



Effect of Cerium Ion Doping On the Biological Behavior of Mesoporous Silica Nanoparticles

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ABSTRACT.

Metal ions, depending on their properties, can affect the porosity and biocompatibility of mesoporous nanoparticles. Antibacterial and regenerative properties are well documented for Ce and Ca ions, respectively. In the present study, the effect of calcium (Ca) and cerium (Ce) ions addition on mesoporous silica nanoparticles size and porosity was studied. The biological behavior (hemocompatibility and cell proliferation) of these innovative mesoporous nanoparticles was evaluated too. The addition Ce ions to the silicate lattice had no effect on the periodicity of the cylindrical pores. However, the specific surface area of the nanoparticles decreased, while the pore diameter increased up to about 4 nm after the ions addition. Based on the hemolysis assay, all the tested materials were hemocompatible at concentrations below 30 µg / mL. Interestingly, after the addition of Ca and Ce, an increase in blood compatibility up to 500µg / mL was observed. Finally, the MTT cytotoxicity test showed a significant increase in cell proliferation, especially in mesoporous nanoparticles with the addition of 1 and 2.5% Ce ions to the siliceous lattice. In conclusion, the addition of Ce ions in the walls of MCM-41 nanoparticles does not influence the tubular pore framework of the materials apart an increase in their pore diameter. Furthermore, the addition of Ce in silica mesoporous promotes the blood compatibility of the materials and at the same time enhances the proliferation of the periodontal tissue cells, making the tested materials attractive as carriers of active agents and drugs.

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