K18 Detection of Biomarkers of Explosives

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After attending this presentation, attendees will become familiar with an approach to detect biomarkers of explosives using screening and low level detection techniques.

This presentation will impact the forensic community and/or humanity by providing novel screening methods that will extend the detection time and concentration ranges of metabolized explosives.

Detecting explosive biomarkers in human biological fluids can be useful in identifying individuals who have either handled or been exposed to explosive compounds. In order to fully implement such detection, methods ranging from screening to trace level detection of metabolites are needed. This presentation will discuss two such techniques applied to volatile biomarkers of explosives.

Explosive compounds may enter the body via inhalation or skin absorption and undergo metabolism. Once the explosive compounds are metabolized, the metabolites may be present in blood and urine. The volatility of these explosives and their metabolites may provide alternative means for detecting them in biological fluids. Finding unique metabolites also referred to as biomarkers, in biological samples will give forensic toxicologists a valuable investigative tool that can assist in identifying people who have handled explosives. The concentration of these biomarkers in the body may be too low to detect using standard analytical techniques. For trace level metabolites, a preconcentration technique such as purge and trap gas chromatography/mass spectrometry (PT GC/MS) is ideal for detecting volatile metabolites in biological matrices. Another method, ion mobility spectrometry (IMS), is a rapid and sensitive screening method with low detection limits. IMS is widely used for the detection of trace explosive compounds; however, minimal research has been reported using direct headspace samples of explosives with IMS. The present work employed using PT GC/MS and IMS as screening methods for the detection of volatile explosives metabolites in headspace. A loop and a trap method for the PT GC/MS were used for this analysis. The samples were incubated at body temperature, thirty-seven degrees, for twenty minutes prior to purging. The ability to detect explosives metabolites in biological matrices is time limited because the body metabolizes substances at various rates. Having the capability to preconcentrate using PT GC/MS gives a wider range of time and concentrations to analyze trace metabolites in real biological samples. The advantage of detecting low concentrations with IMS will assist in rapid screening of explosives metabolites in headspace. In the future, this research may aid in the development in a method which would detect explosives metabolites in breath.

Methods for detecting explosives metabolites in headspace of biological matrices can be useful to the investigation of bombers and bomb-makers. This study primarily focuses on TNT and its metabolites, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene and dinitrotoluene. Other explosives will also be discussed in this presentation. This information will present headspace data obtained in urine and blood by PT GC/MS and IMS.

IMS, PT GC/MS, Explosives Metabolites

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