High-Performance, Militarized Mass Spectrometer System

Jack Syage[1]
Jointly developed by: Syagen Technology, Inc.[1] *and Northrop Grumman Corporation*

In this work we address the need for high-performance, real-time chemical analysis for military vehicle use. The system that we describe is fully ruggedized to withstand the rigors of reconnaissance vehicles in which detection is done while the vehicle is moving along rough terrain. The militarized MS system is based on a previous design and consists of a quadrupole ion trap, time-of-flight (QitTof) system with a dual photoionization/electron ionization (PI/EI) source. A key feature of the QitTof analyzer is the capability to do MS screening at 60 Hz followed by MS/MS confirmation at 30 or 60 Hz. This enables the detection of a large targeted compound list including chemical warfare agents (CWAs) and toxic industrial compounds (TICs) although the detectable range of compounds extends beyond these categories. The MS system is able to detect vapor and liquid samples using an automated sampling system.

The PI/QitTof MS technology has been tested on over 12 CWAs including VX, GA, GB, GD, GF, HD, HN-1, HN-3, BZ, DL, CR, and CX as well as about 40 precursors, decomposition products, and simulants. MS and MS/MS spectra were recorded and real-time detection limits are at the pg level for direct sampling (without GC) of injected or thermally desorbed samples. A trial of 13 TICs demonstrated below Army reconnaissance requirement detection levels for all TICs. The MS system is fully automated including autotuning, auto-mass calibration, and has an algorithm to automatically set the alarm levels for all targeted compounds.

Acknowledgements: Northrop Team: Danielle Dickinson, et. al; Syagen Team: Karl Hanold, et.al.