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Microstructure Control of HAp Based Artificial Bone Using Multi-extrusion Process

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Porous hydroxyapatite has been widely used as clinical implanted material. However, it has poor mechanical properties. To increase the strength as well as the biocompatibility of the porous HAp based artificial bone, it was fabricated by multi-extrusion process. Hydroxyapatite and graphite powders were mixed separately with ethylene vinely acetate and steric acid by shear mixing process. Hydroxyapatite composites containing porous microstructure were fabricated by arranging it in the die and subject it to extrusion process. Burn-out and sintering processes were performed to remove the binder and graphite as well as increase the density. The external and internal diameter of cylindrical hollow core were approximately 10.4 mm and 4.2 mm, respectively. The size of pore channel designed to increase bone growth (osteconduction) was around 150 μm in diameter. X-ray diffraction analysis and SEM observation were performed to identity the crystal structure and the detailed microstructure, respectively.

Keywords: Bioceramics, Extrusion, Artificial bone, Microstructure, Calcium phosphate

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In-vitro and In-vivo Evaluation of the DTBP Crosslinked Collagen and Gelatin Coated Porous Spherical BCP Granules for Using as Granular Bone Substitutes

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DTBP (dimethyl 3,3`-dithiobispropionimidate) was applied to collagen and gelatin coating on BCP granules and a crosslinking agent. The DTBP crosslinking was done for decreasing the solubility of the coating and hence increasing the stability. The nanostructure of collagen and gelatin coating surfaces were observed by SEM technique. Based on the DSC thermograms and FT-IR spectrums, the crosslinkings were confirmed between collagen molecules and gelatin molecules. The compressive strength was measured before crosslinking and after that. In-vitro study was carried out by measuring cell viability and observing cell morphology after DTBP crosslinking. Moreover, the proliferation ability of MG-63 osteoblast-like cells on the crosslinked BCP granules was evaluated by Western blot assay. The BCP granules were implanted into rabbit femur for 4 weeks and 12 weeks. The bone tissue formation was analyzed with micro-computed tomography (micro-CT) and histological analysis was also carried out by hematoxylin and eosin (H&E) staining for visualization of cells.

Keywords: Collagen, Gelatin, Crosslinking, DTBP, Cell response, Bone tissue