DEVELOPMENT OF CALCIUM-PHOSPHATE MICROSPHERES LOADED WITH AN ANTITUMORAL AGENT FOR BONE CANCER TREATMENT

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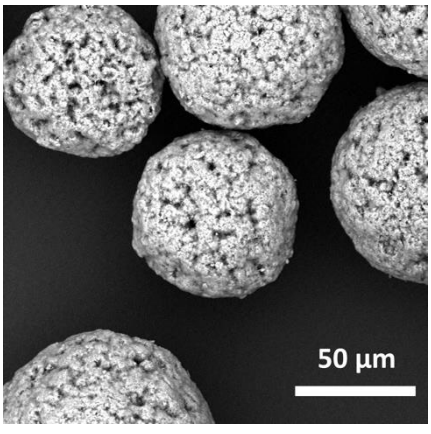
ABSTRACT

In 2020, the American Cancer Society estimated 3 600 new annual primary bone cancer cases and 1720 deaths. Conventional bone cancer treatments existing today are surgery, chemotherapy, radiation and their different combinations. While these techniques are considered effective ways of treating cancer, they imply side-effects such as liver dysfunction, heart toxicity, and bone marrow suppression [1]. In order to minimize and preferably avoid these side-effects, development of new treatments against bone cancers are needed. A promising approach is local cancer treatments using targeting drugs, which could reduce the use of chemotherapeutic drugs or external radiations, among others. Due to their great osteoconductivity, interconnected porosity, bioresorbability, and the possibility to custom their shape, calcium Phosphate Cements (CPCs) are promising as bone graft material to support the self-healing and enhance the regeneration of the bone after a resection surgery [2]. CPCs in the form of microspheres (MS) can act as drug carriers due to their inherent interconnected porosity and high specific surface area, and have shown better filling and packing of irregular shaped bone fractures.

Hence, by using CPCs MS as vehicles for antitumoral agent, the approach is double: i) locally treat bone cancer and ii) promote post-surgical bone regeneration. As the rate of drug release is an important parameter towards any therapy, the main goal of this work is to study different parameters (e.g. particle size) influencing the loading- and the release kinetics of DOX from MS. Furthermore, the effects of low-pressure plasma polymerization to create a polymer coating (i.e. poly(ε-caprolactone)) of the MS was also studied to modulate the release kinetics, with further needs of investigation. Results showed that MS of 100<Ø<150 μm have a greater drug loading capacity (60 %), compared to MS of the size 250<Ø<300 μm (50 %), which can be attributed to the difference of specific surface area. In contrast, that the release kinetics of DOX was shown to be size-independent.



CPC MS used for DOX loading

[1] J. Liao, R. Han, Y. Wu, Z. Qian, Bone Res. 9, 18 (2021).
[2] M.P. Ginebra, C. Canal *et al.*, Adv. Drug Deliv. Rev. 64, 1090 (2012).