B142 A Simultaneous Chiral Analysis of Methamphetamine and Related Precursors and Screening of Methamphetamine-Related Organic Impurities in Seized Drugs by a Small Footprint Ultra High-Performance Liquid Chromatography-Photodiode Array/Mass Spectrometry (UHPLC-PDA/MS) System

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Learning Overview: The goal of this presentation is to present an efficient Ultra High-Performance Liquid Chromatography-Photodiode Array/Single Quadrupole Detection (UHPLC-PDA/SQD) method on methamphetamine profiling and chiral analysis.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by presenting an efficient UHPLC-PDA/SQD method on drug profiling and chiral analysis using a low-cost and small footprint system.

Methamphetamine (MA) is a widely abused stimulant of the central nervous system. MA can be synthesized by a number of routes starting from precursors of l-ephedrine/d-pseudoephedrine or 1-Phenyl-2-Propanone (P2P), which yield d-MA and racemic MA, respectively. Chemical profiling can be used to gather information about the manufacturing processes, emerging trends, cutting agents, and linkages between seizures. A number of analytical techniques are employed for the chemical profiling of MA samples. The detection of organic impurities and the determination of chirality for MA and its related precursors are essential to evaluate precursor chemicals and synthetic routes of clandestine MA production. Hence, dilute and shoot UHPLC-PDA/MS methods employing a small footprint and cost-efficient UHPLC-PDA/SQD systems are presented for the simultaneous chiral analysis of MA and related precursors (amphetamine, ephedrine, pseudoephedrine, norephedrine, norpseudoephedrine, methylephedrine, and methylpseudoephedrine), the targeted screening of MA manufacturing related organic impurities, and the untargeted screening of adulterants and emerging drugs.

Each pair of enantiomers was successfully separated in 9min by a LUX 3µm AMP chiral column with a mobile phase consisting of methanol and 0.2% cyclohexane. The Limit Of Detection (LOD) for MA by PDA, MS scan, and MS in Selected Ion Recording (SIR) mode, was 1µg/mL, 10µg/mL, and 10ng/mL, respectively. The chiral composition of MA was determined by using PDA data, even for samples with extremely skewed ratios of low enantiomer content. Route-specific compounds were separated in 8.5min by a BEH phenyl column with a gradient elution of acetonitrile and 0.1% formic acid. The SIR mode offered excellent selectivity and sensitivity (<25ng/mL) for the target impurities. Substances at a concentration of ≥0.5µg/mL were detected by either PDA or MS scan. Using the developed methods, three sets of data (chirality, targeted, and non-targeted organic impurities) were generated from one sample set with two injections/separations of one sample preparation, which significantly improved the efficiency of MA chemical profiling. The developed method has been successfully applied to illicit MA samples, including tablets containing low doses of MA (<20%) and samples containing skewed ratios of d- and l-MA at trace levels.

Methamphetamine Profiling, Chiral Analysis, UHPLC-PDA/MS