B195 Study of Detection Limits of Odor Signatures of Drugs of Abuse Using SPME GC-MS and SPME-IMS

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After attending this presentation, attendees will have learned about the use of IMS instrumentation for detection of illicit drugs based on odor signatures.

This presentation will impact the forensic community and/or humanity by demonstrating how the field detection of drugs based on their specific odor signatures will help law enforcement agencies. It is the instrumental detection of compounds detected by canines.

Controlled substances are routinely analyzed and identified by Gas Chromatography-Mass Spectrometry in the laboratory. The presumptive detection of drugs and explosive particles has been demonstrated by Ion Mobility Spectrometry for some time. The use of IMS has become more widespread due to its portability, ease of use and rapid analysis time. Over 10,000 IMS instruments are now performing an estimated 10 million analyses/year in field environments. IMS have also been shown to improve the detection limits over GC-MS by an order of magnitude.[1] Traditionally canines have been used to indicate to the presence of illicit drugs in public areas and ports of entry by law enforcement officials. Dogs have been found to alert to very low levels of substances.[2] Previous work has reported that dogs alert to the vapor generated by the substances of interest.[2] Further studies analyzing the headspace above the drugs and explosives and the specific odor compounds (volatile chemical markers) for the various narcotic drugs have been reported. These compounds include Methyl benzoate for cocaine and Piperonal for Ecstasy and others like Camphor and MDP2P.

This presentation presents data from a study conducted to determine detection limits of these above compounds. Solid Phase Micro-Extraction (SPME) is a sensitive, pre-concentration, and sampling technique. SPME when coupled to GC-MS and IMS increases the detection capabilities of these instruments.It allows for the concentration of volatile compounds prior to the analysis. SPME pre- concentrators have been used widely with GC-MS and present no analytical challenges.Previous work done in this laboratory has reported the successful coupling of SPME with IMS. This enables for field sampling and detection by already deployed IMS units.

Since SPME presents itself as a good tool for the analyses of volatile compounds, it is used in this current study for pre-concentration of chemical markers. This presentation also presents data detailing the study done to determine the amount of mass transfer to the SPME fiber that is sufficient to elicit a signal above detection limits for both GC-MS and IMS instruments. Ion mobility spectrometers used in this study include the bench-top and portal configurations. Sampling parameters and instrument parameters vary for each of these instruments and hence they are optimized prior to analysis.[3]

These results will improve the understanding of the instrumental detection of the drugs of abuse and lead to improvements in the detection of controlled substances through their odor compounds.

References:

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2 K.G. Furton, Y. Hong, Y. Hsu, T. Lue, S. Rose, J. Walton, Identification of Odor Signatures Chemicals in Cocaine using Solid-Phase Micro- Extraction – Gas Chromatography and Detector – Dog Response to Isolated Compounds Spikes on U.S. Currency. Journal of Chromatographic Science, 2002, 40,147-155.

3 J.M. Perr, K.G. Furton and J.R. Almirall. Application of a SPME-IMS Detection System for Explosives Detection in Sensors, and Command, Control, Communications, and Intelligence Technologies for Homeland Defense and Law Enforcement, E.M. Carapezza, Ed., Pro.SPIE – The Int. Soc. For Optical Engineering, 2005, 5778, 667-672.

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