B54 Fast Analysis Workflow With No Sample Preparation for Forensic Applications Using Open Probe Fast Gas Chromatography/Mass Spectrometry (GC/MS)

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Learning Overview: After attending this presentation, attendees will understand how the Open Probe Fast GC/MS system works in the forensic drug analysis workflow for compound identification with no sample preparation.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating an alternate technique for fast analysis for a forensic application relating to the positive identification of compounds in a variety of samples ranging from liquids to solids. All of this is achieved by using gas chromatography/mass spectrometry system (GC/MS) coupled with an Open Probe Fast GC device and the routinely used National Institute of Standards and Technology (NIST) library searches.

The need for fast analysis for the identification of compounds in a variety of samples have been steadily increasing over the last one to two decades, especially for seized drugs. Positive identification of drugs and other chemicals in bulk samples is critical during screening in crime laboratories. Conventional drug analysis often requires sample preparation that includes dissolution, dilution, and several reagent-based assays to classify the type of drugs followed by gas chromatography-mass spectrometry (GC/MS) analysis and/or other techniques for confirmation. A simple and fast analysis workflow that does not require sample preparation is demonstrated with Open Probe Fast GC/MS. This system was equipped with 1.5m x 0.25mm (0.1µm 100% dimethylpolysiloxane film) and 0.8m x 0.18mm (0.18µm 100% dimethylpolysiloxane film) restrictor columns using a ~400°C/min temperature ramp that allowed for chromatographic separation in under 1 minute. Individual samples (liquid, solid, powder) were touched with a glass probe and introduced into the Open Probe FastGC/MS system (with single quadrupole or SQ) for 3-6 seconds for vaporization prior to data acquisition. Correct compound identification of drugs in liquids and solids is achieved through NIST library search when using a single quadrupole mass spectrometer at unit resolution. A variety of drug samples were analyzed, including drug mixtures (40-75 ng/µL) in solvent, tablets (whole oxycodone, pulverized hydrocodone-acetaminophen, diphenhydramine, sildenafil) and seized drugs from criminal cases including: black tar heroin, magic mushrooms and a marijuana edible. The fast-chromatographic separation, direct sample introduction and short acquisition (<1 minute) allowed for rapid and high throughput analysis of different types of samples - liquids, solids and powder each of which contained drugs. Drug compounds in a solution containing caffeine, methadone, codeine, 6-monoacetylmorphine (6-MAM) and morphine were all identified with match scores greater than 800 when using a SQ mass spectrometer. Similarly, positive identification of over-the-counter and prescription tablets was achieved without sample preparation with resulting library matches greater than 850. For a pulverized tablet (5 mg hydrocodone-300 mg acetaminophen), acetaminophen and hydrocodone were also confidently identified, although hydrocodone accounted for only 1% of the tablet mass. Additionally, the relative content (1.6%) of hydrocodone-to-acetaminophen was accurately determined by the peak areas ratios of the compounds. Analysis of real case samples resulted in the correct identification of the main drug as well as secondary components without performing any sample preparation. For example, black tar heroin analysis showed diacetylmorphine, noscapine and papaverine and a marijuana edible showed dronabinol, cannabichromene, cholesterol and squalene. The fast analysis did not require sample preparation and allowed for a simple workflow to expedite screening in a forensics application and included the following steps: 1) run blank, 2) run sample, (3) run blank and (4) run standard for confirmation. This analysis workflow resulted in overall screening and confirmation (when running a standard) of < 5 minutes for target analysis of drugs. It can also be expanded to other fields that require fast screening and identification such as homeland security and organic synthesis.

Drug Analysis, Open Probe, Fast Analysis