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.

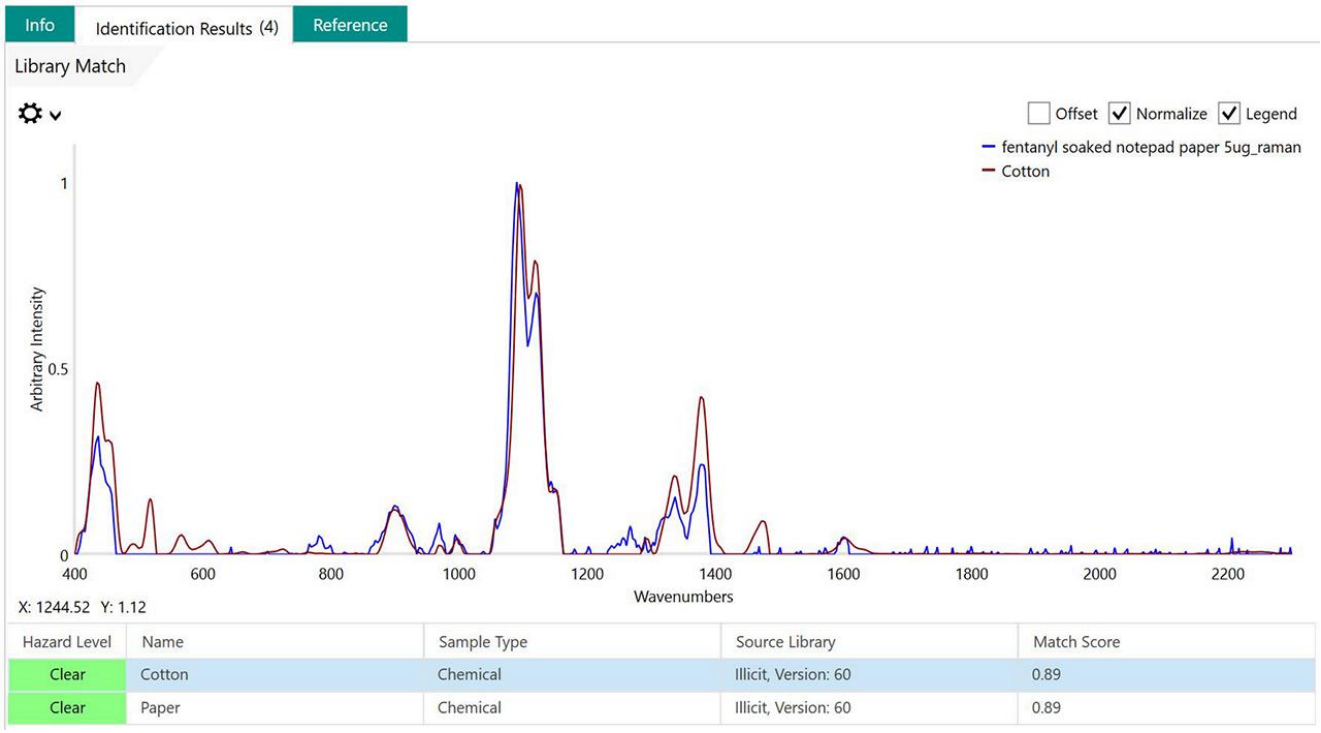


Figure 1. Fentanyl-soaked paper requires SERS for trace detection, while Raman simply identifies the substrate.

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.

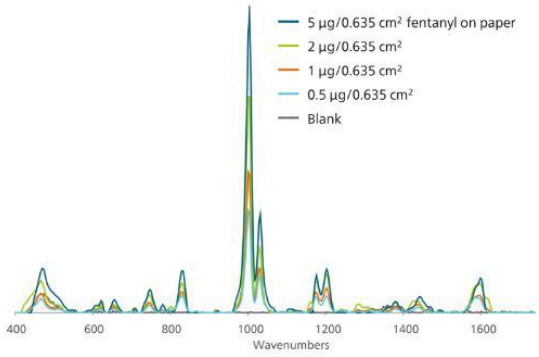
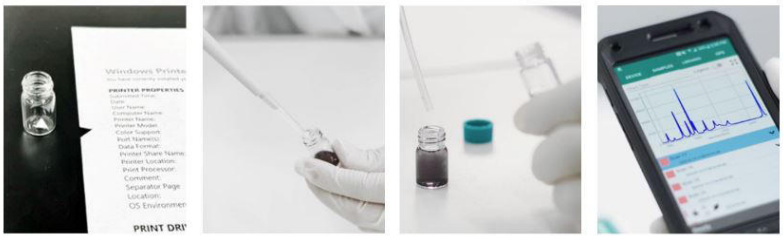


Figure 2. Strong SERS signature of fentanyl is detectable even at 0.5 ug—far below the typical dose of fentanyl in the real world.

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).

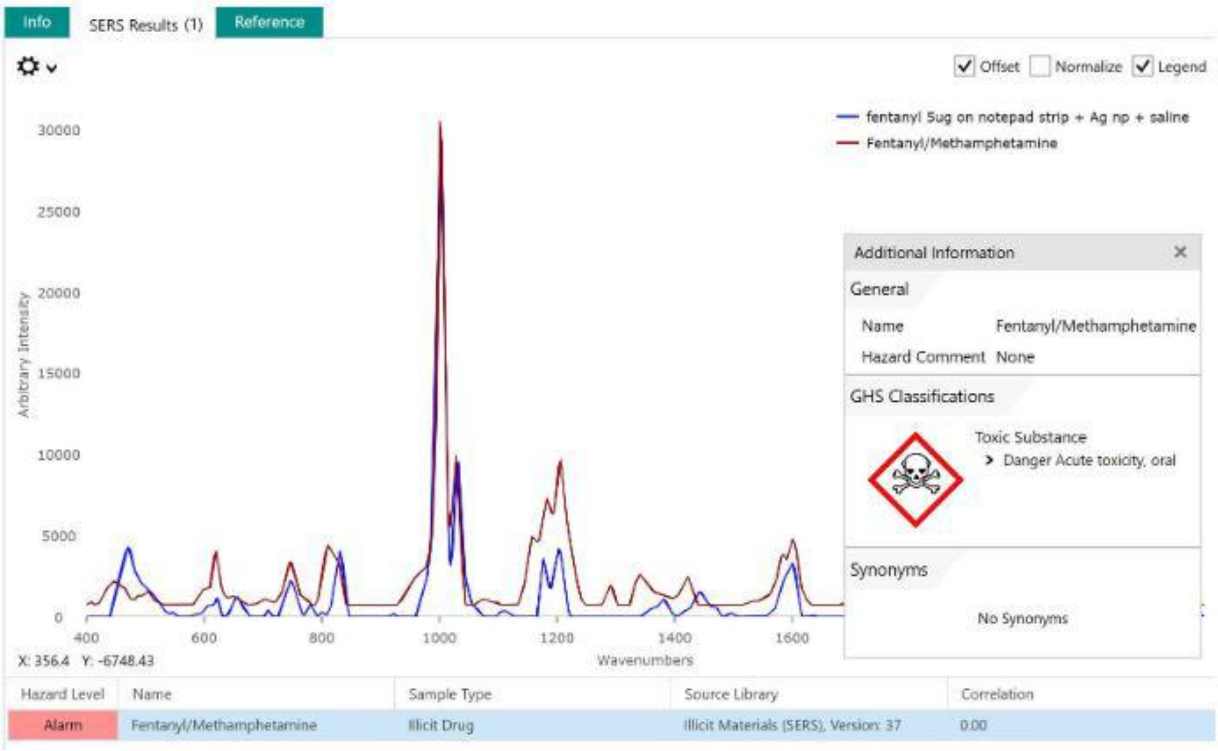


Figure 3. Positive ID of Fentanyl with GHS hazard warning.

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

CONTACT

Metrohm France
13, avenue du Québec - CS 90038
91978 VILLEBON COURTABOEUF CEDEX
info@metrohm.fr

CONFIGURATION

MISA Advanced

Metrohm Instant SERS Analyzer (MISA) est un système d'analyse portable hautement performant pour détecter ou identifier rapidement des traces de substances illicites, d'additifs et de contaminants alimentaires. MISA possède un spectrographe très efficace doté de la technologie ORS (Orbital Raster Scan) unique de Metrohm. Son encombrement est minimal et la durée de vie prolongée de la batterie en fait le système d'analyse idéal pour les tests sur site ou les applications de laboratoire mobiles. MISA propose divers accessoires laser de classe 1 pour des options d'échantillonnage flexibles. L'appareil d'analyse peut fonctionner via la connectivité BlueTooth ou USB.

Le module MISA Advanced est un ensemble complet qui permet à l'utilisateur d'effectuer des analyses SERS avec les solutions de nanoparticules de Metrohm et des bandelettes réactives P-SERS.

Le module MISA Advanced contient un embout de flacon MISA, un embout P-SERS, un standard de calibrage ASTM, un câble USB mini, un bloc d'alimentation USB et le logiciel MISA Cal pour le fonctionnement de l'appareil MISA. Une mallette de protection robuste est également fournie pour ranger l'appareil et ses accessoires en toute sécurité.

MIRA XTR Basic

MIRA XTR est une alternative pour les systèmes haute puissance 1 064 nm. Piloté par un traitement informatique avancé, MIRA XTR utilise une lumière laser de 785 nm plus sensible ainsi que des algorithmes XTR pour eXTRaire les données Raman de la fluorescence de l'échantillon. MIRA XTR dispose également d'un balayage de trame orbital (ORS, Orbital Raster Scanning) pour fournir une meilleure couverture de l'échantillon, augmentant ainsi l'exactitude des résultats.

Le package de base est un module d'entrée de gamme qui contient les composants de base nécessaires au fonctionnement du MIRA XTR. Le package de base comprend le standard de calibrage, l'embout universel intelligent et la bibliothèque de substances illicites. Fonctionnement en classe 3B.

MIRA XTR Advanced

MIRA XTR est une alternative pour les systèmes haute puissance 1064 nm. Piloté par une IA et une technologie d'apprentissage machine (« Machine Learning ») avancées, MIRA XTR utilise un laser de 785 nm plus sensible ainsi que des algorithmes XTR pour eXTRaire les données Raman de la fluorescence de l'échantillon. MIRA XTR dispose également d'un balayage de trame orbital (ORS, Orbital Raster Scanning) pour fournir une meilleure couverture de l'échantillon, augmentant ainsi l'exactitude des résultats.

Le pack MIRA XTR Advanced comprend standard de calibrage, embout universel intelligent, embout à angle droit, support pour flacons et accessoire SERS MIRA. Un package complet pour tous les types d'analyse. Fonctionnement en classe 3B.

Kit d'identification – nanoparticules d'argent (Ag NP)

Le kit d'identification Ag NP comprend les composants nécessaires à un utilisateur Mira/Misa pour une analyse SERS avec une solution d'argent colloidal. Le kit se compose d'une spatule à usage unique, d'une pipette compte-gouttes, d'un petit flacon d'échantillon et d'un flacon d'argent colloidal.