SILVER-DOPED CARBONATED HYDROXYAPATITE GRANULES FOR ANTIBACTERIAL BONE REGENERATION

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Bone repair requires scaffolds that mimic native mineral tissue. Carbonated hydroxyapatite (CHA, $Ca_{10-a}(CO_3)_b(PO_4)_{6-c}(OH)_{2-d}$) meets this need as the principal inorganic component of bone and is widely used as a graft material. It is more biocompatible than another common artificial bone substitute hydroxyapatite (HA, $Ca_{10}(PO_4)_6(OH)_2$) but less thermally stable. Overall, CHA offers a more suitable balance of biocompatibility and stability than HA for bone repair. [1, 2] Such unmodified materials, however, lack intrinsic antimicrobial activity, leaving implants vulnerable to infection. Silver ions were shown to possess antibacterial effects and were successfully incorporated into CHA. [3]

The CHA granules (150–500 µm) were synthesized via a low-temperature dissolution–precipitation method using naturally abundant calcium sulfate (gypsum). The reaction was conducted in aqueous media without organic reagents, aligning with environmentally friendly synthesis principles. Silver was incorporated relative to the initial CHA granule mass at 0.5, 1.0, 2.5, 5.0, and 7.5 wt% to systematically study its antibacterial effect. The characterization of CHA granules focused on structural, chemical, and morphological analysis via X-ray diffraction, Fourier transform infrared and Raman spectroscopies, scanning electron microscopy, and surface area measurements.

The study's outcome is to functionalize the CHA bioceramics by embedding silver into the CHA granules, and in this way produce an advanced antibacterial biomaterial suitable for bone regeneration.

[1] K. Ishikawa, Journal of the Ceramic Society of Japan, 127, 9, 595–601, 2019.
[2] E. Landi, G. Celotti, G. Logroscino, and A. Tampieri, Journal of the European Ceramic Society, 23, 15, 2931–2937, 2003.
[3] J. Kolmas, U. Piotrowska, M. Kuras, and E. Kurek, Materials Science and Engineering C, 74, 124–130, 2017.