Evaluation of Portable Linear Ion Trap Mass Spectrometer Coupled to Paper Spray Ionization Source for the Detection of Chemical Warfare Agents

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In spite of over a century of efforts to eradicate chemical weapon stockpiles around the globe, these compounds continue to pose a serious threat to military and civilian populations. The detection and identification of chemical warfare agents (CWA) in the field is currently dominated by portable ion mobility spectrometry (IMS), but is also performed with colorimetric and portable mass spectrometry (MS) systems. However, IMS and colorimetric systems often suffer from high false positive rates, poor resolution, high limits of detection, and detector saturation. Portable MS represents the best overall combination of size, accuracy, and ruggedness. In addition, ambient ionization techniques such as DART, paper spray (PS), and others represent a simplified approach to sample introduction, often requiring little to no sample preparation for samples taken directly in the field. In order to assess the ability of a portable mass spectrometer to reliably detect CWA chemistries utilizing a paper spray ionization source, dilute samples of the G-series and V-series of CWA were analyzed using this PS technique with a Bayspec Portability linear ion trap mass spectrometer. CWA was introduced onto a paper spray ticket along with spray solvent, and the system evaluated for limits of detection, reliability, and speed of analysis. This portable system showed limits of detection suitable to field analysis, and the ease of sample introduction along with the light weight (~17 lbs) of the instrument showcase its ability to reliably detect minute quantities of CWA in battlefield environments.