Colloidal systems in bone regeneration. Is the size important?

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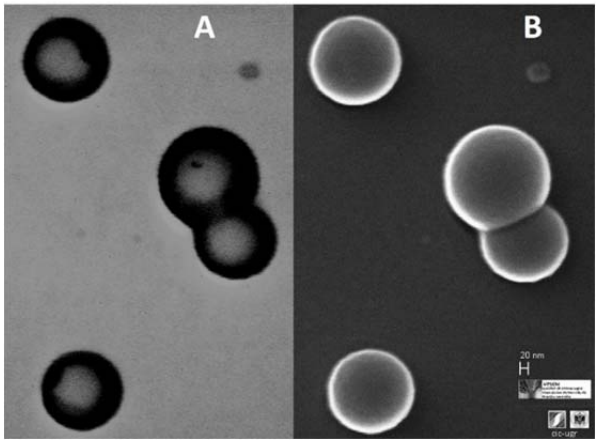
Poly lactic-co-glycolic acid (PLGA) is one of the most widely used synthetic polymers for development of delivery systems for drugs and therapeutic biomolecules. Its properties and versatility make it a reference polymer in the manufacturing of nano and microparticles to encapsulate and deliver a wide variety of hydrophobic and hydrophilic molecules, including biomolecules such as proteins or nucleic acids that must be released in a controlled way [1].

Delivery of growth factors such as bone morphogenetic proteins, and specially BMP-2, is an attractive therapeutic strategy for bone tissue engineering. However, their administration is problematic due to their short biological half-lives, localized action and rapid clearance. Consequently, its clinical use requires high doses far exceeding its physiological concentration which implies possible side effects and high costs. These barriers might be overcome by developing new delivery systems which allow a better control of the release rate in order to achieve the desired concentrations in specific site and time [2].

With this aim, in this preliminary study we have synthesized PLGA particles with different diameters, from nano (200 nm) to micro scale (12.5 μm) via double emulsion procedure, in order to study the influence of size in the release profile of lysozyme, which has been selected as an appropriate model for BMP2. A physico-chemical characterization of the particles was done, followed by a complete study on the encapsulation efficiency, cumulative protein release and bioactivity of the released enzyme with and without co-encapsulated bovine serum albumin, a protective biomolecule that can prevent protein instability during emulsification process. Additionally, fluorescently labeled lysozyme was used to study the protein distribution and the influence of particle size on the *in vitro* cellular uptake.



(A) STEM/ (B) SEM micrographies of PLGA/poloxamer188 blend nanoparticles.

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