

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

이상철[†]

경희대학교 치의학전문대학원
(schlee@khu.ac.kr[†])

Nano-hydroxyapatite (N-HAp) has shown the pivotal role in producing bone-regenerative materials since it has similarity to natural bone minerals in terms of size, morphology, and the composition. Currently, the combination of biopolymers and N-HAp is recognized as an attractive approach in generating hybrid scaffolds for bone tissue engineering. Surface engineering is an important issue since it determines whether cells can effectively adhere and proliferate on porous scaffolds. We aim to develop a synthetic approach to porous 3D scaffolds by immobilizing N-HAp on pore surfaces. The discrete nano-level anchoring of N-HAp on the scaffold pore surface is achieved using surface-repellent stable colloidal N-HAp with surface phosphate functionality. This rational surface engineering enables surface-anchored N-HAp to express its overall intrinsic bioactivity, since N-HAp is not phase-mixed with the polymers. The porous polymer scaffold with surface-immobilized N-HAp provides more favorable environments than conventional bulk phase-mixed polymer/N-HAp scaffolds in terms of cellular interaction and growth. In vitro biological evaluation using alkaline phosphatase activity assay supports that immobilized N-HAp on pore surfaces of polymer scaffolds contributed to the more enhanced in vitro osteogenic potential. Besides, the scaffolds with surface-exposed N-HAp provide favorable environments for enhanced in vivo bone tissue growth, estimated by characteristic biomarkers of bone formation such as collagen. The results suggest that newly developed hybrid scaffolds with surface-immobilized N-HAp may serve as a useful 3D substrate with pore surfaces featuring excellent bone tissue-regenerative properties. Acknowledgement. This research was supported by a grant (code #: 2009K000430) from 'Center for Nanostructured Materials Technology' under '21st Century Frontier R&D Programs' of the Ministry of Education, Science and Technology, Korea.

Keywords: hydroxyapatite, surface engineering, bone regeneration, hybrid

Utilization of functionalized magnetic nanoparticles for high throughput DNA separation

장정호[†]

한국세라믹기술원 바이오IT융합센터
(jhchang@kicet.re.kr[†])

The work describes an optimized process to highly efficient and convenient preparation in high throughput magnetic human DNA separation with chemically functionalized silica-coated magnetic nanoparticles. The effect of nanoparticle's size and the surface's hydrophilicity change were studied for magnetic DNA separation process, in which the optimum efficiency was explored via the function of the amino-group numbers, particle size, the amount of the nanoparticles used, and the concentration of NaCl salt. The DNA adsorption yields were high in terms of the amount of triamino-functionalized nanoparticles used, and the average particle size was 25 nm. The adsorption efficiency of aminofunctionalized nanoparticles was 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 of the NaCl concentration. To elucidate the agglomeration of nanoparticles after electrostatic interaction, the Guinier plots were calculated from small angle X-ray diffractions in a comparison of the results of electron diffraction TEM, and confocal laser scanning microscopy. Additionally, the direct separation of human genomic DNA was achieved from human saliva and whole blood with high efficiency.

Keywords: Nanoparticles, DNA, Magnetic separation, High Throughput