B83 Characterization of Solder by Trace Metals Using Atomic Absorption Spectroscopy (AAS)

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After attending this presentation, attendees will understand: (1) an available method for analyzing solder using AAS; (2) some of the information that may be obtained from trace elemental analysis of solder; and, (3) potential issues in using solder elemental profiles for investigative purposes and as prosecutorial evidence.

This presentation will impact the forensic science community by providing insight into the use of solder as a potential investigative tool in criminal cases that involve improvised explosive devices and/or handmade electronic circuits and fuses.

Trace elemental analysis is capable of characterizing materials found during an investigation and identifying a potential source. This includes potentially linking the evidence to a known brand, lot, or sample of a given product. As a consequence, this technique can provide investigators with valuable knowledge about evidence present at a crime scene. Solder is a relatively common and easy-to-obtain material and is likely to be used in the construction of improvised explosive devices. Rapid analysis of solder found on either exploded shrapnel or undetonated devices may provide investigators with early leads as to the origins of the device and possible primary suspects as well as evidence against the suspect in the case of a trace profile match.

This study employs a method for rapidly digesting and analyzing samples via AAS. Twelve distinct brands of 60/40 tin/lead solder were digested in hydrochloric and nitric acids. Analysis of sample digestions was targeted at identifying differences in trace element concentrations between samples. To examine consistencies within brands, three separate spools each of several brands were analyzed. While other methods for analyzing solder using inductively-coupled plasma sampling techniques have been proposed, AAS is currently more commonly found in forensic laboratories, which would allow for a more facilitated processing of solder samples. A rapid response and dissemination of information pertinent to identifying suspects is critical in cases involving explosives evidence.

This study will present measured concentrations for copper, silver, and bismuth in several commercially available solder samples. Discriminant analysis of these trace profiles suggest that differentiation of solder samples by as little as three elements is possible using AAS according to the proposed method. Sample identification based on trace element concentrations generally had an accuracy of >90%; however, identifying the brand of solder from a given trace element profile is much less accurate. Overall, this study indicates that AAS identification of solder by a direct comparison of an unknown sample to an exemplar may be performed with a high level of accuracy.

Trace Elements, Solder, AAS