B75 Rapid Screening of Seized Drugs Using Direct Analysis in Real-Time Mass Spectrometry (DART®-MS)

Yuriy Uvaydov, MS, 99 Tenth Avenue, Ste 721, New York, NY 10011*

After attending this presentation, attendees will understand how DART®-MS can be applied for the screening and identification of commonly encountered drugs of abuse. Specifically, this presentation will demonstrate the advantages and limitations of DART®-MS over traditional instrumental techniques such as Gas Chromatography/Flame Ionization Detector (GC/FID), Gas Chromatography/Mass Spectrometry (GC/MS), and Liquid Chromatography/Mass Spectrometry (LC/MS).

This presentation will impact the forensic science community by explaining how DART®-MS can be effectively applied as a screening and identification technique for the presence of illicit drugs in single- and/or multi-unit submissions of evidence.

There are currently several existing instrumental techniques that can be applied for screening and identification of commonly encountered drugs of abuse. Typically, analysis of seized drug evidence consists of a series of presumptive and confirmatory tests. Traditional presumptive tests may include color, microcrystal, Thin-Layer Chromatography (TLC), GC, and/or Ultra High-Performance Liquid Chromatography (UHPLC). Confirmatory techniques, on the other hand, may include GC/MS, LC/MS, Fourier Transform Infrared/Attenuated Total Reflectance (FTIR/ATR), and/or Nuclear Magnetic Resonance (NMR). The continuing demand for faster, more efficient methodologies demonstrates the need to incorporate newer analytical instrumentation into the classical workflow.

DART®-MS is a relatively new ionization technique for mass spectral analysis of compounds. DART®-MS allows for ambient ionization of small molecules from different samples without sample preparation. The samples are directly introduced into the ion source using tweezers or capillary glass tubes and are desorbed from sample surface by flow of heated nitrogen or helium while being ionized. In conjunction with the High Resolution Accurate Mass Spectrometer (HRAMS), DART®-MS can deliver rapid results with accurate mass determinations and highly specific mass-to-charge spectral data.

The purpose of this work was to develop a method for rapid detection of drugs (target or unknown) utilizing HRAM coupled to a DART® ionization source. In this study, a 24-second screening method was developed for the detection of commonly encountered illicit drugs. Mass spectral acquisition of data was performed in positive mode utilizing a DART®-Simplified Voltage and Pressure (SVP) ion source with Thermo Fisher's Exactive Plus Mass Spectrometer. Powdered samples were introduced directly into the ion source via glass capillary tubes utilizing the Dip-It linear rail system that is connected to the DART®-SVP ion source. Data acquisition included fragmentation patterns utilizing Source-Induced Dissociation (SID), generated at 30eV, 60eV, and 100eV.

Preliminary results demonstrated successful identification of controlled substances in various drug mixtures. For example, unknown samples containing heroin, fentanyl, and dipyrone were correctly identified based on the characteristic peaks with the assigned chemical formulas. Similarly, unknown samples containing cocaine, levamisole, and phenacetin were also correctly identified. The results also showed that DART®-MS identifications of major sample components in other various drug mixtures were correctly identified. The identification of minor components presented a challenge and may require further optimization of the HRAM/DART®-MS acquisition parameters. Overall, this approach is expected to decrease analysis time, increase efficiency in screening multi-unit drug submissions of evidence, while maintaining cost-effectiveness and achieving valid reproducible data.

DART®-MS, Forensic Drugs, Rapid Screening

*Presenting Author