B149 The Characterization and Rapid Detection of Synthetic Cannabimimetic Materials Using Ion Mobility Spectrometry (IMS) for In-Field Forensic Investigations

Jasmine M. Drake, PhD, Texas Southern University, 3100 Cleburne Drive, Houston, TX 77004; CaSandra Cantue, Texas Southern University, 3100 Cleburne Drive, Houston, TX 77004; Dominique Giger, Texas Southern University, 3100 Cleburne Drive, Houston, TX 77004; Shastazia S. White, BS, 304 McNary Street, Pittsburg, TX 75686; Jessica L. Gutierrez, MS, 11660 Huebner Road, Apt 1608, San Antonio, TX 78230; and Jazmyne McKenzie, MS, 11502 Moonmist Drive, Houston, TX 77072*

After attending this presentation, attendees will be able to evaluate the efficiency of a rapid and portable technique, IMS, for the identification of individual compounds and mixtures of Synthetic Cannabinoids (SCBs) for use in forensic field investigations.

This presentation will impact the forensic science community by providing detection parameters necessary to create and program a spectral library of SCBs into a commercially available IMS. As a result, this research may facilitate law enforcement's efforts to analyze suspected SCBs in the field and reduce the backlog of screening examinations of drug submissions in the laboratory.

The abuse of synthetic cannabimimetic or SCBs, which mimic the psychoactive effects of Δ^9-Tetrahydrocannabinol (THC) found in marijuana, has increased since their initial discovery. The marijuana-like effects of these designer drugs and marketing as "legal highs" have influenced their rising popularity in recent years. Although legislation has been passed to outlaw the manufacture, distribution, and use of a large number of SCBs, law enforcement officials are constantly challenged with the daunting task of rapidly detecting new chemical modifications of SCBs used by manufacturers to circumnavigate local and federal legislation. Routinely used screening methods for SCBs, such as color tests and microcrystalline tests, have been shown to be subjective and possibly lead to false positives. Although confirmatory identification of these SCBs has been successful using laboratory confined instrumentation, such as Gas Chromatography/Mass Spectrometry (GC/MS) and Liquid Chromatography/Mass Spectrometry (LC/MS), to date, there are no reliable and rapid analytical techniques available for detection and characterization of SCBs to support law enforcement efforts in the field. The concerning lack of objective analyses for SCBs may be addressed by investigating the reliability of IMS, which is an analytical tool that is sensitive to trace amounts of compounds.

In this study, the detection parameters (i.e., drift times (ms) and reduced mobility (K_o) values) of 21 widely abused SCBs were determined using IMS, and sensitivity, reproducibility, and selectivity of the instrument were evaluated.

This study will increase knowledge of the structures and detection methods for an ever-evolving class of materials (SCBs), which have greatly challenged forensic practitioners and law enforcement officials in clandestine field operations. The development of new rapid and portable analytical methodologies will assist with the identification of suspected SCBs for criminal justice purposes.

Twenty-one target compounds, which are widely abused and represent a variety of SCBs from different sub-classes with varying structures, have been analyzed. Samples included 21 commercially available certified reference SCBs at various concentrations (0.1mg/mL-1.0mg/mL). A certified THC standard was used as a positive narcotic control. Positive and negative verification standards were also used as positive instrumental controls. Detection

parameters of the test samples were obtained using a Smiths Detection IONSCAN 400B IMS with an atmospheric pressure chemical radioactive 63Ni ionization source in positive (narcotics) mode. Each sample was analyzed in triplicate using approximately 2µL-5µL of the chemical standard solutions. Confirmatory analysis of test samples was performed using GC/MS. To determine variation of instrument detection, time studies were also conducted. The IMS detection parameters (ms and K_o) for each SCB were recorded and evaluated for reproducibility using statistical software.

Presumptive testing using IMS, limit of detection studies, and mixture analysis was conducted on selected SCBs to determine the efficacy of IMS as a quick and reliable technique for in-field use for law enforcement. Using IMS, all 21 SCBs were detected, and selected SCBs could be observed in trace concentrations as small as 0.09µg/mL. Analysis of mixtures containing multiple SCBs revealed that at least one compound can accurately be identified when compared to a standard. Limit of detection experiments were also performed on six selected SCBs.

In this study, 21 SCBs were analyzed using IMS and were shown to exhibit high reproducibility and stability over the course of three years with similar K_o values as provided by the United Nations Office on Drugs and Crime (UNODC). Due to the similarities in the detection parameters obtained in this study and those reported for the selected SCBs in the literature, IMS (positive mode) is a suggested tool for the presumptive identification of SCBs in forensic field investigations.

Synthetic Cannabimimetics, Ion Mobility Spectrometry, In-Field