biomaterial.

CONCLUSION

This work reports the synthesis of nanocomposite particles based on natural polymers and nanohydroxyapatite that will be used in injectable formulations for bone regeneration.

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