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Incorporation of Bioactive Nanoparticles in SiO_2-CaO-P_2O_5-MgO system into the Gelatin Base Biopolymeric Composite Scaffolds

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Abstract

The purpose of this study was to fabricate the gelatin- carboxymethylcellulose- bioactive nanoparticles composite scaffolds. The bioactive nanoparticles in the system SiO_2-CaO-P_2O_5-MgO were synthesized via the sol-gel method. The morphology and crystalline structure of the particles were studied by field emission scanning electron microscopy (FESEM) and X-ray diffractometry (XRD), respectively. The porous scaffolds were fabricated by freeze-drying process. The composition of bioactive nanoparticles was $58SiO_2$-$28CaO$-$9P_2O_5$-$5MgO$. The XRD pattern indicates formation of a partially crystallized glassy product. The bioactive nanoparticles consist of constituent elements, according to the results of EDS analysis. The scaffolds with different ratios of gelatin to CMC were prepared by addition of 3wt% bioactive nanoparticles. The microscopy evaluation reveals the formation of scaffolds with interconnected pores of 50-300μm, suitable for bone tissue engineering. The nanoparticles were dispersed through the scaffold struts as nanoscale agglomerates containing several nanoparticles. The findings indicate that the developed composite scaffolds may be considered as an appropriate system for bone tissue engineering.

Keywords*:* Bone scaffold, bioactive nanoparticles, Gelatin, Carboxymethylcellulose

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