B59 A Static Collection Approach for Target Explosive Analog Odors

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After attending this presentation, attendees will understand: (1) some critical aspects of employing a passive collection method for the creation of potential canine training aids using real explosive as the odor source; (2) a longevity study of target explosive odorants from such training aids; and, (3) practical field testing using certified canine explosive teams.

This presentation will impact the forensic science community by serving as a feasibility study of efficient canine training-aid creation through novel non-contact passive procedures that can augment the practical applications of enhanced canine training and use in military operations.

Currently, there are many training aids being used for explosives detection canines; however, to date, a superior form of an explosive training aid has not been created that effectively mimics the evolving variety or ordnance encountered in the battlefield. For this reason, the development of a training aid suitable for the explosive encountered in daily military operations is necessary to provide effective canine explosive detection, as the use of sniffer dogs has proven to be a reliable tool for the rapid detection of volatile explosive vapors. In practical field operations, an imperative need is to be able to collect target explosive material in a rapid and safe manner. The creation of such aids is not only useful during criminal investigations at pre- and post-blast sites but also critical for further optimized training of explosive canine teams who need to be exposed to the evolving range of explosive material being used in the military arena. The goal of this research is to present a detailed evaluation of the static collection of target explosive analog odors for the creation of useful canine training aids from real explosive materials. Even though currently available training aids utilize synthetic chemicals mimicking the odors emanating from real explosives, this study investigates the feasibility of creating training aids using a passive collection methodology of target odorants using the real explosive as the odor source.

In this study, experiments were based on previously identified signature explosive odors such as 2-ethyl-1-hexanol, derived from plasticized explosives, 2,4-dinitrotoluene from single-based smokeless powder, and 2,3-Dimethyl-Dinitrobutane (DMNB), derived from taggants added to explosives. C-4 explosive material was used for the static collection of the 2-ethyl-1-hexanol and DMNB target odor signatures, as well as single-based smokeless powder for the collection of 2,4- dinitrotoluene. The samples were collected indoors (23.8°C with a relative humidity of 77.2%) with a 4”x4” cotton gauze pad as the collection material. All samples were stored in silanized 40ml glass vials. In order to obtain odorants profile, vials collected from C-4 explosive material were injected via Solid-Phase Microextraction (SPME) for 30 minutes at approximately 56ºC and eventually analyzed by GC/MS and vials collected from single-base smokeless powder were injected via SPME for 21 hours at approximately 56ºC and eventually analyzed by Gas Chromatograph/ **Electron Capture Detector (**GC/ECD). A metal holder device was used to clamp the gauze pad at a distance of approximately two to three inches from the odor source (explosive material). A time optimization analysis was conducted for all three target odor signatures in time intervals of 0.5, 1, 5, 15, 30, 45, 60, 90, and 120 minutes. Samples were taken in triplicate for each of the selected time intervals and each trial was conducted on different days with a corresponding control sample to monitor for any possible background/contamination. According to the generated results, it has been shown that odor signatures such as 2-ethyl-1-hexanol can be collected at an optimal time of 15 minutes, with a collected mass of 82.7±7.75ng for the target odorant. The collection for the DMNB and 2,4-dinitrotoluene target odors showed an enhanced collection at 30 minutes of static exposure of the gauze pad, with a collected mass of 125±10.1ng and 5.05±0.51ng, respectively.

The results demonstrate the successful collection of target odor signature Volatile Organic Compounds (VOCs) from the real explosive as the odor source onto an absorbent material such as a gauze pad, which can then be consequently sealed and stored as a canine training aid. Other factors to be presented include how long the collected odor lasts after being stored and the efficacy of these stored static collected training aids for field use with certified explosive detection canines. Overall, the results demonstrate that it is possible to collect representative explosive odorants using a completely passive static collection procedure for the creation of reliable training aids via this non-contact passive approach which can aid in the development of effective canine team training.

Static Collection, Training Aid, Canine Detection