B86 Effective Field Analysis of Low-Dose Fentanyl Mixtures by Portable Vibrational Spectroscopy and Portable Gas Chromatography/Mass Spectrometry (GC/MS)

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Learning Overview: After attending this presentation, attendees will understand how portable Infrared (IR) spectroscopy and GC/MS can be used in the field to accurately identify fentanyl in low-dose tablets.

Impact on the Forensic Science Community: This presentation will impact the forensic science and law enforcement communities by providing new information regarding the on-scene analysis of low-dose illicit fentanyl tablets by portable instrumentation.

Fentanyl is a potent, synthetic opioid that has caused tens of thousands of deaths since 2013, the start of the latest opioid epidemic.[1] It has been used historically as a powerful pain reliever but recently has become extensively abused. Fentanyl has been found in combination with several other drugs of abuse such as heroin and cocaine, frequently pressed into tablets, whether on its own or in conjunction with other active ingredients and additives. The availability of fentanyl in street samples poses a risk not only to users who may not be aware that their drug of choice may now also contain fentanyl, but also to law enforcement personnel who are responding to scenes of illicit manufacture, selling, or overdoses. When encountering fentanyl that is not legally manufactured, the amount of fentanyl present in the tablet is unknown and potentially fatal.

The availability of fentanyl in pressed tablets poses a unique issue. The fentanyl that is present in these tablets is commonly a very low amount (~1%) and therefore not easily identified by traditional field means. Because traditional field-testing methods routinely deployed may not be able to detect such low amounts of fentanyl relative to other filler ingredients, there has arisen a need to develop more effective methods of analysis.

This research was conducted by making and analyzing mixtures of various percent compositions of fentanyl in additives. Mixtures ranged from 50% active ingredient to 1% active ingredient of fentanyl in combination each with acetaminophen, lactose, and mannitol. A mannitol:fentanyl:heroin mixture was also made in ratios of 65:10:25 and 32.5:5:12.5. Each mixture was analyzed as a solid in triplicate on a next generation portable IR spectrometer equipped with a diamond Internal Reflection Element (IRE) for Attenuated Total Reflection (ATR) analysis. This instrument is capable of achieving lower detection limits than other available portable IR instruments because of higher throughput optics and targeted library-search algorithms. Results showed that fentanyl was identifiable down to 1% (w/w) in both mannitol and lactose using this new portable IR spectrometer. For the mixture in acetaminophen, the major fentanyl peaks overlap with those of the acetaminophen, which prevent detection at low levels, thus extractions were required. Two base-extraction protocols were evaluated using the 1% mixtures of fentanyl: (1) 1M sodium hydroxide and chloroform, and (2) 1M sodium hydroxide and hexane. The organic layer containing fentanyl was directly analyzed by putting a drop or two of the extract onto the IRE, then allowing the solvent to evaporate. Both of these extraction methods were successfully able to remove all detectable acetaminophen and enable easy fentanyl identification from these low dose mixtures.

Portable GC/MS is emerging as a valuable tool for the on-scene detection and identification of illicit drugs. However, low-dose tablets present a challenge for these instruments because the high quantity of adulterant (in relation to the quantity of fentanyl) saturates the MS, which then requires significant maintenance and cleaning. Thus, the fentanyl extracts were also analyzed using a portable GC/MS equipped with simplified sampling. The portable GC/MS positively identified fentanyl in extracts made from both previously described methods.

This research demonstrated that portable IR spectroscopy and GC/MS are valuable tools for law enforcement and other first responders for the field identification of low-dose fentanyl tablets.

Reference(s):

1. Scholl, L., Seth, P., Kariisa, M., Wilson, N., Baldwin, G. Drug and opioid-involved overdose deaths – United States, 2013-2017. *Morbidity and Mortality Weekly Report, 2019*, 67. http://dx.doi.org/10.15585/mmwr.mm675152e1.

Fentanyl, Field Analysis, Portable Instrumentation

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