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LARGE AMOUNT SYNTHESIS OF MAGNESIUM WHITLOCKITE NANOPOWDERS FROM AN ENVIRONMENTALLY FRIENDLY INITIAL REACTANT

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Thousands of people annually have health problems related to bone fractures caused by osteoporosis, trauma, cancer, and various diseases, that frequently require surgical treatment for bone regeneration [1]. Calcium phosphate (CaP) compounds are widely studied and used as bone substitutes due to their similar composition to the inorganic part of bone, their biocompatibility, and ease of fabrication [2]. The most popular and investigated substitutes are hydroxyapatite (HA), tricalcium phosphate (TCP), octacalcium phosphate (OCP), and biphasic calcium phosphate (BCP). Magnesium whitlockite (Mg-WH, $Ca_{18}Mg_2(HPO_4)_2(PO_4)_{12}$) occupies a significant place in the mineral part of human bone, induces osteogenic differentiation, rapid bone formation, and undoubtedly has outstanding substitute properties [3]. Due to the mentioned properties, Mg-WH is relevant in medicine: in bone reconstruction and treatment procedures.

The main idea of our investigation was to synthesize a large amount of Mg-WH nanopowders via a simple, inexpensive, low-temperature dissolution-precipitation (DP) method from an environmentally friendly gypsum ($CaSO_4 \cdot 2H_2O$) powder as a starting material. DP synthesis is appropriate for the fabrication of CaP material as well as Mg-WH compound [4]. The obtained product was investigated by powder X-ray diffraction (XRD) analysis, scanning electron microscopy (SEM), Fourier-transform infrared spectroscopy (FTIR), Brunauer–Emmett–Teller (BET) measurements, and Energy-dispersive X-ray (EDX) analysis.

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[1] I. Lodoso-Torrecilla et. al., Calcium phosphate cements: Optimization toward biodegradability, Acta Biomaterialia 119, 1-12 (2021)
[2] H.-J. Kang et. al., Comparative study on biodegradation and biocompatibility of multichannel calcium phosphate based bone substitutes, Mat. Sc. and Eng.: C 110, 110694 (2020)
[3] J. Jeong et. al., Synergistic Effect of Whitlockite Scaffolds Combined with Alendronate to Promote Bone Regeneration J. Tissue Eng. Reg. Med. 19, 83-92 (2022)
[4] K. Ishikawa, Bone Substitute Fabrication Based on Dissolution-Precipitation Reactions, Materials 3, 1138-1155 (2010)