A123 Confirmatory Analysis of Selected Controlled Substances by DART-TOF Mass Spectrometry

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After attending this presentation, attendees will understand the advantages of utilizing Direct Analysis in Real Time – Time of Flight Mass Spectrometry (DART-TOF) in the context of a forensic drug analysis laboratory, as well as validated parameters for ensuring proper daily instrument performance. Attendees will understand the feasibility of using DART-TOF as a confirmatory test for the selected controlled substances alprazolam and cocaine.

This presentation will impact the forensic science community by providing validation parameters and data for the first known drug confirmatory methods utilizing DART-TOF. Forensic laboratories will be able to better understand the benefits of DART-TOF confirmation leading towards decreased turn-around-time and backlog reduction, a significant concern among controlled substance laboratories.

DART-TOF is a novel and powerful technique providing near real- time mass spectrometry data. It allows for the rapid identification of target analytes with minimal sample preparation through an open atmospheric sampling interface. The selectivity of DART-TOF is based upon the high degree of mass accuracy, various fragment ions at different voltages, and the presence of characteristic isotopic ion ratios. The Controlled Substances Laboratory has successfully validated this instrument for use in forensic casework and it has been in operation since 2007. Herein, criteria are presented to insure proper instrument performance, as well as validated methods for confirmatory analysis of alprazolam and cocaine currently utilized in the Controlled Substances Laboratory.

Confirmation of alprazolam in a pharmaceutical tablet matrix was performed without sample preparation and was based on analyte fragmentation at both 40V and 120V. Thirty previously confirmed alprazolam tablet case samples were analyzed and tested positive for the presence of the protonated molecular ion (309.09070 m/z) at 40V as well

as the presence of two fragment ions (281.07197, 205.07657 m/z) at 120V within a range of ±5 mmu. Neither sample preparation (whole tablet, partial tablet, or crushed tablet dissolved in methanol) nor tablet orientation upon introduction was found to significantly affect the exact mass outside of the specified range. A survey of similar compounds revealed nine potential structures which fall ±10 mmu of the protonated molecular ion. The presence of chlorine in the alprazolam structure and the subsequent observable isotopic ratio excluded all but four of these compounds, with none of them being commercially available. Phenylbutazone was studied as an interfering compound as its protonated molecular ion is within 0.0696 amu from alprazolam. All fragments were distinct from those characteristic of alprazolam.

Suspected cocaine samples for confirmation were prepared by dissolving several milligrams of solid (or a cotton swab of residue) in minimal methanol and were introduced into the DART source by the use of a borosilicate glass capillary tube. Thirty previously confirmed case samples (comprised of either cocaine salt, base, residue or no controlled substance) were analyzed by DART-TOF and fragmented at both 40V and 100V. All previously confirmed cocaine samples tested positive for the presence of the protonated molecular ion (304.15488 m/z) at 40V and the presence of two fragment ions (82.06567 and 182.11810 m/z) at 100V within a range of ±5 mmu. A survey of similar compounds in three scientific databases revealed multiple potential structures which fall ±10 mmu of the protonated cocaine molecular ion. However, most of those compounds are in the research stage, and only two of them are commercially available. Those two compounds, scopolamine and phenoxybenzamine, were studied as interfering compounds. They were distinguished from cocaine by lacking the fragment ions specific to cocaine. In addition, phenoxybenzamine exhibited the typical chlorine isotopic ion ratio of 3:1, which is absent in cocaine samples. It was also determined that up to ten case samples could be easily analyzed in one acquisition with acceptable mass accuracy, with baseline blanks analyzed in between each sample to ensure no carryover between introductions. Grouping samples in this manner significantly reduced acquisition and data analysis time, furthering the efficiency of this technique.

DART-TOF, Controlled Substances, Method Validation

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