K13 The Detection and Quantitation of 17 Synthetic Cannabinoids in Human Whole-Blood Using Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS) Following Supported Liquid Extraction

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Learning Overview: After attending the presentation, attendees will have information on the validation of a detection and quantitation method of select synthetic cannabinoids in human whole-blood with the use of LC/MS/MS.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing information on the analysis of select naphthoylindole, admantoylindole, quinolinyl, and carboxamide synthetic cannabinoids in human whole-blood by LC/MS/MS.

Background/Introduction: Synthetic cannabinoids have become a growing concern in society. The extensive list of synthetic cannabinoids and the abuse rate has drawn the attention of government agencies throughout the world. These synthetic cannabinoids can adopt several different structures, while still acting on endogenous cannabinoid (CB1 and CB2) receptors. In addition, due to structural modifications of these synthetic cannabinoids, many of these compounds can bind to CB1 and CB2 receptors with greater affinity, causing severe adverse and life-threatening effects. Because of their structural dissimilarity to the phytocannabinoid Δ^{9}-THC, combating the rapid growth and emergence of synthetic cannabinoids with conventional THC-based methods has become an ongoing struggle.

Objective: The purpose of this research was to develop and validate a robust and reliable method to accurately identify and quantify 17 synthetic cannabinoids in human whole-blood using LC/MS/MS. The method was validated in accordance to the Scientific Working Group for Forensic Toxicology (SWGTOX) guidelines for quantitative analysis using the following analytes: 4-cyano CUMYL-BUTINACA, 5-fluoro-3,5-ABPFUPPYCA, 5-fluoro ADB-PINACA, 5-fluoro PY-PINACA, ADB-PINACA, APP-PICA, CUMYL-THPINACA, EMB-FUNICACA, JWH-250, MDMB-FUBICA, MEP-CHMICA, MO-CHMINACA, NM2201, PB-22, RCS-8, UR144, and XLR11.

Method: Using High Performance Liquid Chromatograph (HPLC) with a 4000 QTRAP® Electrospray Ionization Tandem Mass Spectrometry (ESI/MS/MS) in positive ionization mode, the total analysis time was 8.013 minutes with samples eluting within 3.8 to 5.8 minutes. Calibration curves for each analyte had accepted R^2 values > 0.99 using a weighting factor of 1/x. A linear dynamic range of 0.5ng/mL –25ng/mL was used for all analytes, except for MO-CHMINACA and NM2201, which were quantifiable at lower (0.1ng/mL) levels. Extraction of analytes was performed using ISOLUTE® Supported Liquid Extraction (SLE) cartridges, which improved sample-prep time by more than half, compared to traditional methods.

Results: Percent recovery of analytes using the SLE was determined to be from 54.92% to 83.36%. Bias and precision was assessed at 1ng/mL, 3ng/mL, 7ng/mL, and 20ng/mL for all analytes. All samples had accepted calculated percent bias and percent coefficient of variation within ±20%. No signs of carry-over were observed with this method. Ionization suppression and enhancement was observed at various levels, from -4.47% to 76.67%, but had little effect on other validation parameters. Analysis of other commonly encountered drugs (clonazepam, diazepam, (+) methadone, morphine, fentanyl, cocaine, amphetamine, 3,4-methylenedioxymethamphetamine (MDMA), 25I-NBOMe, and Phencyclidine (PCP)) at 2,000ng/mL showed false identification for ADB-PINACA.

Conclusion/Discussion: The overall development and validation of this method demonstrates a sensitive and reliable way to positively identify 17 different synthetic cannabinoids in human whole-blood in rapid time.

Synthetic Cannabinoids, Supported Liquid Extraction, Forensic Toxicology