Utilization of Commercial Portable Instruments for Screening Hand Swabs for the Presence of Firearms Discharge Residue (FDR): Collection Efficiency Using Commercial and In-House Media

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ABSTRACT

When a firearm is discharged, a rich source of physical and chemical evidence is created. To date, forensic analysis has focused on inorganic primer residues with relatively few studies published regarding organic components of FDR. In addition, few reliable screening techniques exist for preliminary identification of residues associated with discharge of a firearm. This project addressed both of these issues using hand swabs and ion mobility spectrometry (IMS). Several commercial instruments were evaluated and sample collection and storage protocols were developed and validated. Results are presented in two posters.

In this poster, results related to sample collection, sampling media, and sample storage are presented. Collated data obtained from a subject questionnaire is also presented.

Objectives

- Develop swabbing protocol that is non-invasive and suitable for human subjects
- Select optimal media
- Ensure the media is vendor neutral
- Ensure media is amenable to several sequential analyses
- Determine optimum storage conditions
- Determine stability of samples and holding times

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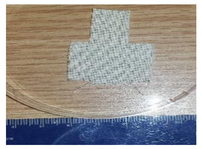
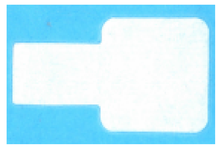
SWABBING MATERIALS



Synergy 3A fabric
- 93% Nomex®
- 5% Kevlar®

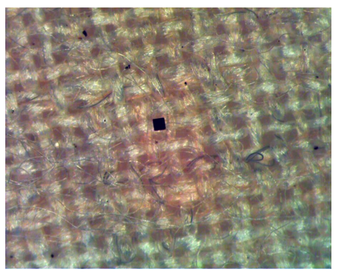
Springfield, LLC

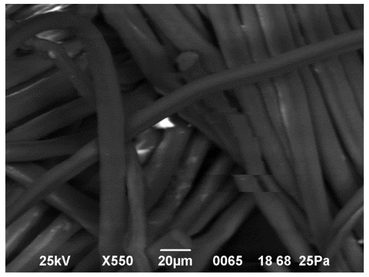
Muslin
DSA Detection



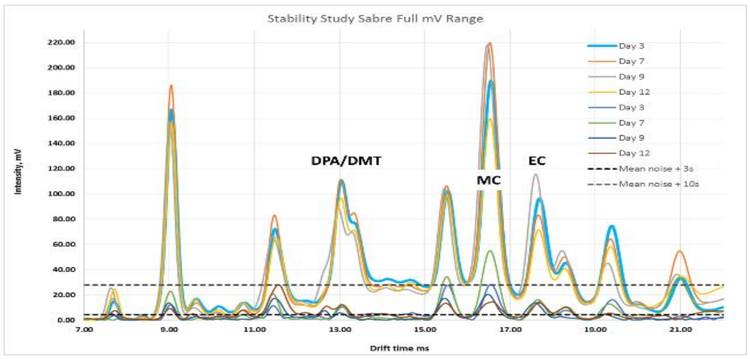
Nomex®
DSA Detection

- Swabs supplied by the instrument vendors were insufficiently absorbent to efficiently collect OFDR
- At least vendor was identified capable of cutting media to optimal size for all instruments at cost comparable to standard consumables
- Swabs could be further characterized after IMS analysis using SEM/EDS and targeting an area of the swab not analyzed using IMS.

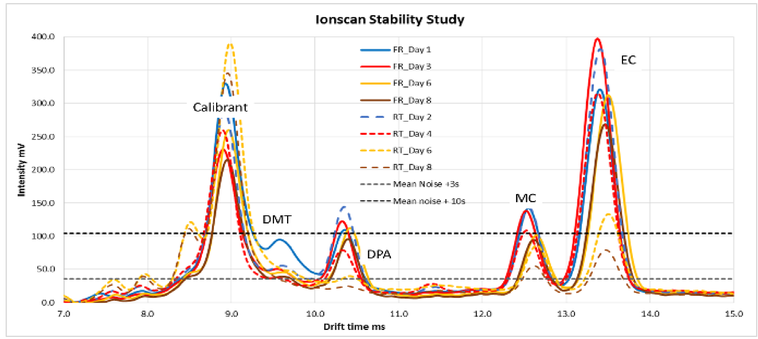




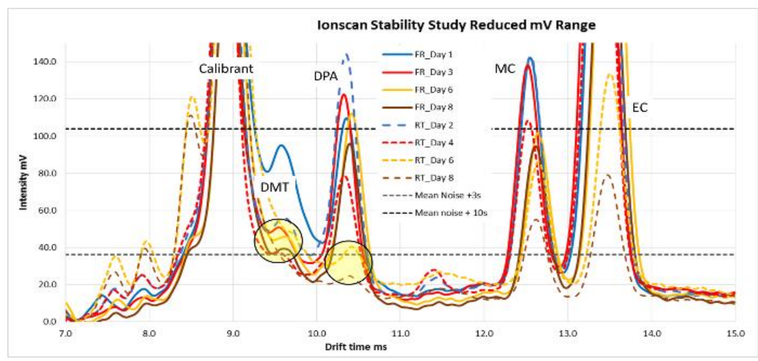
STABILITY STUDY



Samples stored at room temperature and exposed to room lighting. Data collected on a Smiths Detection Ionscan®.



Samples stored in the dark at -20ºC . Data collected on a Smiths Detection Sabre®.



Magnified. Even under ideal conditions, compound-dependent degradation is noted.

KEY FINDINGS

- Nomex®, Nomex®/Kevlar® blend, and muslin are suitable for all instruments in this application
- Swabs can be analyzed using multiple techniques by targeting different sections of the swab for different analyses
- IPA is an ideal and safe solvent for hand swab collection
- Swabs have a holding time of ~ 2 weeks
- Samples show noticeable degradation within ~ 1 week stored in the dark at -20ºC
- Significant degradation is noted at 2 weeks but is compound dependent