A121 The Use of Inkjet Printing Technology for Producing Trace Narcotics Standard Test Materials

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After attending this presentation, attendees will be aware of the efforts made by NIST for developing a method to produce standard test materials for swipe-based ion mobility spectrometers. Attendees will understand the benefits of using inkjet printing technology for precise analyte deposition.

This presentation will impact the forensic science community by providing information about the standard test materials that will be available for use to verify the working conditions of ion mobility spectrometry screening instruments.

Ion Mobility Spectrometry (IMS) is a widely used screening tool for both explosives and narcotics trace detection. These IMS instruments are versatile and can be used in many settings because they operate at atmospheric pressure, are field deployable, and are convenient for laboratory use. In a typical implementation of IMS technology, a fabric swipe or trap is used to sample trace residues on a surface. The trap is then introduced into the IMS where it is rapidly heated to desorb the analyte for chemical analysis. The analysis is based on the gas phase mobility of analyte ions in a weak electric field. In order to ensure these instruments are functioning properly, well controlled test materials are needed. There is a major focus at the National Institute of Standards and Technology to make such standards containing either explosives or narcotics. Historically, quality-assurance verification samples are made by solution deposition onto the instruments collection trap via pipette or dropper bottle. However, this method is often unrepeatable and leads to erroneous results that can mislead instrument operators.

An ideal collection trap and a precise deposition method are needed to make standards that are accurate and repeatable, and a quick production method is desirable. In this work, the feasibility is evaluated of piezo-electric drop on demand inkjet printing for production of standard test materials. One benefit of utilizing inkjet printing technology for making standards includes the ability to deposit extremely small volumes of solution at a specific location on a surface. When similar solutions are pipetted, the volumes dispensed need to be relatively large, causing the liquid to wick-out over the surface. This can cause problems with IMS analysis since most thermal desorption units in these instruments have a “sweet spot” that is generally in the center of the swipe. The larger pipetted volumes soak through the entire swab, distributing the analyte throughout the thickness of the collection trap. This leads to decreased detection levels when a sample is analyzed because the analyte may not be completely vaporized during the thermal desorption process. Piezo-electric inkjet printing offers the ability to dispense smaller, more precise volumes on the top surface of the swipe to ensure that the analyte gets fully desorbed.

Manufacturers of IMS provide a variety of collection swabs for their instruments. For simplicity of this study, one type of material was chosen for all samples. Nomex was the chosen material because of its high resistance to heat and its ability to be easily cut into any shape for use in different IMS desorber configurations. Illicit drugs including cocaine, methamphetamine, and oxycodone were weighed out and dissolved in isobutanol. Piezo-electric print heads have a narrow range of viscosities that they can print, therefore isobutanol was chosen because of its rheological properties and stability during the jetting process. Serial dilutions were made in quartz cuvettes to create a calibration curve using UV-Vis spectrphotometry in order to confirm the solution concentration initially and throughout the printing process. Narcotic solutions were printed on the nomex swipes and stored in metal cans with lids.

Studies were performed in our laboratory to confirm the repeatability of mass printed on the swipe substrates. For further testing, a pilot study was conducted by sending printed samples to various agencies that perform regular drug screening with IMS. The results of the pilot studies will be presented, as well as the studies that have been continually performed in our laboratory with various IMS instruments. **Ion Mobility Spectrometry, Inkjet Printing, Piezo-Electric**

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