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Abstract

Genipin Crosslinked Chitosan Reinforced Apatite Cement as a Carrier for Local Anti-Inflammatory Drug Delivery †

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The development of bone substitute materials containing therapeutically active agents is an attractive and useful tool for treating bone loss and inflammation associated with musculoskeletal diseases. In this context, calcium phosphate-based materials, including cements widely used to repair bone tissue, can also be a valuable carrier for local drug delivery. However, poor mechanical properties limit their load-bearing applications. In this work, the effects of incorporation of (1) a small amount of chitosan (CH) in the absence and presence of genipin (G) and (2) a diclofenac mass fraction of 2.5 wt% (DCF, a non-steroidal anti-inflammatory drug) in α-TCP-based apatite cement composition with a liquid-to-powder mass ratio (LPR) of 0.33 were investigated. For this purpose, compressive strength, phase composition, microstructure, porosity, pore-size distribution, the DCF distribution throughout the cement, and in vitro DCF release profiles and kinetics at two different pH values (7.4 and 5.5) were evaluated. The addition of CH/G increased the compressive strength from 40 ± 5 to 58 ± 7 MPa. The presence of DCF together with these additives slightly decreased the compressive strength value to 54 ± 4 MPa. The amount of DCF released after 21 days at pH 7.4 decreases from 34.6 ± 3.7 % to 19.1 ± 2.7 % for the calcium phosphate cement matrix in the absence and presence of the CH/G, respectively. The formulations containing CH/G and CH/G/DCF were selected for further study of the effects of LPR increase (0.40 and 0.45) under the same conditions. The results indicated that the presence of CH/G in α-TCP-based apatite cement mainly changes the porosity, pore size distribution and the phases formed in the setting reaction, which in turn affect the mechanical properties and the drug release profiles.

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