Synthesis of Aragonite Phase Calcium Carbonate Nanoparticles from Sri Lankan Beach Cockle Shells

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Cockle Shells (CSs) are very rich natural resource for Calcium Carbonate (CC). Synthesis of Aragonite Nano Particles (ANPs) is one of the prime targets of researchers in the biomedical field, since the biodegradability, biocompatibility, and porous nature of ANPs. Further, it is denser than calcite and can be integrated, resolved, and replaced by bone and also has the potential to develop as anticancer drugs, drug delivery systems, and for bone repairing. Highly purified aragonite phase CC hard to obtain by synthesizing. Sri Lanka comprises of a fairly huge amount of naturally formed CSs along the sea-coast without adding any industrial value, other than the beauty. Therefore, the present study has been forced to synthesize ANPs from CSs. The CSs collected from the beach were thoroughly washed, dried, and pulverized. 5.0 g of 63µm powdered CSs sample was stirred with 50.0 mL of deionized water and then 2.0 mL of Coco Diethyl Betaine (CDEB) surfactant has added continue the stirring. Nine different series were tested by varying the stirring speed and time with deionized water before adding CDEB. Raw CSs samples and prepared ANPs were characterized with X-ray diffraction (XRD), Fourier transform infra-red (FTIR) spectrometry, and Particle size analysis (PSA). XRD analysis has confirmed both raw CS and ANPs consist of aragonite phases and the applied mechano-chemical method (MCM) was able to preserve crystallinity of the Aragonite phase in ANPs. FTIR spectroscopic analysis has shown aragonite phase CC and confirmed that the CDEB does not affect the vibration frequencies of carbonate ions. PSA has shown that the average particle size below 100 nm, ANPs were able to obtain by stirring 63 µm powder under 1400 rpm for one hour before adding the surfactant. Hence the MCM was very effective in producing ANPs which is a promising material in biomedical applications.

Keywords: Cockle shells, Aragonite, Biomaterial, Mechano-chemical, Nanoparticles