Advancements in technology for the confirmation of drugs in oral fluid and hair

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OVERVIEW: Advances in instrumental technology have allowed the development of routine assays for the mass spectral detection of drugs at low concentrations and in limited sample volumes, as is often necessary for oral fluid and hair. This presentation will outline developments in gas and liquid chromatography systems coupled to mass spectrometers.

1. Expanded profiles: Inert source single quadrupole mass spectrometers coupled to fast GC ovens with electronic pressure controls, have given analysts multiple options for method optimization, and have allowed low matrix amounts to be used for analysis, resulting in expanded drug test panels from limited volume specimens. Examples of rapid GC/MS methods for the detection of several medicinal drugs in oral fluid will be described.

2. Improved sensitivity: Further technological advances using two-dimensional chromatography, micro-fluidic switches, cryo-trapping of analytes and different ionization modes for detection, have improved detection limits for routine work.
Two-dimensional separation techniques essentially allow the analyte of interest to pass through the primary column along with any background matrix and are vented from the instrument. Immediately before the sample elutes from the first column, the direction of the carrier gas is changed, thereby switching the flow to a second analytical column, which is connected to the mass spectrometer. Immediately after the drug has been diverted to the second column, the flow is switched back and any remaining interference material is not passed onto the analytical column. Usually the primary column is more polar than the secondary column, which promotes retention of background matrix. When the switch occurs, allowing the analyte of interest to pass onto the second column, it is then free from matrix interference. Additional options, such as cryogenic focusing to trap and release the analyte into a sharper peak; and electron capture chemical ionization using ammonia as the reagent gas, have greatly improved the sensitivity of routine assays.
The determination of the marijuana metabolite, THC-COOH in hair has to date been limited to tandem GC mass spectrometers. However, this application, along with the detection of THC-COOH in oral fluid can now be routinely monitored using a single quadrupole mass spectrometer. Detection limits of 0.05 pg/mg of hair and 2 pg/mL of oral fluid are routinely achieved.

3. Tandem mass spectrometry: The increased use of liquid chromatography coupled to triple quadrupole spectrometers has further added options for toxicologists. The lack of derivatization, the speed of analysis and added confidence in a tandem mass spectral mode have shown LC/MS/MS to be a necessary addition to a drug testing facility.
Cocaine, amphetamine, methamphetamine and MDMA in oral fluid can be analyzed in one run of less than 1.5 min; parent THC can be detected at a concentration of 1 ng/mL of oral fluid with a run time of 4.2 min. Other drug assays are currently under development.

SUMMARY: New developments in instrumentation technology have allowed toxicologists to improve sensitivity and speed of analysis, particularly when using matrices with limited specimen volume.

KEYWORDS: *Illegal Drugs, Oral Fluid, Hair, Analytical Toxicology, Advancements*

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