

# Using Handheld Raman Spectroscopy

## Synthetic Marijuana: Field Identification of Bulk and Sprayed Cannabinoids

### Overview

Synthetic narcotics are sweeping across the globe—the latest threat, a group of psychotropic herbal products known as cannabimimetic indoles or more commonly, synthetic cannabinoids or “fake pot.” Spice, K2 and “legal highs” are some street names for these herbal incense products being sold illegally worldwide. Often shipped as bulk powder across borders, the compounds are then sprayed on plant-based material to be smoked. A key challenge—as with cathinones (“bath salts”) and other rapidly evolving threats—is to provide law enforcement and customs agencies the means to robustly identify these emerging narcotic threats however they’re found, whether in bulk or as sprayed cannabinoids.

According to Drug Enforcement Administration (DEA), U.S. Customs and Border Protection first encountered synthetic cannabinoids in the United States in November 2008. Prior to arriving in the U.S., synthetic cannabinoids were marketed as herbal incense products in several Asian and European countries. Some countries banned these products after experiencing numerous health-related incidents.

### Synthetic cannabinoids

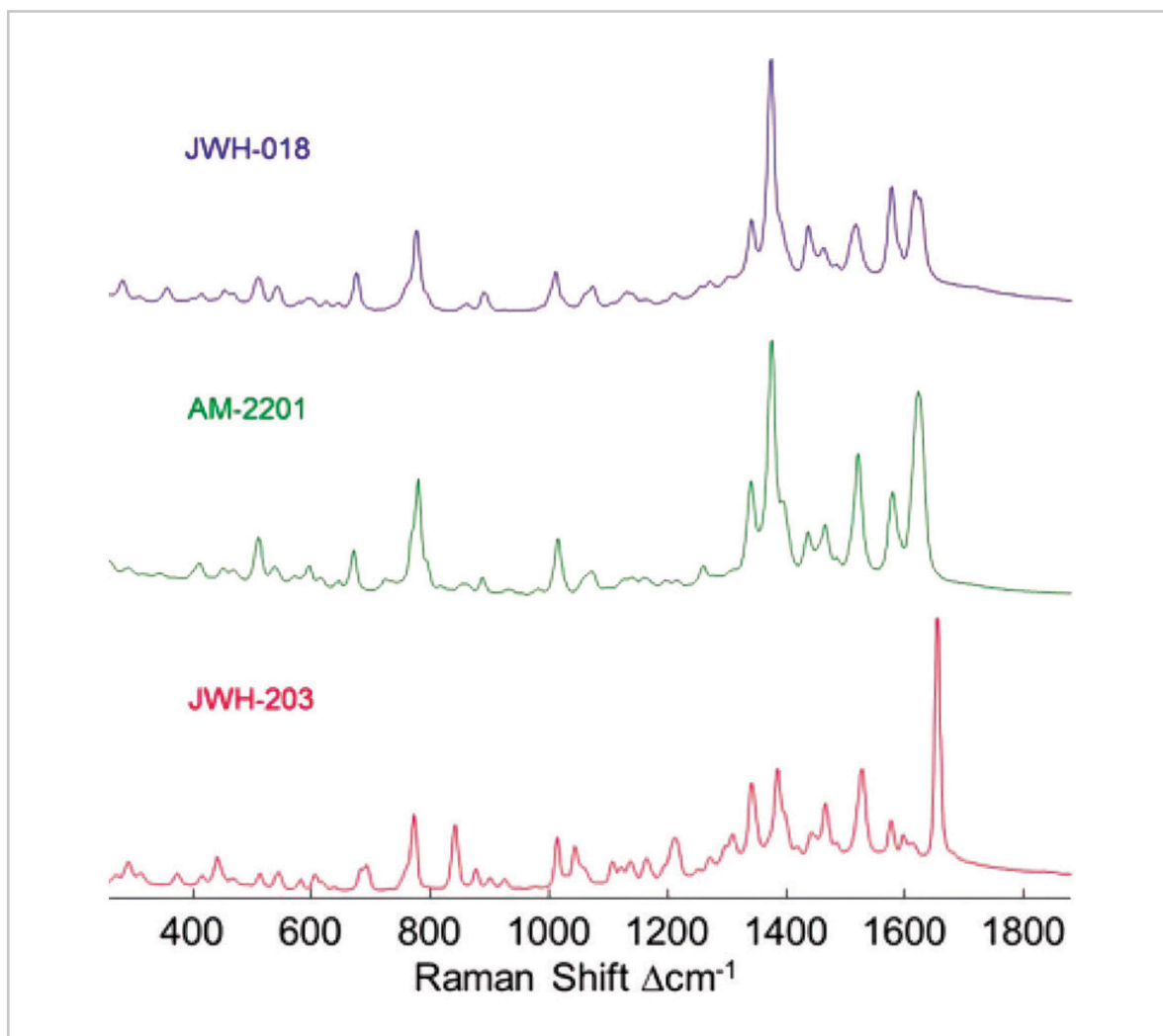
This group of narcotics was originally developed in academic and pharmaceutical labs to explore the affinity to cell receptors compared to naturally occurring psychoactive cannabinoids such as  $\Delta\Delta^9$ -tetrahydrocannabinol (THC) found in marijuana, in the hope of developing new medicines. Although synthetic molecules such as JWH-018 and AM-2201 have vastly different chemical structures than naturally

occurring THC, the synthetic molecules have affinities for cannabinoid receptors that are comparable or even more potent than THC—making them attractive for development as medicines, but, unfortunately, also as illegal narcotics.



### Raman Spectroscopy

Raman spectroscopy is well suited to identify these new synthetic drugs as well as more conventional narcotics such as cocaine, amphetamine, methamphetamine, heroin, and MDMA. Raman spectroscopy has been extensively deployed for use in security applications, due in large part to high chemical specificity, with each chemical having a unique spectral fingerprint. See Figure 1 for examples of unique spectral “fingerprints” for three different synthetic cannabinoid molecules.



**Figure 1. Spectral fingerprint of three narcotics, highlighting the high degree of specificity for different synthetic cannabinoids.**

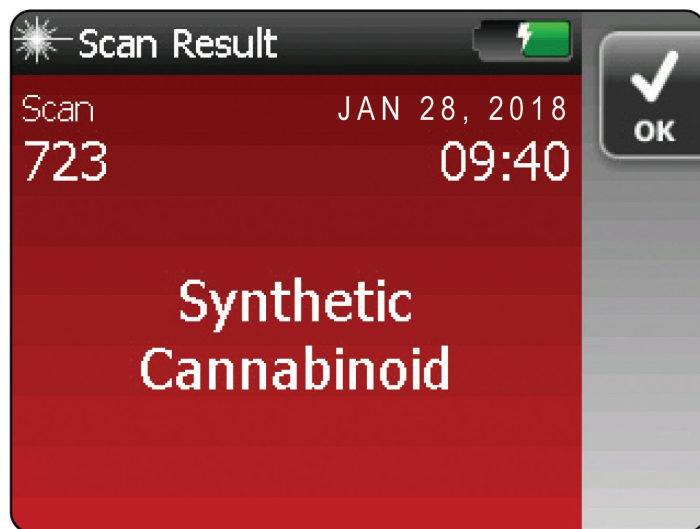
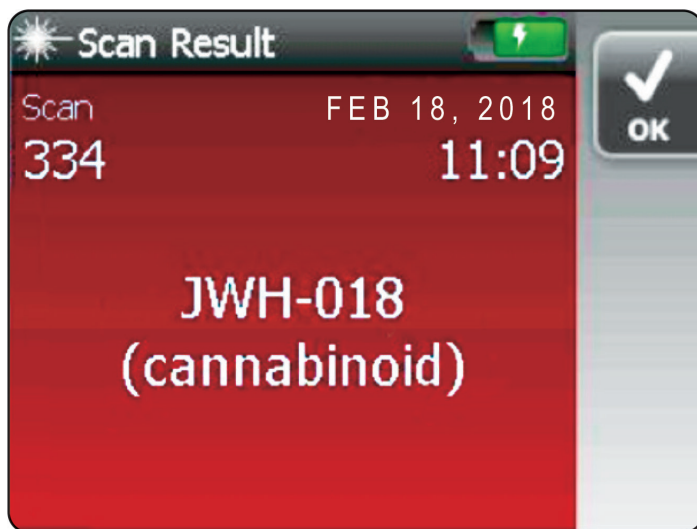
### Thermo Scientific TruNarc

Handheld Raman instruments bring this powerful laboratory technique directly to the point of need. The Thermo Scientific™ TruNarc™ analyzer enables identification of both forms of cannabinoids, bulk and sprayed, as well as numerous other controlled substances in a single test. Weighing just 1.25 lbs (570g), it can be easily transported and used on the street, in a police station, airport arrivals hall, or cargo facility, or as a primary screening tool in a forensic laboratory.

The TruNarc analyzer is designed specifically to meet the needs of the law enforcement community, enabling rapid, precise analysis of a broad range of controlled substances, cutting agents, and precursors. The TruNarc library includes dozens of the most prominent synthetic cannabinoids and is updated regularly to address new emerging threats. The

device collects the molecular fingerprint of an unknown sample, and then compares the fingerprint against the onboard chemical library using sophisticated matching algorithms. Easy-to-interpret results are presented in a matter of seconds, color-coded to distinguish between result type. See Figure 2 for sample alarm result screens. Raman instruments excel at identifying liquids, gels, pastes and light colored solid materials (including tablets and the contents of capsules).

In addition to analysis of bulk synthetic cannabinoids, users can also identify synthetic cannabinoids after they have been sprayed onto plant material by using a Solution Kit (Type H). Using the test stick, users scoop a small amount of the leaf material into the solvent vial, stir the leaf material, then place the test stick on the TruNarc nosecone for analysis once dried.



**Figure 2. Left – Alarm screen for a bulk synthetic cannabinoid. Right – Alarm screen for synthetic cannabinoid when using the Type H kit.**

The test stick has a roughened metal surface which enhances the Raman signal of the molecules adsorbed onto the surface, in this case the synthetic cannabinoids. This allows analysis of very small amounts of narcotic. As with a point-andshoot analysis, the on-board algorithms compare the data collected from analysis of the test stick to the library. If it is consistent with a synthetic cannabinoid, the unit will display a red alarm screen for “Synthetic Cannabinoid” as shown in Figure 2.

### Summary

Synthetic cannabinoids represent the next wave of synthetic narcotics facing law enforcement and forensic labs worldwide. The TruNarc analyzer enables law enforcement personnel to quickly identify multiple suspected drugs—including bulk and sprayed forms of synthetic cannabinoids—in one single test. It leverages widely accepted Raman spectroscopy in a compact, handheld instrument to identify numerous drugs of abuse including emerging narcotics, stimulants, depressants, hallucinogens, and analgesics.

### Health Impact

According to the National Institute on Drug Abuse, while there have been no scientific studies on the effect of synthetic cannabinoids on the brain, it is known that they act on the same receptors as THC, leading to similar experiences as those produced by marijuana consumption. However, some of the synthetic compounds bind more strongly to the receptors, which can lead to a more powerful—and unpredictable— effect. Some users report psychotic effects like extreme anxiety, paranoia, and hallucinations as well as elevated heart rate, vomiting, agitation and confusion. Increased blood pressure, reduced blood supply to the heart (myocardial ischemia), and in a few cases heart attacks have been reported.



#### References:

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- National Institute on Drug Abuse: <http://www.drugabuse.gov/publications/drugfacts/spice-synthetic-marijuana>
- <http://abcnews.go.com/Health/fake-pot-sending-increasing-number-kids-er/story?id=15940721>

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