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Rapid screening of volatile chemicals with proton transfer reaction mass spectrometry

Real-time PTR-TOF MS rapidly screens VOCs in air/water/soil at ppb levels to speed hazardous-spill response.

The increasing prevalence of hazardous chemical incidents in the United States necessitates the implementation of analytically robust, rapid and reliable screening techniques for toxicant mixture analysis to understand short and long-term health impacts of environmental exposures. In response to hazardous chemical incidents, the Emergency Response Guidebook (ERG) provides guidelines that can help first responders in these events, with procedures on recommended evacuation distances, personal protective equipment, first aid, and isolation practices (U.S. DOT, 2024).

Researchers at Purdue University have developed a rapid and innovative screening method for detecting volatile chemicals. This technology is designed for use in various hazardous spill scenarios; it gives responders faster and more accurate results when analyzing soil, water, and air for volatile chemical contamination. This method leverages the capabilities of a proton transfer reaction time-of-flight mass spectrometer. With significantly faster speed and higher efficiency, it is believed that this technology has great potential in chemical assessments for emergency and environmental monitoring applications.

Technology Validation:

Methyl tert-butyl ether (MTBE, C5H12O, detected at m/z 89), another commonly detected VOC in surface water samples, was detected in 18 out of 20 East Palestine surface water samples, with estimated headspace concentrations ranging from 0.56 ppb to 9.64 ppb. This translates into estimated aqueous concentrations of 79.3 ng/L to 1374.7 ng/L.

Advantages:

Rapid, real-time screening

High sensitivity

Technology ID

2025-JUNG-71011

Category

Aerospace & Defense/Advanced Protective Materials & Wearable PPE

GreenTech/Environmental Remediation & Pollution Control

Biotechnology & Life Sciences/Analytical & Diagnostic Instrumentation

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View online

Requires minimal sample preparation

Versatile in sample medium (air, water, soil)

Applications:

Chemical assessment

Enviornmental monitoring

Emergency response

Publications:

Science of The Total Environment Journal publication: https://www.sciencedirect.com/science/article/pii/S0048969724062120?_ga=2.116605189.2005772094.1736894897-115450344.1734223468#gts0005

Press release: https://engineering.purdue.edu/CCE/AboutUs/News/Architectural_Features/purdue-researchers-develop-faster-hazardous-spill-response-method

AAAS Eureka Alert: https://www.eurekalert.org/news-releases/1068130

TRL: 4

Intellectual Property:

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