B132 Rapid Illicit Drug Analysis Using the Infrared Microprobe

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After attending this presentation, attendees will learn that the combi- nation of microscopy and infrared spectroscopy is a unique technology for rapid analysis of illicit drugs.

The forensic drug analyst is overwhelmed with samples, pressured by backlog and pressured for immediate results. By combining microscopy and infrared spectroscopy, the infrared microprobe is a unique tool, able to analyze illicit drug sample quickly and be in compliance with SWGDRUG and ASTM recommendations. Advances in instrumentation and software are combined to create a rapid, reliable and reviewable system. This tech- nology will impact the forensic community and/or humanity by impacting the way illicit drug sample are analyzed.

Because of the magnitude of the illicit drug problem and the ever- increasing scrutiny of the legal system, the forensic drug analyst is under great pressure. A defendant's rights to a speedy trial, establishing probable cause for warrants and standardized analytical testing are important con- cerns of criminal justice. For the forensic drug analyst this translates into "do it fast", "do it right every time", "report results quickly" and "create a reviewable record". Infrared microprobe analysis fills these needs.

The forensic science community recognizes its obligation to provide the public with high quality results in a timely manner. Two peer groups, SWGDRUG and ASTM Committee E-30 have recommended minimum standard practices for illicit drug analysis [1-2]. Recently, ASTM published E 2329-04, *Standard Practice for Identification of Seized Drugs*. This standard is based on the recommendations of SWGDRUG and establishes minimum standards applicable to the identification of seized drugs. Because they provide unique molecular chemistry identifications, infrared spectroscopy, mass spectroscopy, nuclear magnetic resonance (NMR), and Raman spectroscopy are designated as Category "A" techniques.

Based on its ability to discriminate different drugs, infrared analysis is a primary method of analysis. Since no two compounds are exactly the same, mid-infrared spectra are often referred to as molecular "fingerprints". Infrared (IR) spectra of documented samples are recorded and stored in "spectral libraries". An unknown spectrum is "searched" through the library and the "best match" is determined. The analyst compares the library data with the IR spectrum of the unknown and he or she makes a scientific decision. The analyst selects the best method for confirmation. Infrared analysis can differentiate cocaine hydrochloride (HCL) form cocaine base ("Crack"), or ephedrine from pseudoephederine and can identify unstable drugs like GHB (gamma hydroxybutyric acid). These determinations are not possible by other analytical techniques.

Many forensic drug laboratories use microcrystalline test to either pre- screen or confirm the identification of illicit drugs. For example, a common microcrystalline test for cocaine is to place a drop of a gold chloride solution (5-g $AuCl_3$ per 100-ml H_20) on a few grains of powder. Unique crystals, shaped as feathery crosses, are formed in a few minutes. Using internal attenuated total reflection (ATR), the ATR spectrum of the gold chloride salt can be recorded to confirm the microcrystal test.

Street drugs are impure; they are often mixed with cutting agents or impurities. Using an infrared microprobe combines the imaging of the microscope with the analytical power of infrared analysis. Microscopic examination lets the analyst see discrete phases so that infrared spectra can be collected from each phase. Fig. 1 is a micrograph of a heroin street drug. Spectral analysis confirms that the light (birefringent) phase is mannitol and the dark phase is heroin.

When vibrational spectroscopy is combined with light microscopy the analysis of illicit drug samples is enhanced. The three "R's" for the drug analyst are: rapid, reliable and reviewable. Speed is essential for short turn- around-times and reducing case backlog. The analytical method controls the rate of analyses. Reliability is crucial. There is zero tolerance for false positive results (Type I errors). Results and procedures must be reviewable, providing a check on the expert's testimony and protecting the defendant's rights. Modern infrared microprobe analysis satisfies these requirements.

References:

The Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG). Microgram 2001; 34(6):136.

ASTM E-2329-04 Standard Practice for Identification of Seized Drugs, ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

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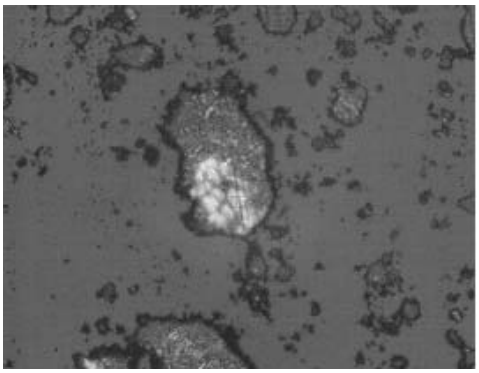

Fig. 1. A heroin "Street" drug sample viewed with polarized light to see dif- ferent phases. The mannitol crystals are birefringent, appearing white, while the heroin is dark.

Infrared Microprobe, Drug Analysis, ASTM

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