B148 Elemental Analysis of Biological Matrices by Solution Based High Resolution (HR)-ICP-MS and LA-HR-ICP-MS

Analyses for Sourcing, Bone, Teeth, and Plant Matrices

Waleska Castro, MS, and José R. Almirall, PhD, Florida International University, Department of Chemistry and Biochemistry and International Forensics Research Institute, 11200 SW 8th Street, Miami, FL 33176*

After attending this presentation, attendees will learn information about a laser ablation method for the analysis of biological matrices bone, teeth, and plant matrices by HR-ICP-MS as well as the possible use of elemental composition in addition to isotope ratios for sourcing bone, teeth, and plant matrices.

This presentation will impact the forensic community and/or humanity by demonstrating a fast and reliable elemental analysis of biological matrices using LA-HR-ICP-MS is presented. LA analyses will reduce the sample consumption and avoid tedious digestion procedures and how to source matrices like bone, teeth and plants as well as showing how elemental composition of biological matrices could provide higher discrimination in addition to isotope ratios for sourcing.

Elemental analysis of glass and paint by ICP-MS and LA-ICP-MS have shown to provide a very high degree of discrimination between different sources of manufacturing of these materials. There has also been an interest in the application of elemental analysis by these sensitive methods to the analysis of biological matrices such as bones, hair, nail, teeth and plants. Isotope ratio analyses of several elements have also been used as geological markers, making possible the investigation of the origin of bones of human remains[1-3] and of plant material.[4-5] Trace element content could provide a high degree of discrimination for the sourcing of bones and marijuana plants in addition to the use of isotope ratios. Inductively Coupled Plasma Mass Spectrometry (ICP-MS) is one of the preferred techniques for elemental analysis since it can provide excellent sensitivity, accuracy and precision of the analysis. The use of a sector field High Resolution (HR-ICP-MS) system offers the resolution of polyatomic interferences improving the detection of trace elements is complex matrices such as bones and marijuana samples, in addition to improving the detection limits over a quadrupole based ICP-MS device. By coupling a laser ablation (LA) system for solid sampling, the sample preparation steps and the destruction of the sample are reduced significantly. The advantages and disadvantages of coupling LA to the HR-ICP-MS are presented along with a comparison of the analytical data retrieved from solution and LA- based analyses.

The Standard Reference Materials (SRMs) NIST 1486 (bone meal), NIST 1400 (bone ashed) and NIST 1515 (apple leaves) were analyzed to develop and evaluate an analytical method for these matrices by HR- ICP-MS and LA-HR-ICP-MS. For this work a high resolution sector field instrument (Element 2) from Thermo Electron Co., Bremen, Germany and a Nd:YAG laser operating at 266 nm from CETAC, USA were used for the analysis of the SRMs and the bone and marijuana samples. The method for solution analysis was developed and validated in terms of sensitivity, accuracy and precision while additional parameters were taken into account for the LA method (spot size, carrier gas, repetition rate, and laser energy). Humerus and femur bone samples from different individuals and marijuana plant samples from different growing regions were analyzed with this developed method. The resulting significance of elemental analysis of these biological matrices for sourcing purposes is presented.

References:

1 Beard, B. L.; Johnson, C. M., Strontium Isotope Composition of Skeletal Material can Determine the Birth of Place and Geographic Mobility of Humans and Animals. *Journal of Forensic Sciences* 2000, 45, (5), 1049-1061.

2 Pye, K., Isotope and Trace element Analysis of Human Teeth and Bones for Forensic Purposes. In *Forensic Geoscience - Principles, Techniques and Applications*., Pye, K.; Croft, D. J., Eds. Geological Society Publishing House: London, 2004, p 215-236.

3 Cox, G.; Sealy, J., Investigating Identity and Life Histories: Isotopic Analysis and Historical Documentation of Slave Skeletons Found on the Cape Town Foreshore, South Africa. *International Journal of Historical Archaeology* 1997, 1, (3), 207-224.

4 Galimov, E. M.; Sevastyanov, V. S.; Kulbachevskaya, E. V.; Golyavin, A. A. Isotope ratio mass pectrometry: ä 13C and ä 15N analysis for tracing the origin of illicit drugs. *Rapid Communications in Mass Spectrometry* (2005), 19(10), 1213-1216.

5 J.R. Ehleringer, J.F. Casale, M.J. Lott, V.L. Ford, Tracing the geographical origin of cocaine, *Nature* 408 (2000) 311–312.

Elemental Analysis, Biological Matrices, LA-HR-ICP-MS

 ** Presenting Author*