Whitlockite

Whitlockite (WH, Ca18Mg2(HPO4)2(PO4)12) is the second most abundant bone mineral and has attracted attention as one of the novel bone regenerative materials. It has proven to enhance growth and promote osteogenesis of stem cells. However, investigating the mechanism of the formation of pure phase WH nanocrystals remains a challenge. In this study, we introduced an interesting synthesis approach of WH nanocrystals using a tri-solvent system for the solid-liquid-solution (SLS) process. The ratio of precursor and reaction solvent composition was optimized to generate WH nanocrystals with tunable size, morphology (nanoplates, nanospheres), and surface properties (hydrophobic, hydrophilic), which is impossible to achieve using the traditional precipitation method. Molecular dynamics (MD) simulations revealed that the growth direction of nanoplates is highly related to the surfactant and its binding affinity. Finite element method (FEM) simulations elucidated that the ratio of ethanol/water plays an important role in defining the crystallinity and morphology of WH. In this study, we demonstrated that the cell proliferation of human bone marrow-derived mesenchymal stem cells (hBMSCs) is enhanced upon treatment with WH. The results of the quantitative real-time polymerase chain reaction (qPCR) revealed that WH can positively accelerate the osteogenic differentiation in hBMSCs. The as-synthesized WH has great potential in the future to be used in osteogenic tissue engineering. This study opens a new horizon for the synthesis and application of WH [1)]

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Wang C, Jeong KJ, Park HJ, Lee M, Ryu SC, Hwang DY, Nam KH, Han IH, Lee J. Synthesis and formation mechanism of bone mineral, whitlockite nanocrystals in tri-solvent system. J Colloid Interface Sci. 2020 Feb 17;569:1-11. doi: 10.1016/j.jcis.2020.02.072. [Epub ahead of print] PubMed PMID: 32092600.