White Powder Incidents

Identifying Narcotics in Complex Samples

Mira DS handheld Raman System

A person suspected of possessing a narcotic can be charged with a crime only after the identity of the illicit substance is confirmed. This confirmation is typically provided by analytical chemists in forensic laboratories and requires highly technical separation and detection methods. Unfortunately, such labs often have deep caseloads that lead to delays in testing. Handheld Raman analyzers bring the reliability and accuracy of lab analysis to first responders in the field, allowing for rapid and accurate identification of street drugs with a white powder appearance. With such tools, demand for forensic analysis can be reduced and enforcement agencies can enforce drug policies with greater safety, speed, and precision.

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Introduction

Presumptive tests, including colorimetric tests that detect classes of drugs, establish suspicion and reduce demands on labs. Such tests are designed for officers in the field, but often lack precision and robustness to field conditions in addition to user-error, subjectivity, and exposure. Moreover, presumptive testing by field-based professionals must be suited to analysis of complex drug street samples. Raman spectroscopy brings the precision of laboratory analysis to presumptive testing. The handheld Metrohm Instant Raman Analyzer for Defense and Security (Mira DS) equipped with Orbital Raster Scanning (ORS) technology provides any user, anywhere, the ability to accurately identify white powder street drugs through library comparison and mixture matching.

Targeted Detection

«White powder incidents» might involve methamphetamine, cocaine, or designer drugs contaminated with excipients. This application describes analysis of real street drug samples using proprietary Library and Mixture Matching routines included with Mira DS. Much research has been dedicated toward identifying related substances and establishing tagged and treed libraries of known combinations of illicit materials. In other words, detection of certain substances activate algorithms that search for specific correlated materials. These libraries inform Mixture Matching routines, which can be described as deconvolution of multiple spectra from components in a mixture.

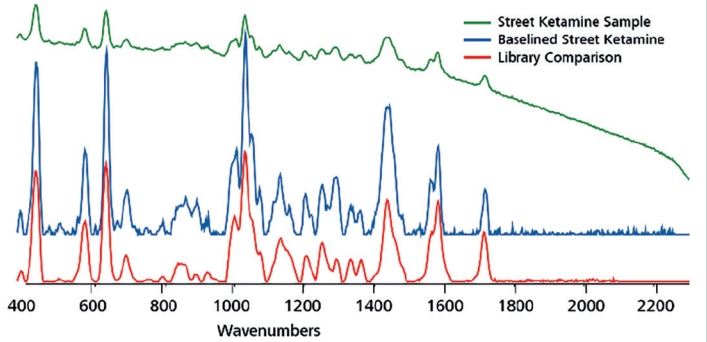
For example, excipients may comprise 70–80% of street drug samples. These are cutting agents that bulk up the sample, residual chemicals from production, or other drugs. For example, caffeine is used as a cutting agent for cocaine – its powdered form has a similar appearance to cocaine, upon inhalation it gives a user a similar euphoria as pure cocaine, and its stimulant properties complement those of cocaine. When caffeine is detected in a complex sample, established library correlations cause the software to analyze the same sample for associated materials, leading to identification of cocaine.

Figure 1. Mira DS with Right Angle Attachment.

Experiment

A local Drug Task Force used Mira DS to scan seized street drug samples with crystalline white powder appearance. Notably, Mira DS uses embedded algorithms that automatically optimize acquisition parameters in order to acquire highest quality spectra: an analytical chemist is available at the touch of a screen.

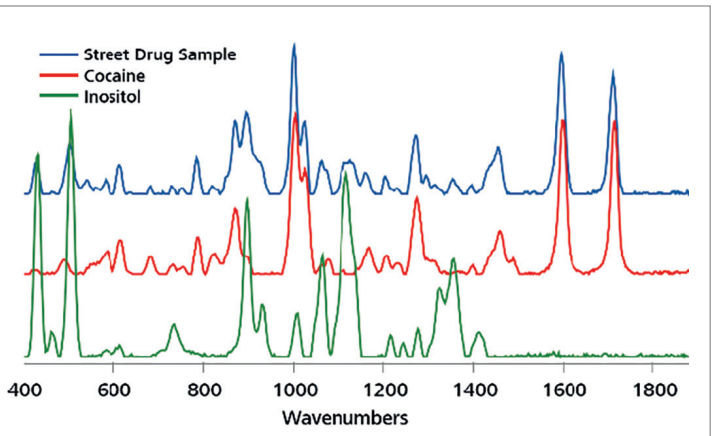
The resulting spectra were imported into the MiraCal DS software and compared within on-board libraries of illicit materials: the results follow. Each search resulted in preliminary identification with a match score indicating how well the sample spectrum correlates to a library spectrum. Mixture matching routines determine if a spectrum is possibly the result of a combination of substances. Up to 3 components in a mixture are identified and reported with accompanying information that includes a qualifier and a color-coded hazard warning.



Hazard Level	Name	Sample Type	Hazard Comm	Source Library	Match Score
Alarm	Ketamine	Illicit Drug	Cutting agent	Illicit	0.91

Figure 2. Ketamine Spectra with Match Score.

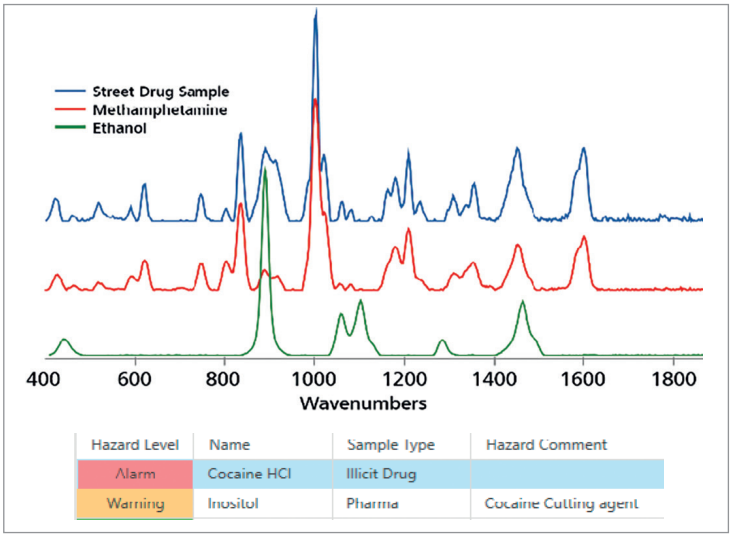
Street ketamine exhibits fluorescence with Raman excitation at 785 nm, as the green spectrum above shows. Baselining emphasizes peaks of interest, but may result in a spectrum with poor signal-to noise-ratio (blue spectrum above.) Even with this complication, MiraCal DS successfully identifies the sample as ketamine with an HQI= 0.91.



Hazard Level	Name	Sample Type
Alarm	Methamphetamine	Illicit Drug
Precursor	Phosphoric Acid	Chemical
Clear	Ethanol	Pharma

Figure 3. Street Cocaine cut with Inositol.

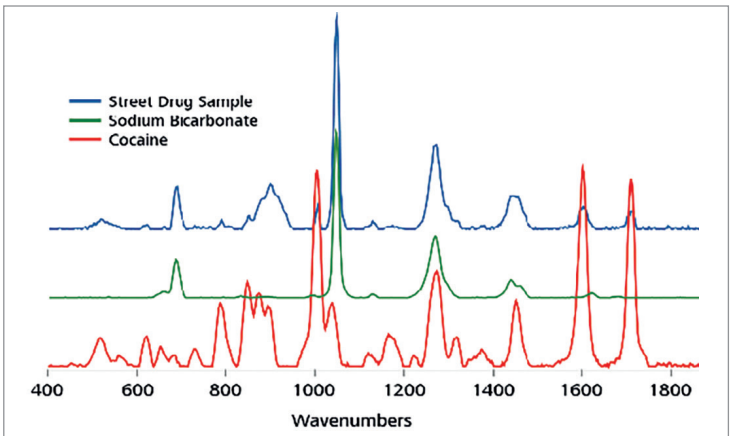
Inositol is a sugar alcohol commonly used to cut cocaine: it has a similar appearance and less sweetness than many other sugars used as excipients. Similarly, sodium bicarbonate is a white powder used frequently to add extra bulk to illicit drugs. **Figures 3 and 5** illustrate that the complex spectrum from the street sample is consistent with both the active substance and the cutting agent. These spectra also provide an excellent example of the color-coded warnings provided by Mira DS.



Hazard Level	Name	Sample Type	Hazard Comment
Alarm	Cocaine HCl	Illicit Drug	
Warning	Inositol	Pharma	Cocaine Cutting agent

Figure 4. Methamphetamine with residual Ethanol.

Ethanol is used in the production of methamphetamine. **Figure 4** is an example of successful identification of an excipient through mixture matching, despite its spectral similarity to the compound of interest.



Hazard Level	Name	Sample Type	Hazard Comment
Warning	Sodium Bicarbonate	Chemical	Cocaine cutting agent
Precursor	Phosphoric Acid	Chemical	
Alarm	Cocaine	Illicit Drug	

Figure 5. Sodium Bicarbonate is a Common Cutting Agent.

Conclusion

Mira DS is a powerful tool for Defense and Security professionals who encounter white powder street drugs. Metrohm Raman delivers fast evaluation of potentially hazardous substances in the field. With Mira DS, first responders can safely get immediate information about unknowns without concerns about contact or sample consumption. Metrohm Raman is excited to offer a rugged little handheld Raman analyzer that brings sophisticated chemical analysis out of the lab and onto the streets.

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