SYNTHESIS OF SILVER-DOPED WHITLOCKITE

Gabriele Egle Budzyte[1], Aivaras Kareiva[1], Inga Grigoraviciute[1]

[1]Vilnius University, Institute of Chemistry, Naugarduko st. 24, LT-30225, Vilnius, Lithuania
egle.budzyte@chgf.vu.lt

Calcium phosphate (CP) ceramics have been the focus of extensive research due to their structural similarity to the mineral phase of biological mammal hard tissues and their capacity to support bone regeneration through their bioactive surface properties. Within this group, particular attention has been drawn to whitlockite-type phosphates as a potential alternative to more conventional CPs, as demonstrated by numerous studies reporting enhanced osteogenic response and accelerated bone healing. It is important to note that the whitlockite crystal structure is capable of accommodating compositional variations without loss of its overall framework. This property allows for the substitution of calcium (Ca) by other ions, thereby enabling the emergence of newly acquired, substitution-induced properties.

A particularly noteworthy modification is that of silver (Ag) doping. The incorporation of Ag into the whitlockite matrix is of interest because it has the potential to introduce antibacterial functionality, which could reduce the risk of infection in scenarios involving bone repair. Nevertheless, the development of practical synthesis routes for Ag-doped whitlockite remains a significant challenge.

In this study, Ag-doped whitlockite was synthesized using calcium sulphate hemihydrate ($CaSO_4 \cdot 0.5H_2O$) as the calcium (Ca) source. The synthesis was carried out in a phosphate-containing medium, where $CaSO_4 \cdot 0.5H_2O$ dissolves and subsequently precipitates as the targeted whitlockite phase. The main synthesis parameters were investigated for their influence on phase formation and product composition. The parameters investigated included synthesis reaction time, Ca to Ag ratio, and the pH of the phosphate medium. Phase composition and purity, as well as morphology of the synthesized samples were evaluated using X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), inductively coupled plasma spectroscopy (ICP), and scanning electron microscopy (SEM).