WHITE PAPER


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# Griffin 460 Mobile GC/MS Analysis of Designer Drugs, Including Synthetic Cannabis & Bath Salts, Utilizing Prepless Sample Introduction (PSI) Probe

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## INTRODUCTION



Consumption of designer drugs has been increasing at an alarming rate. Designer drugs have similar chemical structures and physiological effects to illicit drugs. Unfortunately, users have little to no knowledge of the long-term toxicity or immediate physiological effects that are associated with these new designer drugs, because they aren't necessarily associated with the original illicit drug that was replicated. Herbal incense and bath salt products have been linked to hospitalizations, episodes of psychotic behavior, seizures, death, and long term psychosis in the case of bath salts.

In an effort to subvert drug laws, laboratories have developed new classes of research chemicals that bear resemblance to hallucinogens and stimulants. Two examples of these substances are marketed under the guise of herbal incense and bath salts. The reality is that people have found ways to consume these products for their hallucinogenic affects. *K2* and *Spice* are two herbal incense products marketed as novelties and are labeled "not for human consumption." The herbal incense contains dried herbs that have been sprayed with synthetic cannabinoids with intended effects similar to THC, which is also found in marijuana. *Tranquility*, *Ivory Wave*, and *Ocean* are bath salts that have no reported use for relaxation in baths, but instead contain powerful chemical stimulants similar in effect to cocaine and methamphetamine.

Methylone, MDPV, and mephedrone[1] are three examples of research chemicals masquerading under the general term bath salts. None of these chemicals are currently scheduled by the DEA (Drug Enforcement Administration), however, this is very likely to happen in the near future and these chemicals have been scheduled accordingly by individual states. Broad availability, inexpensive cost, rampant usage, and increased deaths have already catapulted the scheduling of five[2] synthetic cannabinoids by the DEA and individual states[3] are also creating their own legislation tailored at out-lawing region specific research chemicals.

[1] 3,4-methylenedioxymethcatinone (methylone), 3,4-methylenedioxpyrovalerone (MPDV), and 4-methylmethcathinone (mephedrone)

[2] Included on the list as Schedule I substances are JWH-018, JWH-200, JWH-073, CP-47,497 and cannabicyclohexanol.

[3] Oklahoma Senate Bill No. 919 is one such example, which will take effect on November 1, 2011, placing 130 synthetic cannabinoids into Oklahoma Schedule I status, as well as three chemicals marketed as "Bath Salts".

This new era of widespread drug release has created a complex matrix of new chemicals in the market. From cumbersome sample collection techniques and insufficient sample quantities, to time-consuming sample preparation processes and lack of mass spectral data, proper classification of the chemicals has been slow and complicated. Until now, designer drug identification required the skills of laboratory instrumentation experts trained in the art of analytical chemistry.

FLIR Systems has developed a solution to this complicated analytical challenge, which includes its robust GRIFFIN™ GC/MS system and integrated PSI-Probe™ (Prepless Sample Introduction). This analytical platform contains pre-loaded methods and an updated mass spectral library presented in a unique, simplified user interface that allows both advanced users and beginners to utilize the system to their expertise level. The strengths of this methodology also include the ability to transfer ultra-trace residues to the system and perform field characterizations and positive identification of designer drugs within seven minutes, all without the use of conventional sample preparation.

## SAMPLE ANALYSIS

Bath salt and herbal incense samples were legally obtained at gasoline stations and head shops, respectively. *Tranquility* brand, and two other unlabeled versions of bath salts were acquired. Brand names of herbal incense specimens included *Pandorum*, *Killa*, *Blue Lotus* and *Purple Sunshine.* In order to identify the unknown cannabinoids, analytical standards of synthetic cannabinoids were purchased from Cayman Chemical and the mass spectral results were incorporated into the Griffin Chemical Library. These mass spectral results did not exist in the NIST 2011 mass spectral database. Alternatively, MDPV, mephedrone and methylone were identified via the NIST 2011 mass spectral database.

A novel sample collection mechanism, Touch & Go (TAG™), is included with the PSI-Probe kit to facilitate ease of sample transfer to the PSI-Probe. The TAG offers a simple 4-step process to collect a solid or liquid sample and introduce it to the GC/MS.

1) Simply touch or tap the 4” pre-scored capillary to your sample.
2) Break it into the microvial.
3) Drop the microvial directly into the PSI-Probe.
4) Transfer to the injector for thermal extraction and subsequent GC/MS analysis.

TAG was used to transfer both the herbal incense products and powdered bath salts to the PSI-Probe microvial for analysis. When using TAG with PSI-Probe, it is most advantageous to load trace residues, such as powder or crystals. In the case of plant

material identification, slightly more sample can be loaded. The idea is to use as little as possible for effective identification. More can always be added if needed.

**Figure 1:** Transfer of "Bath Salt" residue to TAG™. Transfer on left is excessive. Transfer on right is sufficient.

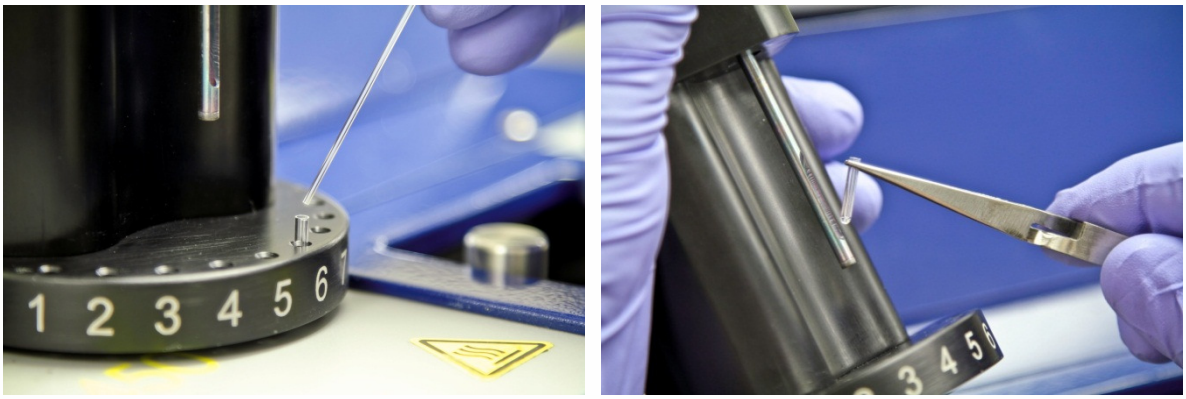


**Figure 2:** Transfer of bath salts to PSI-Probe Microvial via TAG and Loading of PSI-Probe.

**Figure 3:** Samples of herbal incense including *Killa*, *Purple Sunshine*, *Pandorum* and *Blue Lotus* (clockwise from top left).

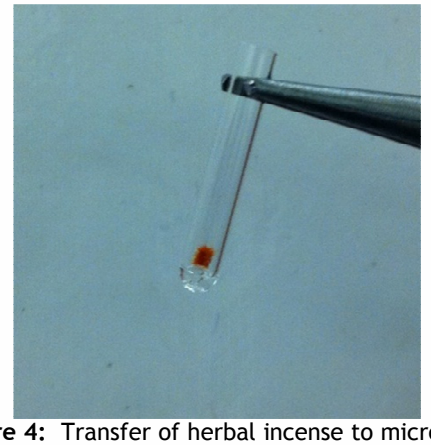

**Figure 4:** Transfer of herbal incense to microvial.

## FLIR INSTRUMENTATION

- GRIFFIN 460 GC/MS system
- Griffin System Software – GSS 3.9
- PSI-Probe

| Gas Chromatograph Operating Conditions: Temperature program is 80° C hold for 0.5 min, then increase at 50° C per minute to 300° C, hold for 1.5 min. Method duration 6.5 minutes. | |
|---|---|
| Column | LTM-GC Rtx-TNT, 5m X 0.18mm X 0.15µm (an LTM-GC DB-5MS, 15m X .18mm X .18um may also be used) |
| Carrier Gas | Helium, 1 mL/min |
| Injector | 300C, 90% split |

| Mass Spectrometer Operating Conditions | |
|---|---|
| Mass Scan Range | m/z 40-425 |
| Analyzer Temperature | 150° C |

## RESULTS AND DISCUSSION

A variety of synthetic cannabinoids were detected in the herbal incense samples, as shown below:

| Herbal Incense Trade Name | Detected Cannabinoid(s) |
|---|---|
| Pandorum | AM-2201, JWH-122, JWH-210 |
| Blue Lotus | AM-2201 |
| Purple Sunshine | AM-2201, JWH-122, JWH-210 |
| Killa | AM-2201 |

Although none of these synthetic cannabinoids are currently scheduled by the DEA, legislation appears imminent to ban most of these chemicals in the very near future. Additionally, individual states are scheduling these cannabinoids with all of the cannabinoids listed above becoming illegal in Oklahoma on November 1st, 2011. Many of these cannabinoids, such as AM-2201, are not included in the current NIST mass spectral library, but the FLIR Chemical library has been updated with many current cannabinoids of interest. Mass spectral data for various cannabinoids are shown below:

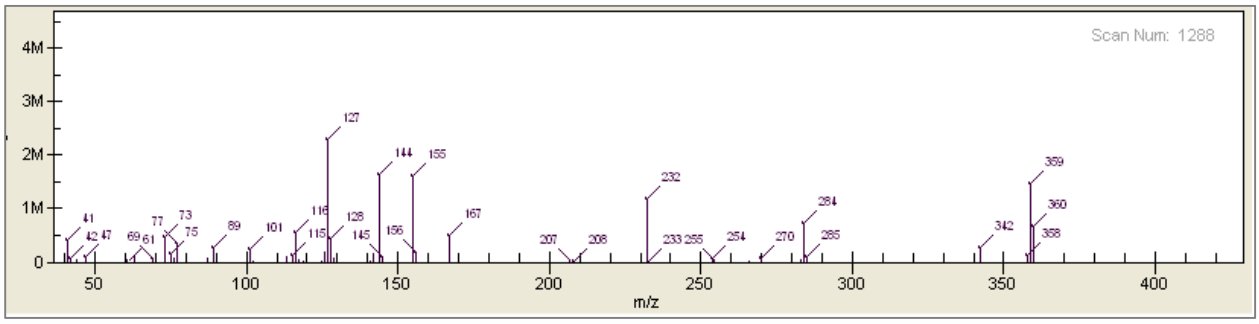


**Figure 5:** GRIFFIN Cylindrical Ion Trap Mass Spectrum of AM-2201, shown in GSS Level II.

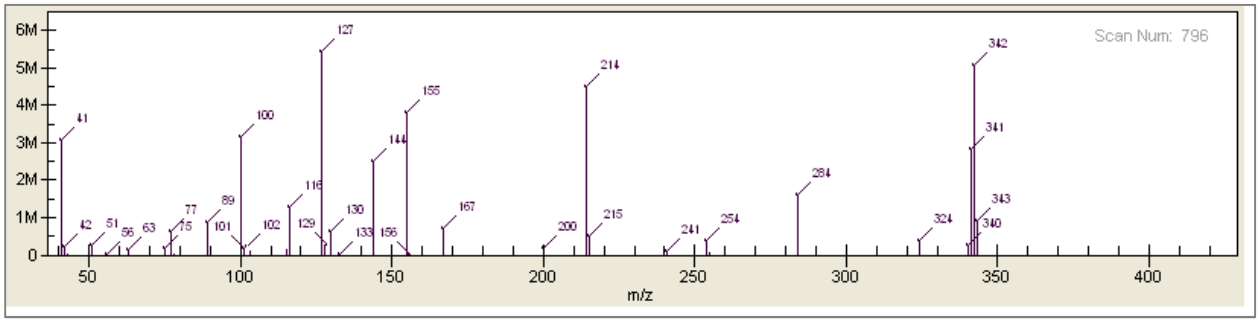


**Figure 6:** GRIFFIN Cylindrical Ion Trap Mass Spectrum of JWH-018, shown in GSS Level II.

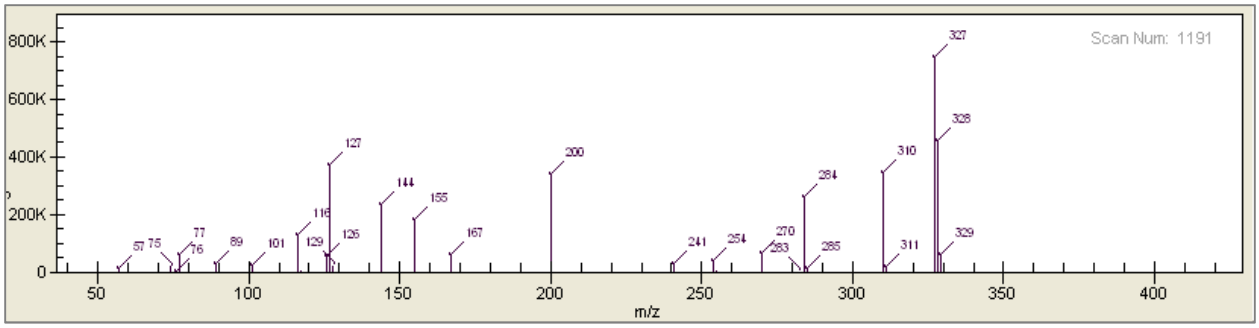


**Figure 7:** GRIFFIN Cylindrical Ion Trap Mass Spectrum of JWH-073, shown in GSS Level II.

The GRIFFIN GC/MS system can also discriminate between "Herbal Incense" products and authentic marijuana samples. Shown below is real time identification of delta-9-tetrahydrocannabinol and cannabinol, detected from an underivatized sample of marijuana leaf:

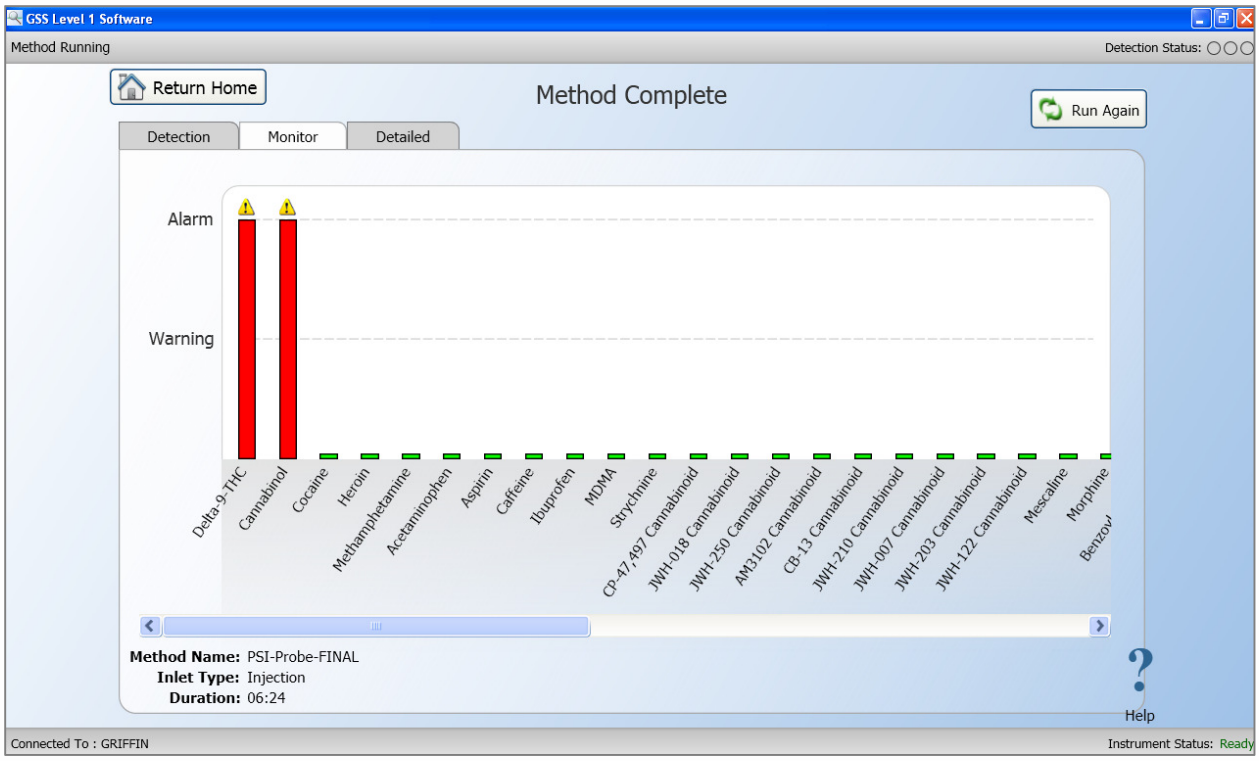


**Figure 8: Identification of Delta-9-THC in Griffin System Software Level 1, Monitor Tab.**

The sample of *Tranquility* bath salts was determined to contain MDPV, as well as caffeine. The other two unlabeled bath salts were analyzed and discovered to be comprised of methylone and mephedrone, respectively. Real time alarming identification of these bath salts was accomplished in Level 1 of Griffin System Software.

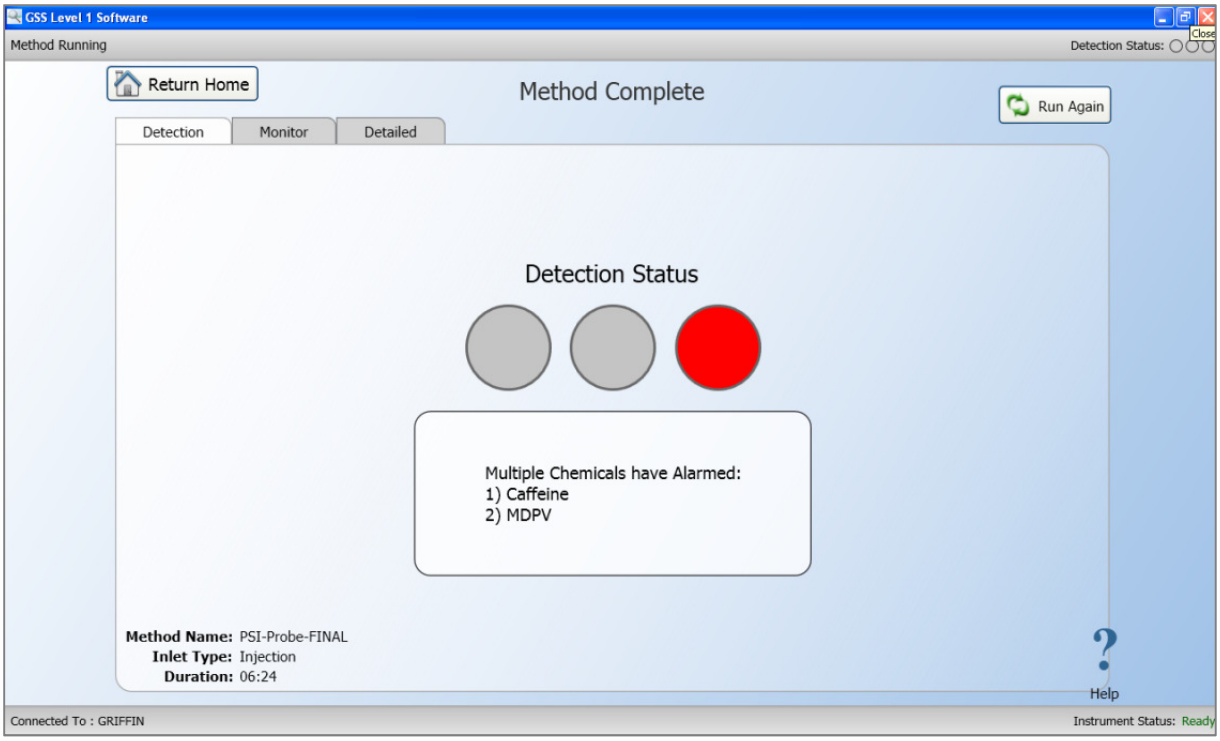


**Figure 9:** Real Time Identification of "Bath Salts" in Griffin System Software Level 1, Detection Tab.

## CONCLUSION

As consumption of designer drugs continues to increase, law enforcement officials will face growing challenges with proper identification of new chemicals. Confirmatory results of these new chemicals empower law enforcement with court admissible data. This white paper clearly demonstrates the FLIR solution for prep-less sampling and rapid identification of designer drugs and the new chemicals used to make them. The GRIFFIN GC/MS and PSI-Probe, in combination with the simplicity of Level 1 Griffin System Software, uniquely positions this analytical platform to be used by virtually anyone. The continuously upgraded Griffin chemical library will serve the end user's requirements for staying abreast of the latest designer drugs, with application chemists at FLIR poised to develop the extensive mass spectral database needed to combat today's increasing threats.

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