B9 Forensic Analysis of Black Powder Substitutes by ESI-TOFMS

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After attending this research presentation, attendees will have been introduced to a newly developed method for the detection of organic and inorganic components of black powder substitutes using electrospray ionization time-of-flight mass spectrometry.

This presentation will impact the forensic community by demonstrating why it is important to have techniques in place which provide rapid and unequivocal information on the nature and composition of black powder substitute explosive materials both pre- and post-blast. These materials are readily available in significant quantities at many locations in the U.S., and the use of these alternative propellants in Improvised Explosive Devices (IEDs) is on the rise.

Black powder substitutes are readily available in significant quantities at many locations in the U.S., and the use of these alternative propellants in Improvised Explosive Devices (IEDs) is on the rise. It is therefore important to have techniques in place which provide rapid and unequivocal information on the nature and composition of these explosive materials both pre- and post-blast.

Black powder substitutes are alternatives to traditional black powder which have been formulated to have a more controlled burn rate, generate less smoke and residue when fired, and improve the safety of storage. Many of the newer black powder substitutes utilize ascorbic acid (vitamin C) as a replacement fuel for sulfur and charcoal. These propellants typically contain a mixed perchlorate/nitrate oxidizer.

Previous approaches to the analysis of these black powder substitutes have included GC-MS, IC-MS, IC-UV, and CE-UV techniques. Because both the organic and inorganic components of interest in black powder substitutes are charged at neutral to weakly acidic pH, ion chromatography and capillary electrophoresis are the preferred separation techniques for these analytes. By coupling these liquid based separation techniques to a time-of-flight mass spectrometric detector via electrospray ionization techniques, more information is available to the scientist concerning exact mass and isotopic ratios, which, when coupled with migration time, provide an unequivocal identification of the residues of interest. In these studies, samples from intact powders, post-burn and post-blast residues will be analyzed, and the ions of interest including ascorbate, chloride, nitrite, nitrate, chlorate, perchlorate, sulfate, and carbonate will be discussed in this presentation.

Electrospray Ionization, Mass Spectrometry, Black Powder Substitutes

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