Tandem MS analysis of explosives, drugs, pesticides and chemical warfare simulants using Direct Sampling Atmospheric Pressure (DSAP) source with APCI and sESI coupled to MT Explorer 30 Mass Spectrometer

Overview

○The MT Explorer 30 (MTE30) miniature mass spectrometer is suited to both lab-based and remote analysis. With a compact footprint and powerful tandem MS capabilities, it delivers rapid, confirmatory detection for diverse applications, including forensic science and peptide studies.

○The MT Explorer 30 portable mass spectrometer, equipped with a Direct Sampling Atmospheric Pressure (DSAP) source, successfully detects explosives, drugs, pesticides, and chemical warfare simulants using APCI and sESI ionization, demonstrating capability for rapid, on-site chemical analysis, supporting applications in forensic science, public safety, and environmental monitoring.

MT Explorer 30 Mass Spectrometer

Introduction

○ Detecting explosives is vital for defense, security, and forensic investigations, including counterterrorism efforts. Pesticides like Parathion are closely monitored in environmental and agricultural industries to ensure safety and compliance. Drug analysis plays a key role in controlled substance detection and forensic drug testing. Chemical Warfare Agent (CWA) simulants, such as Methyl Salicylate, aid in military and emergency preparedness by simulating hazardous compounds for training and response development.

○By integrating APCI and sESI ionization techniques and employing MS/MS analysis, the MTE30 enables direct, confirmatory analysis of low-volatility compounds, enhancing its potential for forensic and regulatory applications.

Methods

Sample Preparation:

○Explosives: TNT and RDX

○Pesticides: Parathion

○Drugs: Cocaine and Methamphetamine

○ Chemical Warfare Agent (CWA) Simulant: Methyl Salicylate.

Samples were prepared in acetonitrile and water with 0.1% formic acid.

Dried sample deposits on glass slides were introduced into the ionization source for MS analysis.

Results and Discussion

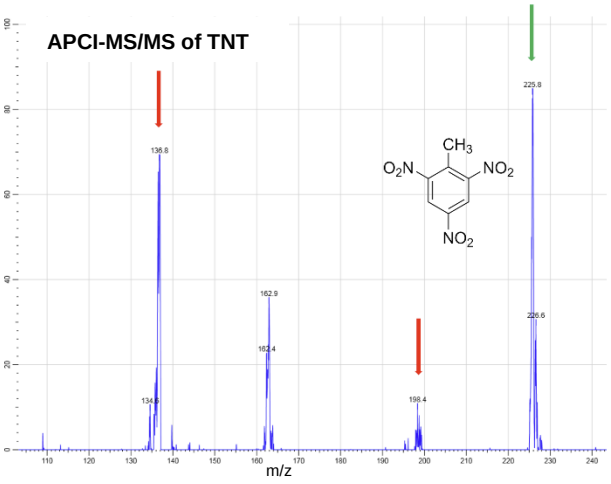

Figure 1 Tandem mass spectrum of TNT explosive by DSAP with APCI in negative ion mode at 200 pg sample load. The green arrow indicates precursor ion and red arrow indicates product ions.

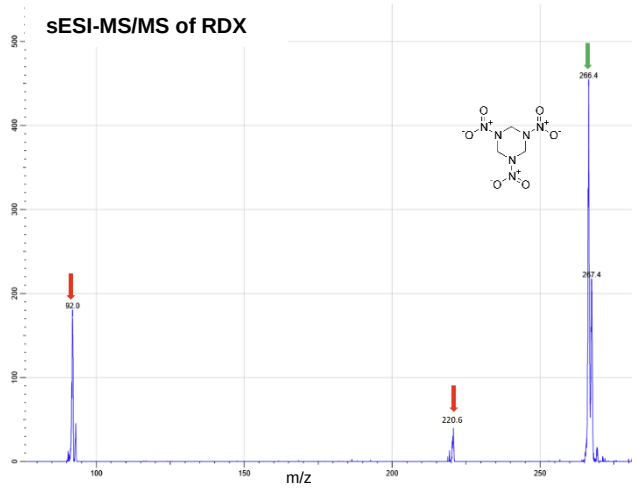

Figure 2 Tandem mass spectrum of RDX explosive by DSAP with sESI in negative ion mode at 2 ng sample load. The green arrow indicates the precursor ion and red arrows indicate product ions.

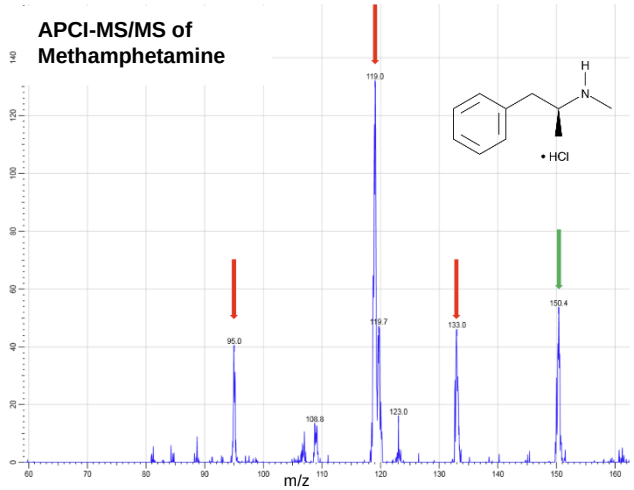

Figure 4 Tandem mass spectrum of Methamphetamine drug by DSAP with APCI in positive ion mode at 2 ng sample load. The green arrow indicates the precursor ion and red arrow product ions.

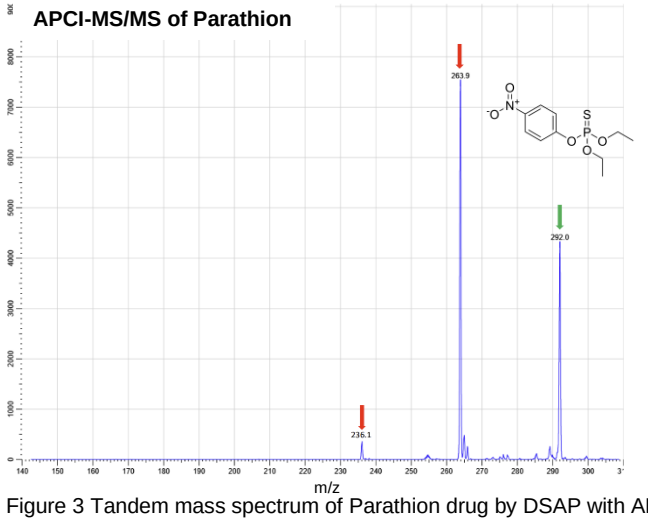

Figure 3 Tandem mass spectrum of Parathion drug by DSAP with APCI in positive ion mode at 2 ng sample load. The green arrow indicates precursor ion and red arrows indicate product ions.

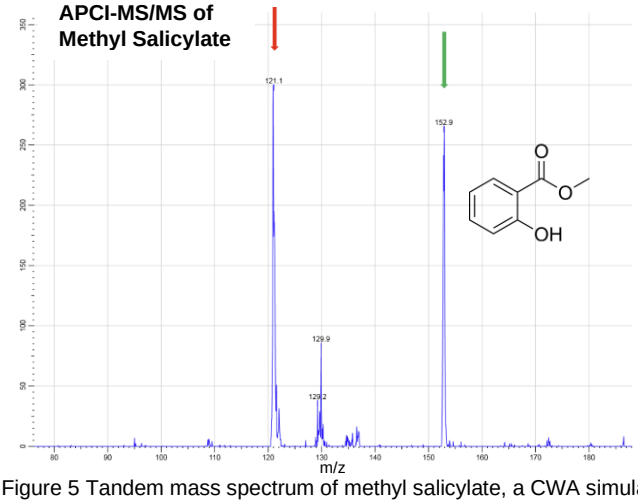

Figure 5 Tandem mass spectrum of methyl salicylate, a CWA simulant by DSAP with APCI in positive ion mode at 2 ng sample load. The green arrow indicates the precursor ion and red arrow indicates product ions.

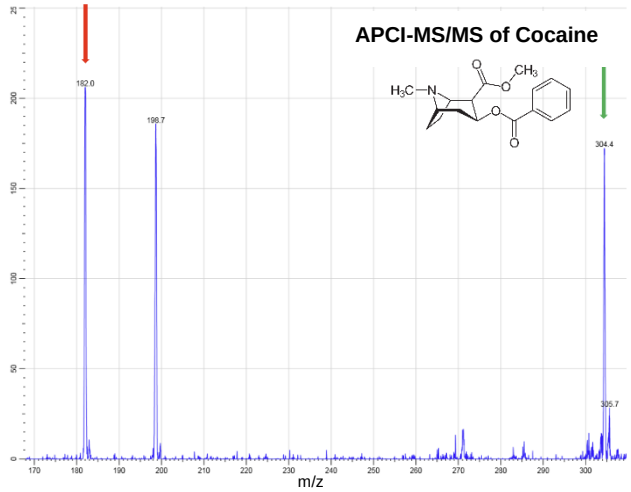

Figure 5 Tandem mass spectrum of Cocaine drug by DSAP with APCI in positive ion mode at 200 pg sample load. The green arrow indicates precursor ion and red arrow indicates the product ion.