X-ray Diffraction Study for the Comparison of Standard and Synthesized Calibration Materials for Human Bone

V.H. DeLeon and T.D. Golden*

Department of Chemistry
1155 Union Circle #305070
University of North Texas
Denton, Texas 76203

Powder x-ray diffraction is used to investigate and compare the crystal structure and phase composition of NIST Standard Reference Materials (SRMs) and electrochemically synthesized (ECS) bioapatite to adult human bone. A suitable calibration material with similar inorganic phase and crystallinity as bone is essential when determining metal contamination by laser ablation inductively-coupled plasma mass spectrometry (LA-ICP-MS). The standard reference materials currently used for bone are produced from either ashing or boiling and grinding of bovine or ovine bones. However, an additional synthetic calibration material is needed, since bone can incorporate metals into its crystal lattice changing the cell volume and lattice parameters. Bone calibration materials were electrochemically synthesized from a simulated body fluid (SBF) with three levels of metal-doping into the hydroxyapatite crystal lattice. The SRMs and synthesized calibration materials were ground for homogeneous distribution and pressed into 13 mm diameter pellets for x-ray diffraction study. As new standards for trace metal analysis, these matrix-matched standards of metal-doped bioapatite can then be used for further studies and bone mapping experiments.