SA-3

Enhanced Bone-Regenerative Performance of Porous HybridScaffolds by Surface Immobilization of Nano-Hydroxyapatite

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Nano-hydroxyapatite (N-HAp)has shown the pivotal role in producing bone-regenerative materials since ithas similarity to natural bone minerals in terms of size, morphology, and thecomposition. Currently, the combination of biopolymers and N-HAp is recognizedas an attractive approach in generating hybrid scaffolds for bone tissueengineering. Surface engineering is an important issue since it determineswhether cells can effectively adhere and proliferate on porous scaffolds. Weaim to develop a synthetic approach to porous 3D scaffolds by immobilizingN-HAp on pore surfaces. The discrete nano-level anchoring of N-HAp on thescaffold pore surface is achieved using surface-repellent stable colloidalN-HAp with surface phosphate functionality. This rational surface engineeringenables surface-anchored N-HAp to express its overall intrinsic bioactivity,since N-HAp is not phase-mixed with the polymers. The porous polymer scaffoldswith surface-immobilized N-HAp provide more favorable environments thanconventional bulk phase-mixed polymer/N-HAp scaffolds in terms of cellularinteraction and growth. In vitro biological evaluation using alkalinephosphatase activity assay supports that immobilized N-HAp on pore surfaces ofpolymer scaffolds contributed to the more enhanced in vitro osteogenicpotential. Besides, the scaffolds with surface-exposed N-HAp provide favorableenvironments for enhanced in vivo bone tissue growth, estimated bycharacteristic biomarkers of bone formation such as collagen. The resultssuggest that newly developed hybrid scaffolds with surface-immobilized N-HApmay serve as a useful 3D substrate with pore surfaces featuring excellent bonetissue-regenerative properties. Acknowledgement. This research was supported bya grant (code #: 2009K000430) from 'Center for Nanostructured MaterialsTechnology' under '21st Century Frontier R&D Programs' of the Ministry ofEducation, Science and Technology, Korea.

Keywords: hydroxyapatite, surfaceengineering, bone regeneration, hybrid

SA-4

Utilization of functionalized magnetic nanoparticles forhigh throughput DNA separation

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The work describes anoptimized process to highly efficient and convenient preparation in highthroughput magnetic human DNA separation with chemically functionalizedsilica-coated magnetic nanoparticles. The effect of nanoparticle's size and the surface'shydrophilicity change were studied for magnetic DNA separation process, inwhich the optimum efficiency was explored via the function of the amino-groupnumbers, particle size, the amount of the nanoparticles used, and theconcentration of NaCl salt. The DNA adsorption yields were high in terms of theamount of triamino-functionalized nanoparticles used, and the average particlesize was 25 nm. The adsorption efficiency of aminofunctionalized nanoparticleswas the 4-5 times (80-100%) higher compared to silica-coated nanoparticles only(10-20%). DNA desorption efficiency showed an optimum level of over 0.7 M ofthe NaCl concentration. To elucidate the agglomeration of nanoparticles afterelectrostatic interaction, the Guinier plots were calculated from small angleX-ray diffractions in a comparison of the results of electron diffraction TEM,and confocal laser scanning microscopy. Additionally, the direct separation ofhuman genomic DNA was achieved from human saliva and whole blood with highefficiency.

Keywords: Nanoparticles, DNA,Magnetic separation, High Throughput