An Ion Trap Mass Spectrometer System for Continuous Monitoring of Biological and Chemical Backgrounds

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We are developing the Chemical/Biological Detection System (CBDS) for the analysis of chemical and biological hazards in civilian environments such as public buildings, transportation terminals and work environments (such as postal services) where process monitoring has become essential. The CBDS is a continuous and autonomous system based on ion trap mass spectrometry, and is an adaptation of the Chemical/Biological Mass Spectrometer (CBMS) Block II system developed as a military battlefield-capable detection system for the U.S. Army.

The CBDS system is designed to monitor both chemical and biological agents. Chemical agents are preconcentrated in a sorption trap, desorbed and delivered directly to the mass spectrometer via heated, deactivated capillary tubing. Airborne particulates are pre-concentrated from a sample stream that draws 300 L/min air. Particles having a 1–10 μm size range are impacted into a pyrolysis tube and treated with a small amount of derivatizing agent. Upon heating, pyrolysis products, such as derivatized fatty acid methyl esters, are transported to the mass spectrometer where they are analyzed using chemical ionization. Ions of selected m/z can be further analyzed by MS/MS if required.

A primary feature of the CBDS system is its capacity for continuous air monitoring. The system uses two chemical sorption traps and two pyrolysis chambers that alternate between sample collection and analysis. This feature maximizes sample throughput and allows new information to be generated every two minutes. This high duty cycle is especially important in process control environments where comprehensive monitoring is required. This presentation will describe the novel aspects of CBDS related to improved operational efficiency and sample throughput.

Hamilton Sundstrand is using independent research funds to develop the CBDS system. This development program leverages the CBMS Block II technology development initiated by Oak Ridge National Laboratory and funded by the U.S. Army. Hamilton Sundstrand is the industrial manufacturing partner for CBMS Block II.