B210 An Analysis of Illicit Drugs by Portable Ion-Trap Gas Chromatography/Mass Spectrometry (GC/MS)

Leah Rynearson, BS, University of New Haven, West Haven, CT 06516; Zachary Lawton, MS, PerkinElmer, Inc, Shelton, CT 06484-4794; Meghann McMahon, MS, Wisconsin Department of Justice, Milwaukee, WI 53204; Pauline E. Leary, PhD, Federal Resources, Stanfordville, NY 12581; Koby Kizzire, PhD, University of New Haven, West Haven, CT 06516; Brooke W. Kammrath, PhD, University of New Haven, West Haven, CT 06516*

Learning Overview: After attending this presentation, attendees will understand the value of portable ion-trap GC/MS for the on-scene analysis of illicit drugs.

Impact on the Forensic Science Community: This presentation will impact the forensic science and law enforcement community by examining the benefits and limitations of field deployable ion-trap GC/MS for the analysis of illicit drugs.

False positive results from on-scene illicit-drug analysis using presumptive color tests have caused numerous wrongful arrests. In many states, forensic laboratories do not ever receive evidence for confirmatory identification of the illegal substance unless the defendant goes to trial, which makes it impossible to know the severity of this problem. Additionally, some defendants take a plea deal, which can result in these defendants spending months or years in prison for a crime they did not commit. Improving the reliability of on-scene illicit-drug testing by incorporating confirmatory methods capable of achieving very low limits of detection, GC/MS into the field could help reduce these wrongful arrests.

The purpose of this research was to build a GC/MS spectral library of illicit drugs and some common additives for a commercially available portable ion-trap GC/MS. The instrument uses a toroidal ion trap, which has three major advantages over other portable GC/MS systems: (1) its small size, which is essential when designing an instrument optimized for portability; (2) its durability due to having no components that require the highly precise alignment of the standard quadrupole system; and (3) its higher operating pressure, which lowers pumping requirements. Due to the potential for space charge and other ion-ion interactions in ion-trap MS, a customized library for this type of field application is critical. Space charge occurs when too many ions are trapped in a small volume causing problematic ion-ion repulsions that can result in a shift in observed *m/z* values. Other ion-ion interactions can occur inside the trap, such as when ion fragments complex with each other, resulting in observed *m/z* values that are greater than those expected from the initial fragmentation that occurs during the ionization process. Since space charge and other ion-ion interactions may potentially occur with ion-trap systems, an electronic GC/MS library created using data collected from an ion-trap GC/MS is a necessary supplement to the National Institute of Standards and Technology (NIST) MS database because the NIST MS database is primarily comprised of quadrupole mass spectra. If the potential of space charge and ion-ion interactions is not accounted for during the library-search process, this behavior may result in a missed identification (e.g., false negative).

In this research, more than 50 common illicit drugs and 15 additives were used to create an ion-trap GC/MS library after repeated testing. Many of the tested compounds had mass spectra different from that of the NIST MS database due to the presence of space charge and/or other ion-ion interactions. The ion-trap GC/MS library was then used to test the ability to detect and identify illicit substances and their additives in seized drug samples. In addition, results were compared with data generated from the same samples using a field-portable quadrupole GC/MS. It was concluded that with additional library development, portable ion-trap GC/MS is a viable choice for the confirmatory identification of seized drugs in the field.

Illicit Drugs, Portable GC/MS, Ion-Trap GC/MS

*Presenting Author