Synopsis of Original Research Paper

Fabrication of calcium phosphate spheres for skin tissue repair and regeneration

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Submicron spheres of calcium phosphate have potential as biocompatible and functional cosmetic materials. In the present study, we developed surfactant-free techniques for the synthesis of submicron-sized calcium phosphate-based spheres. In our techniques, pulsed laser irradiation was applied to dispersions of calcium phosphate integrated with various light-absorbing agents: ferric (Fe^{3+}) ions, ferrous (Fe^{2+}) ions, and carbon nanopowders.

For the integration of calcium phosphate and ferric/ferrous ions, $FeCl_3$ or $FeCl_2$ was supplemented to a calcium phosphate reaction mixture. Pulsed laser irradiation was performed to the reaction mixture during spontaneous precipitation of calcium iron phosphate. After irradiation, submicron- and micron-sized spheres of amorphous calcium iron phosphate were fabricated. In this process, ferric/ferrous ions integrated in the nano-sized precipitates induced melting and spheroidization of the precipitates *via* selective laser heating in the reaction mixture. Nucleation-growth process and Ostward ripening under supersaturated condition might be involved in the sphere growth.

For the integration of calcium phosphate and carbon nanopowders, hydroxyapatite nanopowders as the calcium phosphate source and carbon nanopowders were mixed using a ball mill. Pulsed laser irradiation was performed to a dispersion of the carbon-integrated hydroxyapatite nanopowders in ethanol. After irradiation, submicron spheres of amorphous calcium phosphate were fabricated. In this process, carbon nanopowders integrated with the hydroxyapatite nanopowders induced melting, spheroidization, and amorphization of the hydroxyapatite nanopowders *via* selective laser heating in the ethanol solvent. The carbon nanopowders were decomposed and/or evaporated during laser irradiation; hence, there was hardly any carbon remaining in the final spheres.

Our laser fabrication techniques would provide a new way to produce submicron-sized calcium phosphate-based spheres. The resulting spheres have a potential as biocompatible and functional cosmetic materials.