B20 The Utility of Ultra High-Performance Supercritical Fluid Chromatography (UHPSFC) for the Chiral Analysis of Seized Drugs

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After attending this presentation, attendees will understand the use of UHPSFC for chiral separations. This presentation will also explore the chiral mechanism for UHPSFC.

This presentation will impact the forensic science community by presenting separation conditions for the Supercritical Fluid Chromatography (SFC) chiral separation of certain controlled and non-controlled substances; this can help determine the difference between controlled versus non-controlled drugs, as well as impact trial sentencing and law enforcement intelligence.

The recently introduced separation technique UHPSFC produces highly efficient and rapid separations performed on a new generation of analytical SFC instruments with an environmentally friendly mobile phase, containing as the major component carbon dioxide. Carbon dioxide in the supercritical and subcritical state has properties that are intermediate between a liquid and a gas, giving it excellent diffusivity while maintaining liquid-like properties. UHPSFC, like high-performance liquid chromatography and ultra high-performance liquid chromatography, is advantageous for drugs that are thermally labile, polar and non-volatile, solutes that are problematic for Gas Chromatography (GC) analysis. UHPSFC offers increased selectivity for very similar compounds, such as enantiomers; due to interactions with the stationary phase such as hydrogen bonding, dipole and pi-pi interactions, and a steric fit into a chiral surface. In this vein, UHPSFC is amenable to the chiral separation of drugs of forensic interest.

This project will highlight the use of three chiral columns, the AMY1, CEL1, and CEL2 which contain amylose and cellulose respectively as the chiral backbone. These columns were studied for the chiral separation of synthetic cannabinoids, bath salts, and phenethylamines, including methamphetamine. The studies were performed using carbon dioxide (CO2) with several different modifiers and additives. The modifiers include methanol, acetonitrile, ethanol, and isopropanol, while the additives include ammonium formate and ammonia. The synthetic cannabinoids studied consisted of four controlled drugs, including CP 47, 497, its diastereomer epi-CP 47, 497 and their C8 homologues, as well as two non-controlled positional isomers of controlled JWH-018. The "bath salts" investigated included 14 controlled drugs, in addition to seven non-controlled positional isomers of controlled pentedrone and 4-methylcathinone, four non-controlled positional isomers of controlled mephedrone and buphedrone, three non-controlled positional isomers of controlled α-PVP, two non-controlled positional isomers of controlled 4-MEPP and α-PBP, one non-controlled positional isomer for controlled methcathinone, methylone, butylone, pentylone, and MDPV, respectively. The phenethylamines studied included amphetamine, methamphetamine, MDA, MDMA, and MDEA.

The use of UHPSFC enabled the baseline separation of all of the studied enantiomers of synthetic cannabinoids, and dl-methamphetamine. UHPSFC resolved 9 out of 14 enantiomers of the controlled "bath salts", all 21 of the non-controlled positional isomers of the latter solutes, and MDMA with a resolution of 1 or better.

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