A69 Fabrication and Evaluation of Adhesive Coated Collection Swipes for Improved Particle Collection Efficiency

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After attending this presentation, attendees will learn about one of the ongoing projects occurring at the National Institute of Standards and Technology that is related to forensics.

This presentation will impact the forensic science community by providing information on improved trace contamination collection efficiency.

Sample collection can be considered one of the most important aspects of trace chemical analysis. A trace sample can be in the form of small particles or vapor, either of which can be detected with the appropriate instrumentation. However trace evidence can not be reliably analyzed without a robust method for collecting and transporting the sample to the chemical detector or to a microscope for proper identification. There are many methods used to collect trace contamination, including tape pulls, swiping a surface with a collection swab, and a vacuum with a filter attached. One collection method widely used in airport security today consists of swiping a surface, such as luggage and even people's hands, with a particle collection swab. These swabs are then placed in an ion mobility spectrometer (IMS), with the ultimate goal of detecting explosives or drugs. The swab material used can vary between different IMS instruments. In a previous study,[1] it was found that some of these swabs collected particles with a higher efficiency than others. The current study was designed to find a method to improve the collection efficiency of some commercially-available IMS collection swabs.

One type of collection swab used in many IMS instruments is a fiberglass woven swab with a proprietary polytetrafluoroethylene (PTFE) coating. This swab had relatively low particle collection efficiencies compared to a muslin woven cloth collection swab.[1]

This presentation will describe a simple modification used to improve the particle collection efficiency of the PTFE swab. In this work, the PTFE swabs were coated with a heat-resistant low out-gassing pressure-sensitive silicon adhesive to make the trap surface tacky, promoting increased adhesion of the particles to the trap surface. Initial studies with polymer test particles suggest that improvements in collection efficiency by factors of 14 are possible using this approach. However there are other important factors to consider when using this adhesive material with IMS. One reason PTFE coated fiberglass swabs are used for IMS is because of the low background interference with the IMS chemical analysis. Adding an adhesive could potentially create more background noise and cause competitive ionization by depleting the reactant ions. These issues were tested during this study, and results revealed that the low-outgassing adhesive did not interfere with the ionization process, nor did it increase background noise. To examine the collection efficiency, polymer microspheres containing small amounts of explosives were placed on four types of surfaces using three different deposition methods.[2] All surfaces were swiped in a repeatable manner with both untreated and adhesive coated PTFE swabs. Both the particle collection efficiencies and IMS responses were recorded. IMS calibration curves with explosives solution deposition directly onto the untreated and

adhesion swabs were created prior to the swiping experiment for comparison of IMS results. Results, feasibility, and potential issues with using this method will be discussed, and videos and/or images from the swiping method will be presented.

References:

1. J.R. Verkouteren, J.L. Coleman, R.A. Fletcher, W.J. Smith, G.A. Klouda, and G. Gillen, A method to determine collection efficiency of particles by swipe sampling, *Measurement Science and Technology*, 19 (2008) 115101.
2. M. Staymates, et.al., Production and characterization of polymer microspheres containing trace explosives using precision particle fabrication technology, *Journal of Microencapsulation*, in press 2010.

Trace, Ion Mobility Spectrometry, Particle Collection

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