B161 Heroin Identification by Fourier Transform Infrared/Attenuated Total Reflectance (FTIR/ATR) Spectroscopy on Petroleum Ether-Based Extracts

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Learning Overview: The goal of this presentation is to train analysts, chemists, and criminalists in efficient, effective ways to analyze suspected heroin samples through IR on petroleum ether (pet ether) -based extracts to reduce backlogs while maintaining high quality.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating the feasibility of FTIR spectroscopy with ATR to identify heroin in pet ether-based extracts of suspected heroin street samples. By incorporating this IR spectroscopic technique into heroin analysis, drug analysts, criminalists, and chemists can complement or even replace Gas Chromatography/Mass Spectrometry (GC/MS) and microcrystalline methods for increased efficiency while maintaining quality and effectiveness. The impact of adopting this technique results in faster identification of heroin in complex mixtures and potentially lowers backlogs while achieving the highest possible selectivity through structural information.

Because heroin (diacetylmorphine) has been a major factor in the current opioid crisis and epidemic, this study has explored ways to supplement current analysis techniques for seized suspected heroin samples. Such seized samples represent a significant portion of cases and can present themselves in various forms of mixtures—as tar-like gummy or chunky material, brown powders of various shades, or off-white powders. For years, pet ether-based extracts have been used for microcrystalline testing to identify heroin, in conjunction with color testing. Acid/base chemistry is used along with the selective solubility in hydrocarbon solvent to achieve separation of heroin (base) from other components for microcrystalline testing. Moreover, this study has also explored ways to reduce potential exposure to hazardous chemicals and ease the production of reviewable data.

To build on the microcrystalline approach using a Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG) Category B technique, it was logical to examine the pet ether extracts using FTIR/ATR, a SWGDRUG Category A instrumental technique. Starting from about 50mg of seized drug mixture, the process of the base extraction with sodium carbonate solution and isolation with pet ether is outlined, followed by drying of the pet ether with sodium sulfate, then air evaporation of the solvent. The extraction takes around five to ten minutes, followed by FTIR/ATR data collection on the remaining dried solid for one minute. By contrast, GC/MS analysis data collection could take 30–40 minutes, including the blank run before the sample. After the analysis of 200 casework samples, a summary of the results from IR spectroscopy is presented and supported by GC/MS data. In over 90% of the samples, the resulting FTIR spectrum could be identified as heroin (base). For about 7% of the samples, the FTIR spectrum was less clear and could only indicate the presence of heroin. The advantages of the whole procedure are listed (ease, efficiency, confirmatory results, and applicability for all types of samples), along with some limitations and caveats (required sample size greater than 100mg, insufficient data for multiple drugs, and no inference to original salt form). Overall, the results show that the FTIR/ATR technique on pet ether-based extracts is a feasible, efficient, and effective tool for routine heroin identification in seized street samples.

Heroin, FTIR, Petroleum Ether

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