APPLICATION NOTE

Fig. 1 Clandestine drug labs are dangerous crime scenes for responders.

Detection of Fentanyl Using Portable GC/MS

Clandestine drug labs are not a new problem for responders, but they are growing in number and present potentially dangerous crime scenes. One of the greatest opioid threats facing responders today is fentanyl. Portable gas chromatography mass spectrometry (GC/MS) equipment can help hazardous materials (HAZMAT) response teams quickly identify white powders, like fentanyl, on-scene.

FENTANYL CHEMICAL RELEVANCE

Opioids are medically used for pain relief. One of the most common opioids is fentanyl (N-(1-(2-phenethyl)-4-piperidinyl-N-phenyl-propanamide), the effects of which are similar to heroin.[1] Fentanyl is listed as a Schedule II drug under the United States Code (USC) Title 21 Controlled Substance Act and is also controlled internationally under Schedule I of the Single Convention on Narcotic Drugs of 1961.[2,3] It is a favored painkiller because it is fast-acting. According to the Centers for Disease Control and Prevention (CDC), fentanyl is up to 100 times more potent than morphine and many times that of heroin.[4]

In the 1980s, fentanyl became infamous as a street drug. By the 2000s, drug dealers began adding fentanyl to heroin to create an even more intense high that onsets very quickly.[5] Misuse is on a significant rise due to the euphoric effect felt by the user. The ease of access has turned it into a global epidemic. Because of its high potency and the fact that users don't know how much to administer, fentanyl has led to a significant surge in overdose deaths. According to the CDC, "Overdose deaths involving synthetic opioids other than methadone, which includes fentanyl, increased by 72% from 2014 to 2015. Roughly 9,500 people died from overdoses involving synthetic opioids other than methadone in 2015."[6]

THREAT TO FIRST RESPONDERS

Fentanyl is most commonly distributed as a powder, pill, or patch (Figure 2). A person can overdose by simply touching or inhaling a small amount, presenting an incredibly dangerous threat to first responders, law enforcement officers, and even forensic chemists. "An amount the size of a few grains of sand of fentanyl can kill you," said Drug Enforcement Agency (DEA) Special Agent John Martin.[7] If fentanyl is suspected, the DEA recommends that law enforcement officers do not field test drugs.[8] Hazardous Materials Incident Response Teams (HMIRTs)

Fig. 2 Fentanyl is commonly distributed as a powder and looks similar to other illicit drugs found on the streets.

should be called to assess suspected clandestine labs (Figure 1).

CHEMICAL IDENTIFICATION USING GC/MS

HAZMAT responders must perform quickly and with limited dexterity when wearing Personal Protective Equipment (PPE). In a clan-lab, responders are responsible for data collection, sampling, and in some cases, analysis that leads to real-time decision-making. A GC-MS like the FLIR Griffin™ G510 can aid responders with decision-making by delivering quick identification of illicit drugs, synthetic analogues, and associated precursors. On-scene confirmation gives responders the actionable intelligence needed for timely law enforcement and remediation.

Fig.3 The Griffin G510 can be operated while wearing full PPE

The Griffin G510 is completely self-contained in a 36-pound box, including the batteries, carrier gas, and vacuum system. Responders can carry it into the clan-lab. It is IP65-rated, which means it is dust-tight and spray-resistant, adding flexibility to decontamination procedures. The G510 alerts the operator with visual alarm confirmation both on the handheld probe, as well as the on-board, 9-inch touchscreen. The large touchscreen can be operated by a responder while wearing full PPE (Figure 3).

HAZMAT responders can use the Griffin G510 to analyze all phases of matter (solid, liquid, gas). Its integrated survey mode capability identifies vapor phase chemical threats within seconds. This mode can be used to identify many chemical solvents found in a clan-lab. Its

Fig 4 Direct syringe injection performed on Griffin G510

integrated split/splitless liquid injector enables responders to perform direct syringe injection of prepared organic liquids. Any unknown powders retrieved from a clan-lab can be prepared for syringe injection. This same injector also accepts samples via the Prepless Sample Introduction (PSI) Probe. Direct solid samples in their native form (such as unknown powders) are placed into the PSI-Probe for analysis by GC/MS. The Griffin G510 reduces the burden of sample preparation for the operator and provides ultimate flexibility as the daily mission changes.

Standard analytical methods for the detection of drugs of abuse (including fentanyl and heroin) are included with the G510, and are linked to the full National Institute of Standards and Technology (NIST) Mass Spectral Library. Although the systems perform highly selective and sophisticated analysis, they display the results via a simplified user interface that expedites decision-making for both field operators and forensic chemists.

EXAMPLE ANALYSIS USING GRIFFIN G510

On the street, heroin is commonly cut with fentanyl. HAZMAT responders are likely to uncover both drugs in a single unknown powder sample. GC/MS is an ideal tool for clan-lab assessments, because it can separate out multiple drugs in a single, complex sample. One of the most common sample preparation techniques for unknown powders is a solvent extraction. This technique involves adding the powder to an organic-based solvent. A syringe is then used to extract a very small portion of the organic-based liquid sample and inject it into the GC-MS for analysis.

An organic sample was prepared and then extracted via 1 µL syringe. The sample was injected into the FLIR Griffin G510 (Figure 4). In this single GC/MS sample run, both fentanyl and diacetylmorphine (the most common chemical name for heroin) were detected in

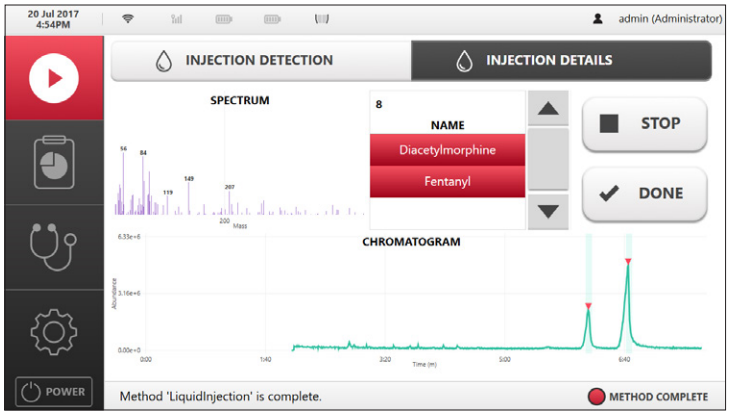

Fig 5 NIST confirmation showing both fentanyl and heroin detected in a single sample

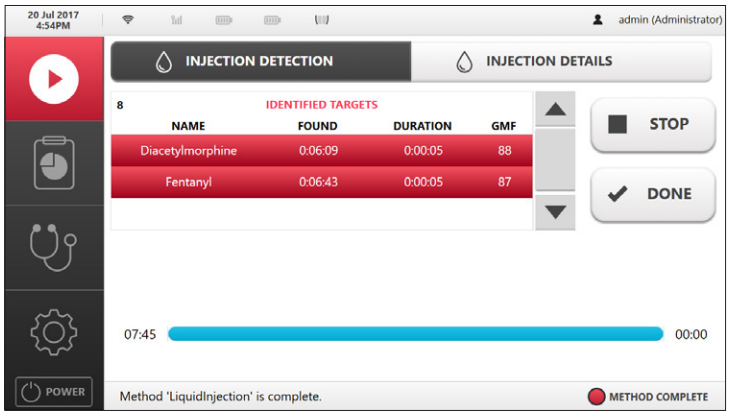

Fig. 6 Simple, color-coded alarm view identifying heroin and fentanyl

Fig. 7: Griffin G510 being used in Vapor Mode

less than ten minutes (Figure 5). Confirmation of the drug via a NIST match is presented. Figure 6 displays an alternative view of the results in a simple, color-coded alarm format.

Many chemicals can be detected and analyzed in the vapor phase, including solvents used in the production of narcotics. Pyridine is a common solvent used in the production of fentanyl and is likely to be discovered in a clan-lab scenario. The FLIR Griffin G510 was placed into Vapor Confirmation Mode and exposed to pyridine (Figure 7). The results in Figure 8 show the detection of pyridine in less than two minutes and is confirmed with a NIST match. Figure 9 displays an alternative view of the results, a color-coded alarm with identification of pyridine.

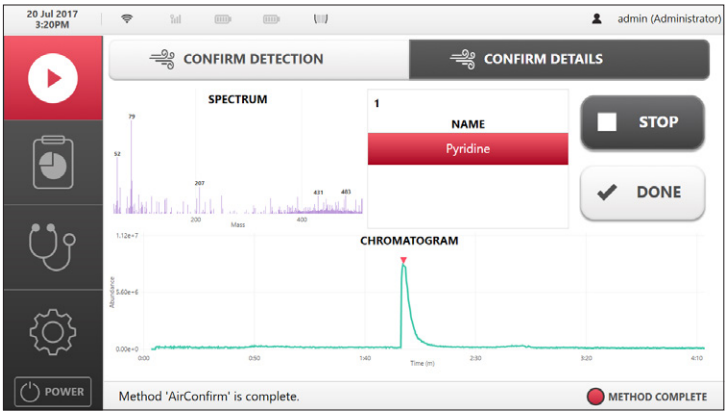

Fig. 8 NIST confirmation showing pyridine detected while in Vapor Mode

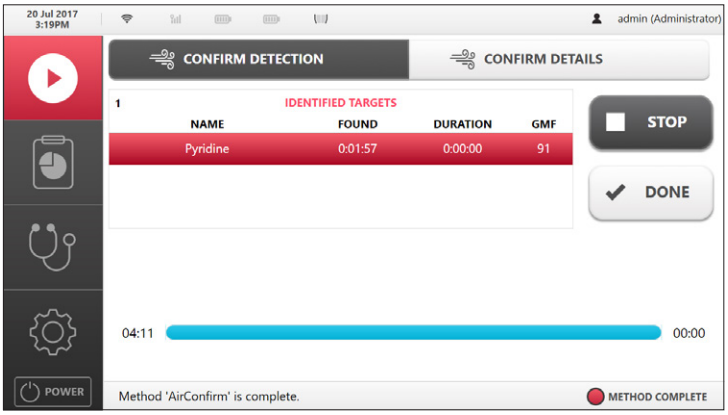

Fig. 9. Simple, color-coded alarm view identifying the presence of pyridine

SUMMARY

GC/MS has long played a critical role in traditional laboratory-based chemical analysis, and is the gold-standard for forensic analysis. But chemical emergencies rarely occur in the safety of a laboratory as evidenced by the rise in street drugs and clan-labs. Chemical emergencies can happen anywhere, extending the need for GC-MS equipment beyond the lab. Person-portable GC-MS systems, like the FLIR Griffin G510, provide the ability to confirm clandestine production of illicit drugs via same day analysis.

SOURCES

1 Source: PubChem; URL: https://pubchem.ncbi.nlm.nih.gov; Description: Data deposited in or computed by PubChem.

2 Title 21 United States Code (USC) Controlled Substances Act; Information retrieved from https://www.deadiversion.usdoj.gov/21cfr/21usc/812.htm July 2017.

3 United Nations Conference for the Adoption of a Single Convention on Narcotic Drugs. (1962). Single convention on narcotic drugs, 1961. New York: United Nations. https://www.incb.org/documents/Narcotic-Drugs/1961-Convention/convention_1961_en.pdf

4 Information retrieved from https://www.cdc.gov/drugoverdose/data/fentanyl.html July 2017.

5 Whitehead, Nadia. 2015, Aug 26. "How The Prescription Painkiller Fentanyl Became A Street Drug." Retrieved online http://www.npr.org/sections/health-shots/2015/08/26/434867357/how-the-prescription-painkiller-fentanyl-became-a-street-drug July 2017.

6 Rudd RA, Seth P, David F, Scholl L. Increases in Drug and Opioid-Involved Overdose Deaths — United States, 2010–2015. MMWR Morb Mortal Wkly Rep 2016;65:1445–1452. DOI: http://dx.doi.org/10.15585/mmwr.mm655051e1.

7 Sidner, Sara. 2016, June 3. "Fentanyl: The powerful opioid that killed Prince." Retrieved online http://www.cnn.com/2016/05/10/health/fentanyl-new-heroin-deadlier/index.html July 2017.

8 Information retrieved from https://www.cdc.gov/niosh/topics/fentanyl/risk.html July 2017.

FLIR Systems, Inc.
27700 SW Parkway Ave,
Wilsonville, OR 97070
+1.877.692.2120
detection@flir.com

For more information about chemical, biological, radiological, and explosives detection solutions, or about this specific application, please visit: www.flir.com/detection

The World's Sixth Sense®