Abstract

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Title of Thesis: Calcium phosphate bone cements: Synthesis, characterization and drug release properties

Non-healing bone traumas are currently a complication, which may disable a patient from active life for a long period. Due to the fact that bone mass consists mostly of hydroxyapatite, a derivative of calcium phosphate - calcium phosphate cement (CPC) - is studied as an injectable bone substitute. The cement's characteristics (low setting temperature, injectability, bioactivity, and resorbability) are very promising. Furthermore, the possibility to incorporate a drug in the formulation that would support the healing process opens a way for new therapeutic options. Firstly, the aim of this research was to synthesize a high-quality α-tricalcium phosphate (α-TCP) and characterize its properties. Subsequently, the prepared α-TCP was used for the preparation of an injectable and washout resistant cement paste. Finally, the properties of developed pure or ibuprofen-loaded cement were examined by X-ray diffraction, Raman spectra, compressive strength, scanning electron microscopy, and dissolution studies.

The obtained data revealed that α-TCP of high-quality was isolated. Furthermore, the majority of α-TCP to calcium-deficient hydroxyapatite conversion was completed after one day of hardening, while residues of α-TCP remained present even after 15 days. In addition, a significant difference between the compressive strength of pure CPC and ibuprofen-loaded CPC was noticed. Results also revealed that the drug incorporation did not affect the crystalline structure of CPC or the hydration reaction. The ibuprofen release lasted more than 21 days (reaching 80 % of the initial amount) and followed Higuchi's law. Finally, the injectability, as well as the washout resistance, were optimal. In conclusion, the experimental results suggest that the CPC might be a promising drug carrier.