RAPID IDENTIFICATION OF NOVEL PSYCHOACTIVE SUBSTANCES (NPS) USING HANDHELD 1064 nm RAMAN

NPS: A Complex and Diverse Global Health Threat

Available through many sources, novel psychoactive substances (NPS) continue to rapidly emerge on the global market at an unprecedented rate. According to the World Health Organization (WHO), these substances pose "a threat to human health and well-being."[1] Illegal or marketed as pure 'legal highs,' the effects mimic traditional drugs. Global reporting of newly introduced NPS preparations is a growing challenge along with full knowledge of the health dangers and social ramifications.

NPS compounds are synthesized using a number of chemicals, including pharmaceutical and dietary supplement components. In one study, 8 out of 10 NPS products purchased online were found to contain ingredients and impurities inconsistent with the product labeling.[2]

Rapid identification in the field is vital to determine if substances are legal or illegal, reducing supply and collecting data on emerging NPS mixtures and use trends. However, identification and detection continues to be an issue because of varying complex and diverse mixtures and their similarity to like-drugs.

Handheld Raman: 1064 nm Overcomes Analysis Limitations

The benefits of handheld Raman technology for chemical identification in the field are well known. Handheld Raman systems have evolved in recent years. Studies utilizing new generation Raman technology demonstrate the advantages of longer wavelength systems - "it is recommendable to focus on 1064 nm systems because a lot of NPS cause fluorescence with 785 nm systems."[3]

Sample-induced fluorescence interference is naturally occuring, especially with chemicals that are impure or colored.

Fluorescence limits accurate and timely chemical identification by overwhelming the chemical's "signature" spectral peaks. It is experienced most frequently at 785 nm, 830 nm, and 1030 nm-based Raman systems.

Figure 1 shows result from a comparative analysis of SNOW performed as part of the "Spice II plus" project.[3] The 1064 nm Rigaku analyzer generated clear spectral peaks. Analysis was performed through a plastic bag.

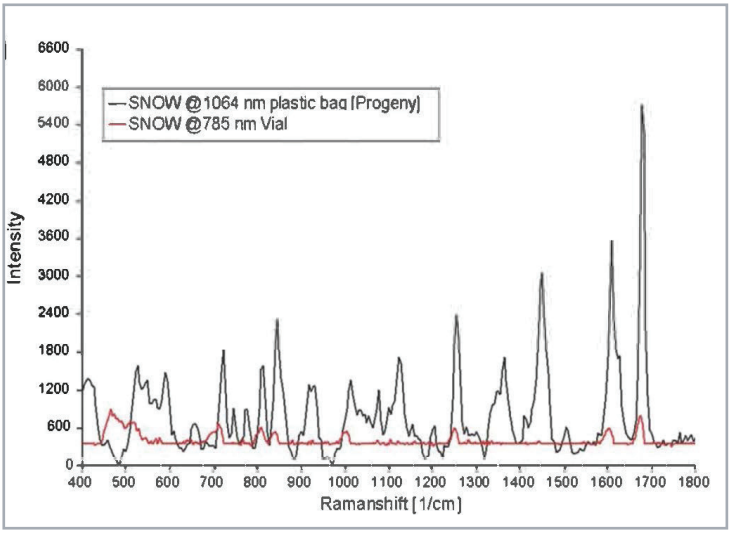


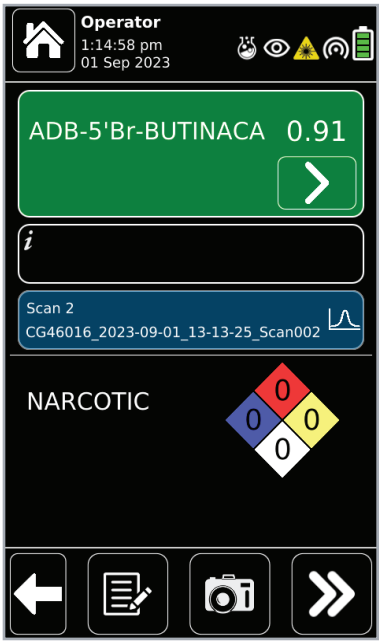
Figure 1. Results from a comparative analysis of SNOW performed using a 785 nm Raman analyzer vs. a 1064 nm Raman analyzer.

NPS Identification: Accuracy and Efficiency

"Post processing of raw data can cause identification problems."[4]

It is important to note that some spectral massaging techniques / algorithms actually result in loss of critical spectral peaks required for positive NPS identification. The Rigaku Series of CQL analyzers better identify the true chemical fingerprint, resulting in accurate and timely compound identification.

In another study by Waynesburg University, a handheld Raman unit utilizing a 785 nm laser excitation source reported scan times of up to 29 minutes for a single sample.[5] In comparison, the Rigaku handheld Raman analyzer provides results in minutes, with a typical analysis time in under 1 minute.



Example of a result for a cannabinoid using a Rigaku 1064 nm Raman analyzer.

Data and User Traceability

Traceability is essential for protecting the integrity of analysis results. To meet this requirement, the Rigaku CQL Series analyzer ensures integrity by recording and retaining the complete history of any and all changes made to the device. Substances cannot be deleted from the master library. Additions to custom created user libraries are recorded and retained. User activity is tracked. All data in non-editable files that cannot be accessed or altered to prevent accidental or intentional corruption.

Extending the Utilization of the Chemical Identification Device

With the introduction of new handheld Raman analyzers, integrating capabilities expands utilization and provides the best return on investment for users. Features on the Rigaku unit include an onboard camera for documenting samples, an easily expandable library, and rapid data transfer all extend the usefulness of the device. 4C™ Technology automatically warns the user of individual scan results for potential recipe combinations. QuickDetect Mode provides the user the ability to scan non-visible substance.

Conclusion

The chemical specificity and mobility of Rigaku's 1064 nm Raman series make them an effective device for the identification of NPS compounds. Numerous studies have proven that 1064 nm laser excitation provides distinct advantages for accurate and timely substance detection. The unique features of the Rigaku unit expands field analysis and supports efforts to reduce the supply of new psychoactive substances from the streets, helping to ensure public safety.

References

1. Executive Board 139th session. World Health Organization. 27 May 2016. http://apps.who.int/iris/bitstream/10665/250813/1/B139_12-en.pdf?ua=1.

2. Sulaf Assi, David Osselton, Bethany Wallis. (2016). The Evaluation of Dual Laser Handheld Raman Spectroscopy for Identifying Novel Psychoactive Substances. American Pharmaceutical Review.

3. Amira Guirguis, Sarah Girotto, Benedetta Berti, Jacqueline L . Stair, Abstr Identification of new psychoactive substances (NPS) using handheld Raman Spectroscopy employing both 785 and 1064 nm laser sources., Forensic Science International http://dx.doi.org/10.1016/j.forsciint.2017.01.027

4. Sarah Harkai; Michael Putz. Comparison or rapid detecting optical techniques for the identification of New Psychoactive Substances in 'Legal High' preparations. Society of Toxicological and Forensic Chemistry Proc: XIX. GTFCH-Symposium, 16.-18.04.2015. Toxichem Krimtech Jahrgang 39- Band 82 Special Issue (April 18, 2015); https;//www.gtfch.org/cms/images/stories/media/tb/tb2015/Harkai_Putz_2015.pdf

5. Kimberly Patnaude, Michael Cipoletti., Portable Raman Analyzer's Performance in The Detection of Controlled Drugs. Waynesburg University. http://www.waynesburg.edu/docman/73-portable-raman-analyzers-performance-in-the-detection-of-controlled-drugs/file

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