Detection and Analysis of Simulated Chemical Warfare Agents using Portable Mass Spectrometry

_____

Camila Anguiano Virgen[1], James D. Fox[2], Jamie L. Winfield[2], Kenneth C. Wright[2], Guido F. Verbeck IV[1]

[1] 1508 W Mulberry St, Department of Chemistry, University of North Texas, Denton, Texas 76201
[2] Two Technology Place, Inficon Inc., East Syracuse, New York 13057

There's been a significant demand for the development and improvement of technology used for the detection and identification of chemical warfare agents (CWA). Current government technology includes Fourier Transform Infrared (FTIR) and Lightweight Chemical Detector (LCD3) systems. While the systems are able to quantitate, they cannot perform an analysis in a short period of time nor identify the type of CWA. The U.S. Army Dugway Proving Ground's annual S/K Challenge provides the opportunity to assess the performance and reliability of prospective devices being developed by researchers worldwide to optimize their performance. To do so, trial testing of simulated chemical and biological warfare agents in both indoor and outdoor environments were performed, mimicking past attack scenarios. One of the major chemical simulants used throughout the trials is Methyl Salicylate (MeS), which is known for being a simulant for sulfur mustard gas. Other simulants used include: Trimethyl Phosphate (TMP), Triethyl Phosphate (TEP), Sulfur Hexafluoride (SF_6), and a TEP-Syloid complex.

Membrane Inlet Mass Spectrometry (MIMS) technology on a portable system was successful in performing a rapid analysis along with quantification and identification of each CWA simulant utilized for the trials. The MIMS system can detect and quantify low-mass (1-300 m/z) permeable compounds with high parts-per-trillion (ppt) limits of detection. This allows for analysis to be achieved in seconds after the initial time of exposure, which is significantly faster than that of the FTIR and LCD3 systems utilized at Dugway Proving Ground. The system's performance at the S/K Challenge along with previous successes in various other applications, proves its ability for the use of CWA detection and identification purposes. Further testing can be conducted leading to the minimization and prevention of exposure time experienced by areas that are at high risk of attacks.