Application Note AN-RS-035

Fentanyl in the Mail

Strategic Detection of Illicit Drugs in Prison Mail

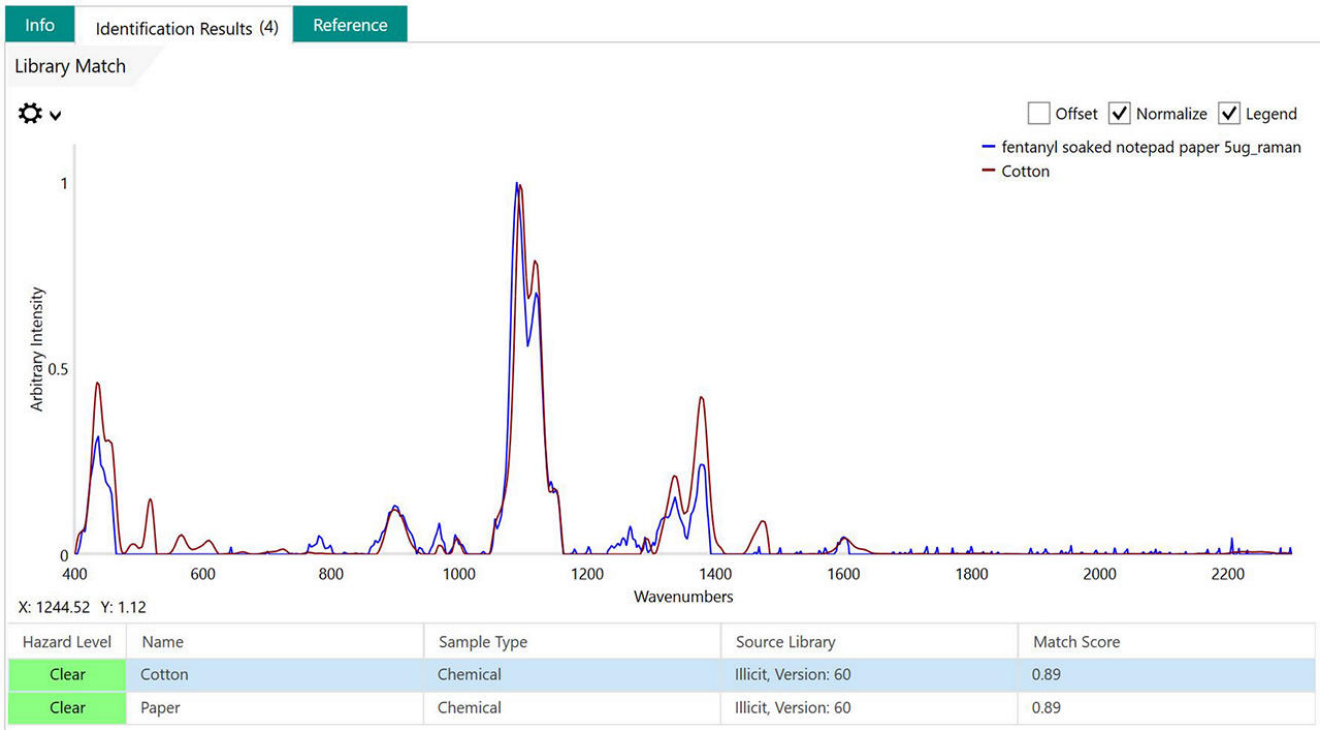
According to the US Bureau of Justice, in the years 2007–09 more than half of state prisoners and nearly two-thirds of sentenced prison inmates met formal criteria for drug dependence or abuse. But how do the drugs get into prisons? They enter illegally inside of body cavities, baby diapers, bibles, and of course the mail. Once stationery is treated with a concentrated solution of heroin, MDMA, LSD, or fentanyl, small portions of a letter can be easily distributed among inmates. Narcotics in prison mail is such an issue that millions of dollars are being spent to re-work the system. Digitizing each piece of mail is one solution, but it is an imperfect one. It is time and personnel intensive, does not protect digitizers from harmful mail content, and it could potentially violate inmates' rights. It is truly a complicated issue made even more complex by fentanyl. Mere exposure to trace amounts of fentanyl can be toxic for anyone handling laced mail, and death by fentanyl overdose is an issue on both sides of the bars. An ideal solution therefore would be a detection system that is quick, accurate, and efficient, and can test for the presence of drugs on paper at the point of receipt. Metrohm Raman offers excellent trace-detection solutions with both MISA and MIRA XTR DS systems, which can be used for instant onsite detection of opioids, cocaine, MDMA, and fentanyl. This Application Note describes trace detection of fentanyl on paper.

INTRODUCTION

Raman systems with SERS capabilities can be used to provide positive onsite identification of fentanyl. This Application Note demonstrates Raman analysis of fentanyl-soaked paper, describes the SERS detection range for fentanyl on paper, and provides a real-world example of fentanyl identification.

RAMAN AND FENTANYL-SOAKED PAPER

Direct point-and-shoot analysis of notebook paper at a fentanyl concentration of 5 µg/ 0.635 cm^2 yields a spectrum of substrate material, identified as cotton and paper (Figure 1). This is a typical limitation of using Raman alone for trace analysis applications, but it is not an issue for Metrohm's MIRA and MISA systems with dual Raman and SERS capabilities.



Hazard Level	Name	Sample Type	Source Library	Match Score
Clear	Cotton	Chemical	Illicit, Version: 60	0.89
Clear	Paper	Chemical	Illicit, Version: 60	0.89

Figure 1. Fentanyl-soaked paper requires SERS for trace detection, while Raman simply identifies the substrate.

FENTANYL ON PAPER SERS DETECTION RANGE

To demonstrate SERS detection of illicit drug-laced mail, this experiment begins with notebook paper cut into 0.635 cm (0.25 inch) squares. A stock solution of 0.1 mg/mL fentanyl in methanol was prepared and deposited onto these squares in the following volumes: 1 µL, 5 µL, 10 µL, 20 µL, and 50 µL to yield 0.1 µg, 0.5 µg, 1 µg, 2 µg, and 5 µg of fentanyl per 0.635 cm^2. Each square was dried and placed into a glass vial with 500 µL of silver colloid. This vial was capped, shaken, and rested for five minutes to enhance extraction. Saline solution (100 µL of 0.9%) was added and the vial was agitated gently to mix. After one minute, this mixture was measured with the ID Kit OP on MIRA XTR DS, with results shown in Figure 2.

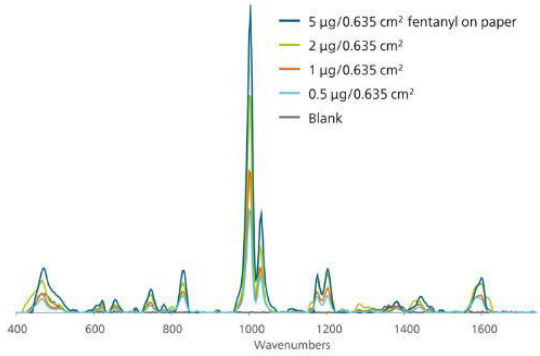


Figure 2. Strong SERS signature of fentanyl is detectable even at 0.5 ug—far below the typical dose of fentanyl in the real world.

SERS METHOD AND RESULTS

SERS provides instant on-site identification of fentanyl in laced mail in four simple steps, as illustrated in the images above:

1. Remove a small sample of the suspect paper
2. Extract active compounds by shaking the paper sample in a vial with colloids.
3. Add saline solution to the vial.
4. Acquire data with ID Kit OP on MIRA or MISA

The results are unambiguous identification of fentanyl (Figure 3).

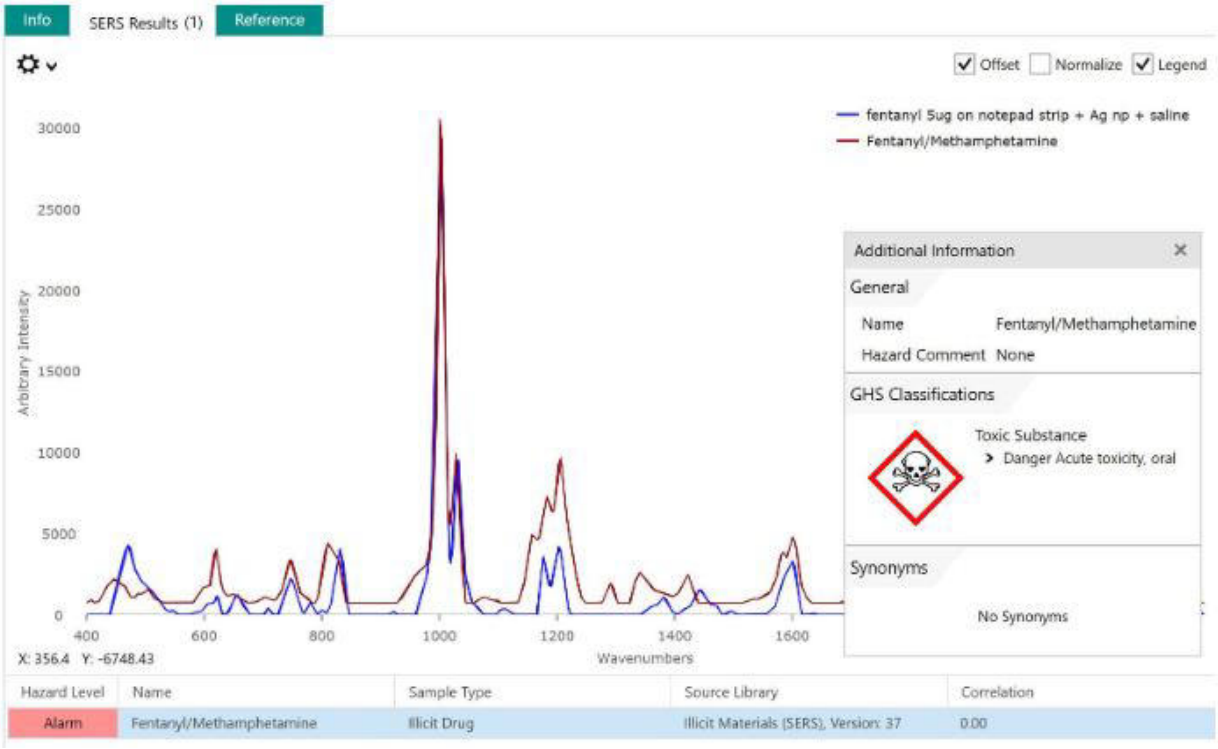


Figure 3. Positive ID of Fentanyl with GHS hazard warning.

CONCLUSION

Dual functionality MISA and MIRA Raman and SERS systems from Metrohm Raman are an excellent solution for real world issues like fentanyl-laced prison mail. Reduce the risk of exposure to deadly substances and save time, money, and personnel commitments without sacrificing the ability to positively identify narcotics in non-technical settings. Learn more about fentanyl ID

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CONFIGURATION

MISA Advanced

Metrohm Instant SERS Analyzer (MISA) is a high performance, portable analyzer system used for rapid, trace level detection / identification of illicit materials, food additives and food contaminants. MISA features a high-efficiency spectrograph equipped with Metrohm's unique Orbital-Raster-Scan (ORS) technology. It has a minimal footprint and extended battery life, perfect for on-site testing or mobile laboratory applications. MISA offers various Laser Class 1 attachments for flexible sampling options. Analyzer operation is available through BlueTooth or USB connectivity.

The MISA Advanced package is a complete package that allows the user to perform SERS analyses using Metrohm's nanoparticle solutions and P-SERS strips.

The MISA Advanced package includes a MISA Vial Attachment, a P-SERS Attachment, a ASTM Calibration Standard, a USB Mini Cable, a USB Power Supply and MISA Cal software for operating the MISA instrument. A ruggedized protective case is also provided to securely store the instrument and accessories.

MIRA XTR Basic

MIRA XTR is an alternative for high power 1064 nm systems. Powered by advanced computational processing, MIRA XTR uses a more sensitive 785 nm laser light along with XTR algorithms to eXTRact the Raman data from the sample fluorescence. MIRA XTR also features Orbital Raster Scanning (ORS) to provide better coverage of the sample increasing the accuracy of the results.

The Basic package is a starter package that contains the basic components required for operating the MIRA XTR. The Basic package includes a Calibration Standard and Intelligent Universal Attachment. Class 3B operation. MIRA XTR supports Metrohm handheld Raman libraries.

MIRA XTR Advanced

MIRA XTR is an alternative for high power 1064 nm systems. Powered by advanced computational processing, MIRA XTR uses a more sensitive 785 nm laser along with XTR algorithms to eXTRact the Raman data from the sample fluorescence. MIRA XTR also features Orbital Raster Scanning (ORS) to provide better coverage of the sample increasing the accuracy of the results.

MIRA XTR Advanced package includes a Calibration Standard, Intelligent Universal Attachment, Right-angle Attachment, Vial Attachment, and MIRA SERS Attachment. A complete package for any type of analysis. Class 3B operation. MIRA XTR supports Metrohm handheld Raman libraries.

ID Kit - Ag NP

The ID Kit - Ag NP contains the components a Mira / Misa user requires to perform a SERS analysis using silver colloidal solution. The kit contains a disposable spatula, dropper, sample vials, and a bottle of silver colloid.