Cockle shell-derived calcium carbonate (aragonite) nanoparticles: a dynamite to nanomedicine

ABSTRACT

Cockle shell is an external covering of small, salt water edible clams (Anadara granosa) that dwells in coastal area. This abundant biomaterial is hard, cheap and readily available with high content of calcium carbonate in aragonite polymorphic form. At present, cockle shell-derived calcium carbonate nanoparticles (CSCaCO3NPs) with dual applications has remarkably drawn significant attention of researchers in nanotechnology as a nanocarrier for delivery of different categories of drugs and as bone scaffold due to its beneficial potentials such as biocompatibility, osteoconductivity, pH sensitivity, slow biodegradation, hydrophilic nature and a wide safety margin. In addition, CSCaCO3NP possesses structural porosity, a large surface area and functional group endings for electrostatic ion bonds with high loading capacity. Thus, it maintains great potential in the drug delivery system and a large number of biomedical utilisations. The pioneering researchers adopted a non-hazardous top-down method for the synthesis of CSCaCO3NP with subsequent improvements that led to the better spherical diameter size obtained recently which is suitable for drug delivery. The method is therefore a simple, low cost and environmentally friendly, which involves little procedural steps without stringent temperature management and expensive hazardous chemicals or any carbonation methods. This paper presents a review on a few different types of nanoparticles with emphasis on the versatile most recent advancements and achievements on the synthesis and developments of CSCaCO3NP aragonite with its applications as a nanocarrier for drug delivery in nanomedicine.

Keyword: Cockle shell; Calcium carbonate; Nanoparticles; Nanomedicine; Aragonite; Biocompatibility; Drug delivery