MAGNESIUM WHITLOCKITE FORMATION FROM AMORPHOUS CALCIUM PHOSPHATE: EFFECTS OF BUFFER COMPOSITION AND Mg^{2+}

Greta Linkaitė[1], Gabrielė Eglė Budžytė[1], Aleksej Žarkov[1], Aivaras Kareiva[1], Inga Grigoravičiūtė[1]

[1]Vilnius University, Faculty of Chemistry and Geosciences, Vilnius, Lithuania
greta.linkaite@chgf.stud.vu.lt

Magnesium whitlockite (Mg-WH, $Ca_{18}Mg_2(HPO_4)_2(PO_4)_{12}$) is a biologically relevant calcium phosphate that is increasingly studied for bone regeneration and hard-tissue engineering owing to its osteoconductive and bioresorbable behavior [1][2]. Mg-WH can occur naturally in some tissues such as dentin and cartilage [3], and according to some sources, it has been associated with early-stage or actively forming bone, particularly in younger individuals [4], making it an attractive synthetic alternative to conventional calcium phosphates that lack structurally incorporated Mg^{2+} ions despite their known osteogenic role.

In this study, Mg-WH was synthesized at a relatively low temperature of 80 °C through a dissolution–precipitation synthesis route in a phosphate buffer, using amorphous calcium phosphate as a precursor. The effect of phosphate buffer composition and magnesium ion concentration on the final product was investigated in order to determine the most favorable conditions for single-phase Mg-WH formation. Optimized synthesis conditions resulted in the formation of phase-pure Mg-WH powder with particle size varying between 100-300 nm, whose purity was verified by XRD, Rietveld refinement, and FTIR analyses. Deviations from the selected conditions led to the formation of secondary impurity calcium phosphate phases.

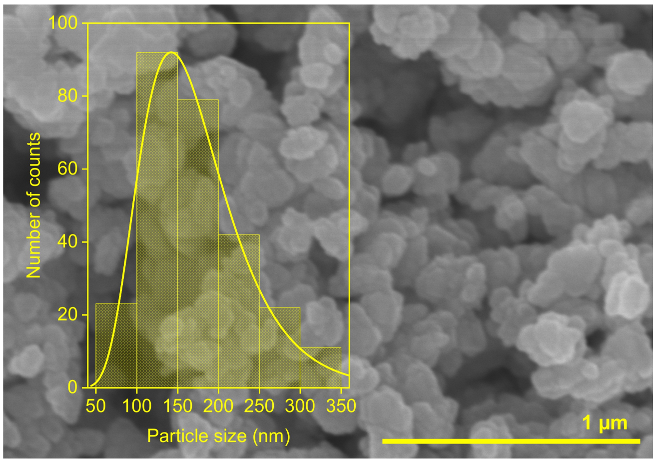

Fig. 1. Histogram of synthesized Mg-WH particle sizes (n = 270) with a lognormal fit (solid line), showing a right-skewed particle size distribution.

Keywords: Calcium Phosphates, Whitlockite, Biomaterials, Amorphous calcium phosphate, Dissolution–precipitation

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