

Waterborne CB Agent Detection System

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The goal of this work is to develop a miniature, low power system to detect chemical and biological warfare agents and related industrial chemicals in seawater or lake water and the air immediately above the water surface. The NASA/Caltech and Jet Propulsion Laboratory designed system has demonstrated several of the components of the sensor package in previous funded research. The key elements employed are the miniature Rotating Field Mass Spectrometer (RFMS), a compact nano-electrospray nozzle (for liquids) and a small electron filament ionizer (for gas sampling) interfaced to a portable analysis system. Thus far we have demonstrated the ability to detect chemicals (at sub ppm levels) such as DMMP, an analog of Sarin gas, in both vapor and liquid phases. We have also demonstrated the detection of Malathion, a neurotoxin insecticide and trichloroethylene, an industrial chemical that pollutes water supplies in liquid phase. Benzene and toluene were also measured in vapor phase, as well as other biological samples. It has also been used to detect low-level residual atmospheric gas components.

The RFMS is an ideal match for research partnership with many of the "Smart Sensors" and "Integrated Microsystems" currently being discussed for mini-sized field portable application. Some of the advantages of the RFMS include a flexible sampling interface that allows for direct in situ analysis of lake water and seawater to full ocean depth pressures. The advantages of this compact mass spectrometer system are: 1. Use of a robust vacuum assisted nano-electrospray ionizer. 2. Use of a rotating field electric field that allows mass separation and detection at only modest vacuum levels. 3. Detection ability for molecular mass greater than 1,000,000 amu (such as PCR chemistry DNA fragments). 4. Low power (<10 watt) vacuum maintenance by use of chemical and ion pumps. 5. Biomedical application for low-level volatile organic compound (VOC) detection as an indicator for cancer screening. The novelty of the system is deployment of a realtime detection of chemical agents and related industrial chemical products in a system is small enough to fit in a standard rollerboard suitcase.

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