Following the Scent: Development of Canine Training Aids Guided by Measurements

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Why do we care?

- Canines are sensitive, selective, mobile detectors
- Outperform portable instruments
- Canine evidence challenged effectively in court
- Lit et al “Handler beliefs affect scent detection dog outcomes”
- Supreme Court currently questioning canine evidence in two cases
What can be done?

- Follow consensus training/certification “best practice” guidelines
- Need a uniform, validated set of training/testing materials with well characterized properties
- Costs of *real* controlled substances = high
- Costs of *non-hazardous* training aids = low
How did we start?

A "snapshot" in time of the volatile content using SPME

C-4 Non-volatile and Volatile Components
Characterizing Odor Release as a Function of Time with SPME

Vapor-time profile for TATP materials (1.4 mg) using direct, automated SPME

Characterizing volatiles in explosives as a **function of time**

SPME with Externally-Sampled Internal Standard (SPME-ESIS)

**Measure** A/E ratio = Area Analyte/Area ESIS

**Calibrate** | **Measure**

SPME-ESIS of C-4 Explosive for 2-EH (plastic explosive odorant)

Dynamic, asymmetric sampling
ESIS: 1-Oct 6 s
Analyte: 2-EH 5 min
Training Aid Odor-Delivery Systems

Odorant laden particles

Particle/vapor delivery - via fine particles loaded with odorant(s) - trapped in the nose (not the lungs) and heated to 39 °C

Permeation Devices

Permeation tube/bag delivery (COMPS) - vapor release by diffusion through container

Odorant infused polymer

Odorant(s) infused (3 ways) into PDMS - polydimethylsiloxane (PDMS), easily cast - clear, like firm Jello
SPME-ESIS of Training Aids for 2-EH (plastic explosive odorant)

Dynamic, symmetric sampling 6 s
ESIS: 1-Oct; Analyte: 2-EH

1 % 2-EH infused PDMS
1 % 2-EH on C\textsubscript{18} silica

Vapor Concentration (μg/mL)
Dynamic, asymmetric sampling ESIS: $^{13}$C$_3$-TATP 30 s
Analyte: TATP 10 min

SPME-ESIS of Training Aids for TATP

A/E Ratio vs. Hours

TATP on glass
TATP on PRP-1
TATP on SDVB disk
TATP infused PDMS

2,4-DNT too!
Infusing Vapor Components into PDMS

- **Direct** vapor infusion from complex hazardous substances, i.e., 3 types of *Semtex* - *no a priori* knowledge of composition required, i.e., marijuana

- Direct addition of vapor compound(s) to uncured polymer

- Absorbtion from solution of vapor compound

*Renders hazardous substances safe to handle*
**Infused PDMS as a Canine Training Aid**

Controlled-release vapor canister

controlled-release holes

“infused” polymer
Conclusions

• Canine detection is highly useful for a wide range of mobile detection needs provided accuracy can be validated

• Important role for ‘best practices’ consensus standards

• Metrology can support development of technology for canine training aid development

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