B168 The Identification of Phencyclidine (PCP) and Designer PCP Analogs Using Microcrystalline Tests Followed by Raman Microspectroscopy

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Learning Overview: After attending this presentation, attendees will understand a new protocol that is fast and confirmatory for the identification of phencyclidine (PCP) and several designer PCP analogs that simultaneously incorporates microcrystalline tests and Raman microspectroscopy.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating the effectiveness of a novel drug analysis technique, which has the potential to be used in forensic laboratories for the identification of new designer drugs.

Designer drugs are compounds being synthesized and distributed to circumvent drug schedules and the legal system. It is the duty of a forensic scientist to identify the chemical structures of these compounds in today's evolving drug market. This has created an immense challenge in crime laboratories across the world.[1-3] Color tests are widely used for preliminary screenings and are most often paired with mass spectrometry, the current gold standard for confirmatory drug analysis.[4] These techniques have proven to be consistent and reliable when analyzing traditional drugs of abuse like cocaine, heroin, and amphetamines. However, they are not universal, and the emergence of designer drugs has posed a hindrance on the traditional analytical procedures. Due to accreditation standards, a lab must go through rigorous method development and validation to analyze new drug compounds within their standard operating procedures. Understanding the chemistry of a new drug takes time and resources. This issue has sparked a need for re-evaluation of standards for the analysis of new emerging drugs, especially regioisomers of traditional drugs.

In this study, PCP and twelve designer PCP analogs (tenocyclidne, rolicyclidne, benocyclidine, phencyclamine, eticyclidine, 3-methoxy phencyclidine, 4-methoxy phencyclidine, PCEEA, PCMPA, 3-methoxy eticyclidine, methoxetamine, diphenidne) were subjected to microcrystalline tests followed by Raman microspectroscopy on the successfully grown microcrystals. The method proved reproducible through replicate examinations over several days. A microcrystalline test method for each compound was developed using exact concentrations and volumes to eliminate the ambiguity of previous microcrystalline testing. Additionally, a Raman microspectroscopy method was developed to ensure high quality spectra and the ability to identify the original compound. The combination of these two analytical techniques adhere to the recommendations described by the Scientific Working Group for the Analysis of Seized Drugs.[5] A recent study has demonstrated the viability of utilizing microcrystalline tests in tandem with Raman microspectroscopy for the identification of designer drugs.[6]

Microcrystal properties such as shape, habit, time of growth, color, retardation colors, type/angle of extinction, and sign of elongation (when applicable) were observed and documented. These optical properties were proven effective in distinguishing structurally similar compounds. Using pictures and descriptions, microcrystalline test results for PCP and designer PCP analogs previously documented will be presented here in a clear, more detailed fashion. Results for compounds not yet analyzed in literature are described in the same manner.

Analysis with a Raman microscope was able to provide structural information on the microcrystals. A library containing pure drug spectra was used to compare drug microcrystal spectra and ultimately identify the original compound. Further spectral comparisons indicated peak shifts along with the addition or subtraction of specific peaks for each microcrystal.

This presentation will demonstrate the utility of microcrystalline tests followed by Raman microspectroscopy for the identification of PCP and designer PCP analogs. While this research focuses on a specific structural class, the analytical procedure can be applied to all other classes for fast and confirmatory identification.

Reference(s):

1. Khandasammy S R, Fikiet M A, Ahmed Y, Halamkova L, Bueno J, Lednev I K. Bloodstains, paintings and drugs: Raman spectroscopy applications in forensic science. *Forensic Chemistry* 2018;8:111-133.
2. Anstett A, Chu F, Alonso D E, Smith R W. Characterization of 2C-phenethylamines using high-resolution mass spectrometry and Kendrick mass defect filters. *Forensic Chemistry* 2018;7:47-55.
3. Mohr A L.A., Friscia M, Yeakel J K, Logan B K. Use of synthetic stimulants and hallucinogens in a cohort of electronic dance music festival attendees. *Forensic Sci Int* 2018;282:168-178.
4. Harper L, Powell J, Pijl E M. An overview of forensic drug testing methods and their suitability for harm reduction point-of-care services. *Harm Reduction Journal* 2017 Jul;14:53.
5. United States Department of Justice Drug Enforcement Administration. *Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG) Recommendations*, Version 7.1. 2016.
6. Elie L, Elie M, Cave G, Vetter M, Croxton R, Baron M. Microcrystalline testing used in combination with Raman micro-spectroscopy for absolute identification of novel psychoactive substances. *Journal of Raman Spectroscopy* 2016 Nov;47(11):1343-50.

Designer Drugs, Microcrystalline Tests, Raman microspectroscopy