B48 Elemental Analysis of Bone, Nail and Hair by ICP-MS and LA-ICPMS

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After attending this presentation, attendees will have the results for the elemental analysis of bone, nail and hair using solution digestion and laser ablation coupled to both unit resolution and high resolution ICP-MS instru- ments.

This presentation will impact the forensic community and/or humanity by demonstrating the utility of both solution and LA sampling of bone, nail and hair to determine the elemental profile of these materials when analyzed by either unit resolution or high resolution ICP-MS.

The utility of trace elemental analyses and comparisons of glass and paint fragments by sophisticated methods such as laser ablation inductively coupled plasma (LA-ICP-MS) has been shown to offer a high degree of discrimination between different sources of these materials. Elemental analysis can be used to associate materials originating from the same source with a high degree of confidence based on the excellent discrimination observed between different sources. ICP-MS and LA-ICP-MS methods have been developed and validated through intra-laboratory and inter-labo- ratory trials, published in the scientific literature, and even used in actual criminal prosecution proceedings in Europe and in the US.

An analytical protocol for the determination of trace elemental pro- files in bone, nail, and hair by two methods, ICP-MS and LA-ICP-MS, has been developed and is presented. The NITECRIME network, an interna- tional effort associated with validating the protocols for sample preparation and analysis of trace metals in various matrices, has conducted inter-labo- ratory trials for the analysis of bone, nail, and hair. One application, where such elemental profiling may be utilized, involves drawing an association of buried remains to a particular burial site, associating remains to a geo- graphic region (where the subject previously resided), and discriminating between sets of bones that have been co-mingled in a burial site. Such pro- filing is made possible through the measurement of the geo-chemical markers found in bone as trace elements. Similarly, the elemental profile in nail and hair can be used to associate individuals to geographic markers, acquired through diet and other means.

The analytical protocol for solution analysis, via two different digestion methodologies (open vessel and microwave) is described. A com- parison conducted in terms of precision, accuracy, time, and ease of analysis, is presented. These matrices/samples were also sampled using LA-ICP-MS to simplify the sample preparation step; LA has proven to offer many advantages over solution-based methods. A Perkin Elmer DRCII quadrupole ICP-MS and a Thermo Element 2 High Resolution magnetic sector instruments were used to measure the determined ele- mental menu for each of the sample matrices. Standard reference materials (NIST 1400, NIST 1486, CRM 397, ICP02H06, ICP03H06 and ICP01N01) and actual bone, nail and hair samples were analyzed and the results of the analyses by the different combinations of the methods and instruments are presented. This work demonstrates the utility of both solution and LA sampling of bone, nail and hair, as used to determine the elemental profile of these materials by either unit resolution or high resolution ICP-MS.

Bone/Nail/Hair, ICP-MS, Elemental Analysis

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