A90 Ultra Rapid Separation of Cocaine and Cocaine Adulterants by Differential Mobility Spectrometry-Mass Spectrometry

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After attending this presentation, attendees will understand how differential mobility spectrometry (DMS) is similar to ion mobility spectrometry (IMS) as well as how it is different. Relevant applications to forensic drug analysis will be highlighted.

This presentation will impact the forensic science community by introducing practical applications of a new, ultra-rapid, separation technology to the field of drug analysis. This separation technology, DMS, is interfaced to an ion trap mass spectrometer for confirmation by MS-MS analysis.

Differential Ion Mobility Spectrometry (DMS) has been interfaced to nano-ESI-MS to provide an ultra rapid ion filtration technique for the separation of ions in gas phase media prior to mass spectral analysis. This technique as a forensic tool for ultra rapid separations and analyte quantitation with minimal sample pre-treatment in an effort to replace the necessity for lengthy GC or LC-based chromatographic separations is being evaluated. DMS affords an analyst the ability to selectively feed an ion trap with targeted analytes preventing saturation of the trap from unnecessary chemical noise. DMS-MS separation conditions were optimized and included modifier selection, desolvation gas temperature, and variance of trap fill time for the analysis of a variety of chemical species.

The aim of this work has been the rapid detection of analytes of interest to the forensic science community with the overall goal of reducing case backlogs. A planar, DMS-Ion Trap MS has been constructed in the laboratory. This system has been shown to be efficient at the rapid separation of ions under ambient conditions and has been utilized in the laboratory as an ion filtration technique prior to mass analysis. Compared to traditional LC-MS based techniques requiring 30- 40 minutes of chromatography, DMS-MS is capable of separating a five drug mixture in 25 seconds. DMS allows for ion selection from a mixture by the application of dispersion (Rf) and compensation (Vc) voltages. Determining appropriate Vc's by scanning as a function of time is a critical step to isolating species of interest from a complex chemical matrix. Drug and drug adulterant mixtures were introduced to the DMS- MS system via infusion without sample pre-treatment or purification. MS-MS of the targets at fixed Vc's was then conducted, confirming the

presence of the analyte of interest from the background matrix. DMS-MS was shown to suppress chemical noise by approximately one order of magnitude allowing for increased signal-to-noise at increased trap fill times. Furthermore, use of DMS as an ion filtration technique afforded a nine-fold increase in S/N for the analyte of interest.

Drug Analysis, Separation Science, Differential Mobility Spectrometry

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