B133 Characterization of Microdrop Printed Calibration Standards for Ion Mobility Spectrometers

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The goal of this presentation is to introduce the use of the inkjet microdrop delivery system for standards would be of interest to researchers working in other areas.

The forensic community and especially those involved with illicit substance detection and trace detection will benefit from the development of standards as described in this presentation. This presentation will impact the forensic science community by demonstrating how these standards may be used in currently deployed IMS instruments.

Ion Mobility Spectrometers are widely used in airports and other high security areas to detect trace levels of illicit substances such as explosives and drugs of abuse. Quantitative analysis standards with known mass loadings for delivery to the IMS do not currently exist. Therefore, there is a need for calibration standards with known mass loadings to verify that these instruments are consistently detecting their target compounds at the designed level of detection (i.e., as low as ng quantities of explosives). This presentation reports the data obtained using Microdrop printing to verify the detection limits of IMS instruments and also to demonstrate the reliability of the microdrop delivery process. Persistence of some of the volatile compounds of interest after deposition onto various substrates is also presented.

Inkjet printing technology allows for the precise delivery of known amounts of analyte to a substrate for subsequent analysis by Ion Mobility Spectrometry. This technology has been investigated for its potential to provide quantitative standards for IMS instruments.[1] The piezo- electric inkjet m and the drops formed at the orifice have the μm print- head has a diameter of 60 same diameter. Each drop has a known volume and therefore known concentration of analyte.[2] By varying the number of drops, the amount of analyte delivered can also be varied. In bench-top IMS instruments, the particles of the illicit substance collected on the surface of the swipe are introduced into the instrument through a heated desorber. Drop-on-demand printing of microdrops allows for the delivery of the analyte directly onto the swipes. Through previous studies we have been able to show that the delivery of mass in the range of 0.04 ng to 0.28 ng can be performed reproducibly. The IMS produces a linear response within this range of mass of analytes delivered. Substances tested include common drugs of abuse and explosives and their odor signature compounds. Standard solutions of Cocaine, 2, 4, 6- trinitro toluene (TNT), 3, 4 methylenedioxymethamphetamine (MDMA), Diphenyl Amine (DPA), and Ethyl Centralite (EC) were prepared and delivered onto different substrates and then introduced into the IMS.

The persistence of the printed compounds on different surfaces is an important factor affecting the development of viable standards. The persistence of the compounds depends upon the matrix/substrate properties and the physical properties of the target compound. The vapor pressures of the some of the compounds being tested are very low and they tend to persist on surfaces, however some of the more volatile compounds are lost over time. This presentation reports on the persistence of these compounds on various matrices after deposition. The substrates chosen are those suitable for introduction into IMS and also amenable for other surface characterization studies. These include solgel, PDMS, Teflon, Filter paper, and manufacturer supplied filter swipes. Analytical techniques such as GC-MS, FTIR and FT-Raman were used to qualitatively and quantitatively characterize these printed surfaces.

The studies presented in this presentation will enable further development of the microdrop printing technique to prepare robust and viable calibration standards for Ion Mobility Instruments both for the target compounds and their odor signatures.

References:

1 Fletcher, J.R. Verkouteren, M.R. Verkouteren, G.A. Klouda; Advanced InkJet Printing Technology for Trace Explosives Standards; G.J. Gillen, R.A. NIST-CSTL

2 Lee, E. R., *Microdrop generation*. p 1-6, 19-21;CRC press: 2003;

Ion Mobility Spectrometers, Calibration Standards, Microdrop Printing

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