B61 An Analysis of Non-Detonable Canine Training Aids for Hexamethylene Triperoxide Diamine (HMTD)

Alison G. Simon, PhD, Washington, DC 20375; Lauryn DeGreeff, PhD, U.S. Naval Research Laboratory, Washington, DC 20002*

Learning Overview: After attending this presentation, attendees will understand about commercial-off-the-shelf training aids of the homemade explosive HMTD for the training of explosives detection canines. Attendees will learn how the vaporous characteristics of these training aids compares to that of bulk HMTD with implications for canine training.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by presenting a method of strengthening pre-existing canine detection in forensic science and explosives through the characterization of the headspace of canine training aids used to mimic or present a non-detonable version of the extremely hazardous but field relevant explosive, Hexamethylene Triperoxide Diamine (HMTD).

Defense and security communities have typically focused on the detection of traditional explosives, but due to the increasing frequency of homemade explosives (HMEs), developing detection methods of these explosives is imperative. Explosives detection canines are trained for this purpose, protecting United States civilians and military personnel by locating or identifying the presence of an explosive device or explosive components. Canines have long been considered the gold standard of real-time standoff explosives detection, so it follows that law enforcement and military canine programs are at the forefront in developing an efficient method for detecting such materials. Explosives detection canines are typically trained to detect traditional explosives, such as TNT, RDX, PETN, dynamite, black powder, and/or smokeless powders. However, the popularity of HMEs has increased as they are manufactured from commercial ingredients and equipment that are easier to obtain than military-grade or traditional explosives. The prevalence of their various components in the environment or legitimate uses also makes them more difficult to detect by traditional methods, as does the novelty of certain mixtures.

One such commonly encountered HME is hexamethylene triperoxide diamine (HMTD), a peroxide explosive. HMTD has been recovered in the 2016 New York and New Jersey attacks as well as the 2005 London subway bombings. HMTD can be hazardous to handle due to its instability and friction sensitivity. Therefore, several companies have developed pseudo or non-detonable canine training aids to be used as a safe alternative to training on the bulk material.

Previous research shows that the headspace of HMTD is complex and varies with time, temperature, humidity, and manufacturing process. There have been no evaluations of how these variables affect canine detection of various HMTD samples that may be encountered. This study evaluated the headspace of five commercial-off-the-shelf (COTS) canine training aids for HMTD using solid phase microextraction-gas chromatography-mass spectrometry (SPME-GC/MS) to determine how accurately they represent bulk HMTD samples. Of the six previously identified headspace components, all six were identified in the various COTS training aids analyzed, though each brand contained a different combination of these compounds. The odor profiles of the training aids varied drastically and were not consistent with bulk HMTD. Based on analytical results, it may be possible to incorporate COTS training aids as brief “snapshots” of HMTD odor, for example, when training with the live explosive is not possible due to hazards or associated costs. However, it is still recommended to train on actual substances when possible. Such evaluations have important implications for canine training and eventual success in the field.

HMTD, Canine Detection, Headspace Analysis