Introduction

A developing problem within the illicit drug market is the increasing use of opioids and their analogues. Among these opiates is the potent synthetic analgesic, fentanyl. Fentanyl is 50 – 100 times stronger than morphine. It is a very powerful opiate agonist of μ-opioid receptors in the brain. Fentanyl drugs can be classified into registered therapeutic fentanyl and illicitly produced fentanyl and its analogues. One of the illicitly produced analogues that has recently been encountered within forensic laboratories is fluorofentanyl. Para-fluorofentanyl activates the human μ-opioid receptor with greater potency than fentanyl.

Para-Fluorofentanyl is the only isomer that is federally controlled by the DEA. Para-Fluorofentanyl is federally a Schedule I controlled substance. The ortho and meta isomers are currently not federally scheduled. Differentiation of these isomers can be achieved via infrared spectroscopy. DiscovIR® coupled with a Dani-GC offers forensic chemists conclusive infrared spectra for each compound in a mixture. This application will show the analysis and differentiation of the fluorofentanyl isomers.
**DiscoviR-GC® Fluorofentanyl Isomers**

The fluorofentanyl isomers were purchased from Cayman Chemical. A 1mg/mL concentration of each compound was made in MeOH. Each compound was basified with 0.5M NaOH and extracted with CHCl₃. The resulting extract was placed into a normal GC vial with screw cap fitted with a low volume insert. Each isomer was analyzed via a Dani-GC coupled with a DiscoviR® infrared detector. Collection occurs onto a ZnSe disc super-cooled with LN2. Thus, separation of any mixture is achieved with the GC, with the resulting IR collected in a solid phase. Solid phase collection results in improved resolution when compared to gas phase or light pipe technology.

The compounds were analyzed singularly as well as made into a mixture. Mixture concentration of 0.33mg/ml and split ratio of 5:1 places 67ng of each isomer onto the column. A 15-meter column with 0.25mm ID and 0.25µm film thickness of DB35 was used for analysis of each compound as well as to provide adequate separation of the mixture of the compounds. The infrared spectrum of each compound is depicted below.
Gas Chromatogram of a Mixture of Fluorofentanyl Isomers by FTIR

Expanded Fingerprint Region of Fluorofentanyl Isomers

Meta, Para, and Ortho Fluorofentanyl Isomers in order of elution

DB-35 Column 15M, 0.25um film thickness and 0.25mm ID

180 degrees C initial temperature ramp 25 degree C/min to a final temp of 300 degrees C with 1 minute hold time
**DiscovIR-GC® Fluorofentanyl Isomers**

Top four reasons to purchase a DiscovIR-GC system:

1. Spectral Resolution
2. Sensitivity – ng level of nonadecane, <100ng level of most controlled substances
3. Compatible with most existing solid phase (ATR) IR libraries
4. Compatible with existing GC-MS columns and methods, no need for customer to change to unknown columns or methods

<table>
<thead>
<tr>
<th><strong>DiscovIR-GC® Specifications</strong></th>
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<tbody>
<tr>
<td>Infrared Spectrum Range</td>
<td>4000-700 cm(^{-1})</td>
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<tr>
<td>Resolution</td>
<td>4 cm(^{-1})</td>
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<tr>
<td>Spectrum Type</td>
<td>Transmittance</td>
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<tr>
<td>Re-Usable ZnSe Sample Disc Capacity</td>
<td>50 hours</td>
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