



Young Forensic Scientists Forum— 2019

Y8 The Analysis of Fentanyl Analogs by Gas Chromatography/Solid State Infrared Spectroscopy (GC/IR)

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Learning Overview: After attending this presentation, attendees will be introduced to a new method that meets the Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG) guidelines for the analysis of fentanyl and its analogs.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by allowing forensic labs and scientists to utilize a new method for the analysis of fentanyl and its increasing analogs.

An investigation of the analysis of fentanyl and ten fentanyl analogs by GC/IR has been performed. GC was performed using an Agilent® 6890N gas chromatograph. IR spectroscopy was performed on a Spectra-Analysis® DiscovIR-GC® using an operation system with Thermo™ Galactic™ GRAMS 8.0. The cryofocused disk was cooled with liquid nitrogen to -40°C and the dewar was set to 20°C for all experiments. GC/solid-state IR spectroscopy has shown to be capable of identification of fentanyl and ten of its analogues (4-ANPP, acetyl fentanyl, acryl fentanyl, alfentanyl HCl, butyryl fentanyl, cyclopropyl fentanyl, crotonyl fentanyl, furanyl fentanyl, isobutyryl fentanyl, valeryl fentanyl). The method, using the conditions in this study, is capable of producing a reproducible quality solid-state IR spectrum from injection of 1µL of a 1mg/mL methanolic solution of sample onto a chromatographic column. Using the chromatographic conditions in the method developed, most of the fentanyl analogues can be separated such that IR spectra can be produced for identification of the compound. Most of the fentanyl analogues were separated with 99% confidence (s=3sd.) except for three pairs, isobutyryl fentanyl/fentanyl, fentanyl/acryl fentanyl, and butyryl fentanyl/cyclopropyl fentanyl. Multiple injections of the fentanyl compounds resulted in reproducible retention times (standard deviation=0.023 and a CV% of 0.012 %). The data also produced spectra containing absorption peaks with an average standard deviation=0.272 and an average CV%=0.022, showing good reproducibility for the IR spectra. The solid-state IR spectra of fentanyl and the ten fentanyl analogues analyzed in this study were quite similar but were easily discriminated by comparison of the fingerprint region of the spectrum. The amide region (1,650cm⁻¹) clearly showed different absorption peaks and pattern as well as the region for the C-H stretches of the aromatic and alkyl region (2,700cm⁻¹-3,050cm⁻¹) and the spectral region between 1,200cm⁻¹ and 1,500cm⁻¹. The linear retention indices for the fentanyl compounds were calculated using a qualitative retention index standard mixture.

Overall, GC/solid-state IR spectroscopy is a viable and reproducible method for the analysis and identification of fentanyl and fentanyl analogues that may be found in seized drug material.

Fentanyl, Gas Chromatography, Infrared Spectroscopy