B193 The Utility of Ultra High-Performance Liquid Chromatography With Time-of-Flight Detection for the Identification of Synthetic Cannabinoids: Part I — The Role of the Separation Technique

Ira S. Lurie, PhD, George Washington University, Dept of Forensic Science, 2100 Foxhall Road, NW, Somers Hall, Lower Level, Washington, DC 20007; Ioan Marginean, PhD, George Washington University, 2100 Foxhall Road, NW, Somers Hall L14C, Washington, DC 20007; and Walter F. Rowe, PhD, George Washington University, Dept of Forensic Science, 2100 Foxhall Road, NW, Washington, DC 20007*

After attending this presentation, attendees will understand some principles of Ultra High-Performance Liquid Chromatography (UHPLC), in particular how to develop a separation for a complex mixture. In addition, attendees will gain insights into the differences between UHPLC and capillary Gas Chromatography (GC) for the separation of synthetic cannabinoids, including structural isomers.

This presentation will impact the forensic science community by clarifying the role of UHPLC in aiding in the identification of highly similar solutes, such as synthetic cannabinoids, that are present in emerging drugs.

Separation techniques are an integral part of forensic drug analysis toolbox for both screening and confirmation purposes. The Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG), which is responsible for setting standards for drug analysis, requires a category A test such as Mass Spectrometry (MS) with an additional test from either category B or C. If a category A method is not used, two uncorrelated techniques from category B and one from category C must be included, from which separation techniques such as capillary electrophoresis, gas chromatography, liquid chromatography, and thin layer chromatography would qualify. In addition, even if a technique such as GC/MS is used, an additional identification test is highly desirable for increased confidence of analysis and quality assurance purposes. Methodology capable of resolving a host of similar compounds is required, especially in the case of emerging drugs. In this vein, UHPLC offers relatively high resolving power and is well suited for this purpose. Besides the ability to separate controlled substances of a particular class of seized drugs, such as the synthetic cannabinoids, the utility of UHPLC depends on the capability of distinguishing between structural isomers and certain stereoisomers. The latter is particularly important since the controlled substances can have both controlled and non-controlled isomers. Distinguishing compounds based on retention time becomes particularly important when the solutes have identical mass spectra. UHPLC-Time Of Flight (TOF)/MS and GC/MS separations are compared for 23 out of the 25 controlled synthetic cannabinoids. For UHPLC reversed phase chromatography with three 2.7µm 2.1x 150mm columns containing superficially porous stationary phases, including C18, Phenyl-Hexyl, and pentafluorophenylpropyl (PFP) are used, while for capillary GC a 0.25µm 0.25mm x 30m Elite-5MS (equivalent to DB-5, HP-5) capillary column is employed. Superficially porous particle columns (i.e., 2.7µm particles) offer UHPLC performance with significantly lower back pressure than fully porous ≤2µm particle columns. For UHPLC "optimum" isocratic or gradient separations are obtained with 0.1% formic acid as the base solvent by varying the amount of acetonitrile or methanol, changing the time of the gradient and varying the temperature. For a gradient separation using a Phenyl-Hexyl column, 19 out of 23 solutes are resolved (resolution ≥1), including two pairs of diastereomers (CP47, 497and epi CP47, 497; CP47, 497-C8 and epi CP47, 497-C8) and a pair of structural isomers (JWH-019 and JWH-122) employing acetonitrile as the strong solvent at 35°C. The unresolved solutes are resolved using alternative chromatographic systems, employing either GC or a UHPLC (C18 or PFP stationary phase), which separate 15, 17, and 14 out of the 23 controlled synthetic cannabinoids, respectively.

For the separation of a controlled synthetic cannabinoid JWH-018 and nine of its structural isomers, using the same chromatographic conditions for the 23 solutes above, capillary GC, and the three UHPLC stationary phases Phenyl-Hexyl, C18 and PFP resolved 4, 0, 3, and 3 compounds, respectively. For the four systems investigated, only UHPLC with the PFP stationary phase resolved JWH-018 from the other structural isomers

The degree of orthogonality of the various chromatographic systems is demonstrated using multivariate analysis.

Synthetic Cannabinoids, UHPLC, SWGDRUG