



Criminalistics Section - 2016

B123 Toward On-Site, Real-Time, Confirmatory Analysis of Drugs and Their Optical Isomers Using a Battery-Operated, Portable, Ultra-Fast Capillary Electrophoresis/Mass Spectrometry (UFCE/MS)

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After attending this presentation, attendees will better understand a novel portable device for on-site, real-time confirmatory analysis of drugs and their optical isomers.

This presentation will impact the forensic science community by discussing the role of a portable confirmatory technique for the detection of explosives, illicit drugs, and their optical isomer that takes approximately one minute.

In the past several years, there has been considerable interest in developing hand-held devices for detection of chemicals and biological samples in the forensics area. Most of the devices are based on spectroscopic techniques and are therefore only sufficient for screening purposes. To address the need for portable confirmatory methods, a variety of portable mass spectrometers have been developed and used with real-time ionization techniques such as Desorption Electrospray Ionization (DESI), Direct Analysis In Real Time (DART®), and paperspray ionization. The limited or lack of separation with these ionization techniques makes the analysis of complex mixtures difficult; therefore, a portable and fast separation technique is desired. A variety of fast separation techniques based on Gas Chromatography (GC), Liquid Chromatography (LC), supercritical fluid chromatography, and Capillary Electrophoresis (CE) have been developed, but CE is the most amenable to miniaturization. Presented here is a portable (battery-operated), UFCE/MS for fast separation of drugs and their optical isomers.

Analyses were performed using fused silica capillaries utilizing a porous tip to interface between the CE and MS. Short (≤ 25 cm long) capillaries with inner diameters between $5\mu\text{m}$ and $15\mu\text{m}$ were used for separation. The capillary wall was coated using polybrene, which under reverse polarity mode provided electro-osmotic flow toward the outlet. A separation voltage of -25kV was used to achieve $\geq 1,000\text{V/cm}$ across the capillary. A background electrolyte analyses of (+)-(18-crown-6)-2,3,11,12-tetracarboxylic acid (18-C-6-TCA) was used.

The portable UFCE electrospray ionization source fits in front of a low- or high-resolution MS similar to a conventional electrospray/nanospray ionization source and has about the same size and weight. The UFCE ionization source is equipped with two high-voltage power supplies ($\pm 25\text{kV}$ HVPS) capable of operating in forward or reverse polarity modes and powered by a 12V rechargeable Lithium ion battery, making it compatible with a portable MS. The device was able to separate illicit drugs (including amphetamines, cathinones, and cannabinoids) and their optical isomers in approximately one to two minutes. The portable ultrafast CE ionization source for MS allows for separation of compounds and their isomers in about one minute.

Portable CE, CE/MS, Explosive Drugs Optical Isomer