B88 Exploring a New Approach to Canine Training Aids for Explosives

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Learning Overview: After attending this presentation, attendees will understand a new method for the successful preparation of canine training aids for explosives using an odor capture-and-release technology based on Polydimethylsiloxane (PDMS).

Impact on the Forensic Science Community: This presentation will impact the forensic science community by presenting a new approach to providing nonhazardous canine training materials for hazardous substances that is being developed. This technology potentially could expand the availability of canines trained for the detection illicit substances to establish probable cause and avert terrorist threats.

A contentious issue in the training of canines to detect explosive threats is the ready availability of suitable training aid materials, particularly for TATP (triacetone triperoxide). As an easily prepared primary explosive, TATP has been used in several terrorist explosive events. Handling this sensitive, chemically unstable material requires specialized storage, transport, and expertise. Even obtaining and storing less hazardous explosives such as C-4 and TNT is a nuisance for maintenance canine training. The availability of alternative training aids (ATAs) would simplify access to reliable explosives materials.

The National Institute of Standards and Technology (NIST) has developed a promising approach to preparing ATAs based on the use of the flexible polymer, polydimethylsiloxane (PDMS). PDMS captures the odor profile of the target explosive by its rapid transport properties and affinity for organic molecules. Once "charged" with the target, the polymer slowly releases the characteristic odor of the target material for canine training. Special vapor-time measurements were used to study these capture-and-release processes for two odorants associated with the canine detection of C-4, cyclohexanone and 2-ethylhexanol. The vapor capture process takes several days at room temperature to fully charge the PDMS for these two odorants. In simulated use as ATAs, target-loaded PDMS provided a relatively steady release of odor when left out in the open for a ~4-hour period. Covering the ATA and storing it at room temperature allowed the continued re-use of the aid for additional ~4-hour periods over several months, albeit with a decline in the amount of odor released.

ATAs for TNT (TNT@PDMS) and C-4 (C-4@PDMS) were also developed and tested in canine trials. Because the volatility of TNT is so low, a more volatile impurity, 2,4-DNT is considered the primary odorant used by the canines for detection. For this experiment, elevated temperatures were studied to enhance the odor capture process. Six dogs trained on real TNT alerted to ATAs prepared with 2,4-DNT gave 100% alerts as did those charged with C-4. However, no experiments were done using the ATAs to train the canines.

In the latest collaborative experiments with Auburn University and the FBI Explosives Unit, PDMS ATAs were prepared by charging with purified TATP for one week. Thirteen experienced detection Labrador Retrievers were imprinted on TATP@PDMS. In both fixed-position scent wheel and operational searches, the canines detected real TATP at rates well over 90% of the time. Distractor experiments included 3 of the precursor chemicals use to prepare the TATP as well as 32 common materials. The sensitivity (to detect TATP) as well as the selectivity (to ignore distractor materials) was found to be excellent using this new approach to canine training aids for TATP.

Canine Training Aids, PDMS, TATP