B135 A Micro-Fluidic Device Integrating Color and Crystal Tests and ATR

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After attending this presentation, attendees will learn how color and crystal tests can be integrated with IR microscopy in a simple microfluidic device. An indispensable aspect of such application is a searchable database of both crystal morphologies and IR spectra.

With this new microfluidic design, forensic scientists will be capable of performing a series of simple, standard tests both in the field and in the laboratory in a short amount of time. These simple tests, coupled with infrared spectroscopy, will impact the forensic community and/or humanity by having the potential to automate many of the routine aspects of forensic drug analysis.

When first introduced into the forensic community in the late 1800s, color tests and then microcrystal tests became invaluable assets to chemists, and were often the only methods available to identify certain substances. As analytical chemistry progressed, advanced technology became more available, such as mass spectroscopy and infrared spectroscopy. These became standard tools in the identification process. The continued practice of color tests for screening purposes is rarely challenged today. However, the role of microcrystal tests in drug analysis is not as apparent. Recent advances in instrumentation, particularly in microspectrophotometry, coupled with a greater understanding of the chemistry, the structure and the morphology of the microcrystals used in forensic science has led to a renewed interest in forensic chemistry's oldest tool. These potential appli- cations include coupling microspectrophotometry with a polarizing light microscope, and microfluidic devices specifically designed for solid drug analysis. The analytical procedure used for both the color and the micro- crystal tests are described below and will be discussed in the presentation.

The first step in the analytical procedure was performing color tests on cocaine, methamphetamine, amphetamine and heroin using typical reagents, including Marquis and Mandelin. The color reagent was first added to a fiber to observe any change of color the reagent might produce. Then, a solution of the controlled substance in methanol was added to the fiber. Thirteen different types of fibers were tested to determine which type of fiber showed the most color change when both the reagent and the drug solution were added. Using microspectrophotometry and CIE-LAB coor- dinates, images and information about how both the reagent and the drug react with the fiber were collected. The information and images collected where then stored in a database for further analysis. This analysis is described in a related presentation.

Secondly, microcrystal tests were performed on cocaine, metham- phetamine, amphetamine and heroin following the ASTM methods. These microcrystal tests were performed first with pure substances, then the addition of diluents and adulterants commonly found with each type of drug. These diluents and adulterants were added one at a time, approxi- mately 1:1 ratio until a total of 5 additives were mixed with the controlled substance. Images of the crystals formed were then taken and stored in an image database for further analysis.

The final step was to add confirmatory tests. Infrared microscopy using attenuated total reflectance (ATR) and a diamond tip objective were employed for this purpose. As applied in this work, simple microfluidic device prototypes were designed on templates that fit on a typical micro- scope slide. These devices utilized various combinations of color, crystal and ATR-IR spectroscopy for the identifying and analyzing of various drugs and drug mixtures. This presentation will discuss these results in detail.

Micro-Fluidics, Infrared Spectroscopy, Crystal Tests

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