Double hydrophilic polyphosphoester containing copolymers as efficient templating agents for calcium carbonate microparticles

Titre	Double hydrophilic polyphosphoester containing copolymers as efficient templating agents for calcium carbonate microparticles
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Résumé en anglais	The use of calcium carbonate (CaCO3) microparticles is becoming more and more attractive in many fields especially in biomedical applications in which the fine tuning of the size, morphology and crystalline form of the CaCO3 particles is crucial. Although some structuring compounds, like hyaluronic acid, give satisfying results, the control of the particle structure still has to be improved. To this end, we evaluated the CaCO3 structuring capacity of novel well-defined double hydrophilic block copolymers composed of poly(ethylene oxide) and a polyphosphoester segment with an affinity for calcium like poly(phosphotriester)s bearing pendent carboxylic acids or poly(phosphodiester)s with a negatively charged oxygen atom on each repeating monomer unit. These copolymers were synthesized by a combination of organocatalyzed ring opening polymerization, thiol–yne click chemistry and protection/deprotection methods. The formulation of CaCO3 particles was then performed in the presence of these block copolymers (i) by the classical chemical pathway involving CaCl2 and Na2CO3 and (ii) by a process based on supercritical carbon dioxide (scCO2) technology in which CO32− ions are generated in aqueous media and react with Ca2+ ions. Porous CaCO3 microspheres composed of vaterite nanocrystals were obtained. Moreover, a clear dependence of the particle size on the structure of the templating agent was emphasized. In this work, we show that the use of the supercritical process and the substitution of hyaluronic acid for a carboxylic acid containing copolymer decreases the size of the CaCO3 particles by a factor of 6 (~1.5 μm) while preventing their aggregation.
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