Analysis and comparison of several synthetic cannabinoids

Amber L. Rasmussen*[1], Christopher S. Binion[2], Joseph A. Tanner[2], Larry Boggs[2], and J. Graham Rankin, PhD[1]

[1] Marshall University Forensic Science Program, 1401 Forensic Science Drive, Huntington, WV 25701

[2] Kentucky State Police Eastern Regional Laboratory, 1550 Wolohan Drive, Suite #2, Ashland, KY 41102

ABSTRACT

Synthetic cannabinoid compounds are added to a mixture of vegetative material in order to produce effects similar to or greater than cannabis, and are commonly marketed as herbal incense or potpourri. Some of the most frequently reported compounds include HU-210, CP 47,497 (and its homologs), JWH-018, JWH-073, JWH-398, and JWH-250. A simple methanol extraction followed by GC/MS analysis is sufficient for the identification of many of these compounds within samples of the unburned product. An analysis of the burnt residue and ashes remaining after burning a portion of synthetic cannabinoid sample indicates a diminished yet identifiable sustained presence of several of these compounds. Future analysis of evidentiary samples may be utilized to track sample cannabinoid content.

INTRODUCTION

Commonly marketed as herbal incense or potpourri with the disclaimer that these substances are “not for human consumption”.

DEA emergency scheduling on November 24, 2010

- JWH-018
- JWH-073
- JWH-200
- CP-47,497
- Cyclobicyclohexanol

Effects: Many adverse effects have been reported including seizures, withdrawal, and heart and respiratory issues. Synthetic cannabinoids are said to be 20 to 800 times more potent than THC in the pure form.

Production: Synthetic cannabinoids are added to a mixture of vegetative material. The specific compound(s) included varies greatly among both brands and batches. Product content has been reported to rapidly change in response to local regulation.

Toxicological identification:

The presence of synthetic compounds within blood samples is detectable, but this method limits the ability to detect usage after a short period of time from consumption.

Urine analysis allows for detection over a longer period of time, but current technologies identify only a select few synthetic cannabinoid compounds.

To be determined:

- Which specific cannabinoids are present?
- What are the optimal methods of forensic testing?
- Are there any trends within product synthesis and production?
- How can these findings be applied for forensic use?

MATERIALS AND METHODS

•Rapid, simple extraction with methanol followed by GC/MS analysis
-50 mg of sample

•Agilent 6890 GC System/5973 MS Detector
-1 µL injected with a 50:1 split
-Carrier gas: Helium
-Phenomenex ZB-1 30.0m x 0.25mm x 0.25µm column
-Oven Initial temp: 100°C, hold for 0.50 min
-Ramp rate: 40°C /min
-Oven Final temp: 280°C, hold for 7.50 min
-Total Run time: 12.5 minutes
-All samples run in duplicate

RESULTS

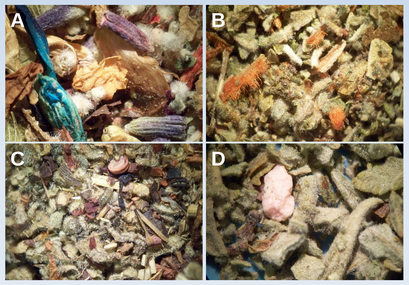

Figure 1. Low magnification view of several tested samples including (**A**) K2 Summit, (**B**) Space, (**C**) Spice Diamond, and (**D**) Atomic Bomb. Upon closer magnification (not pictured) light-colored particles were also observed and are suspected artifacts from the spraying of chemicals during the product manufacturing process.

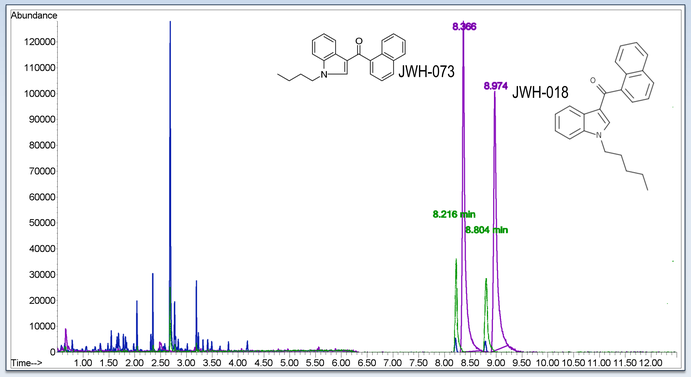

Figure 2. Overlay of K2 Summit extract total ion chromatograms. Standard methanol extract is shown in violet, ash extract is shown in green, and oily residue extract is shown in blue. Differences in retention times are a result of varying concentrations.

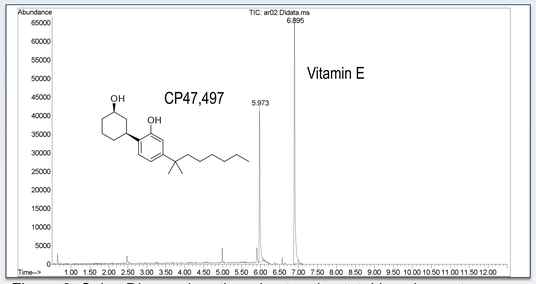

Figure 3. Spice Diamond methanol extraction total ion chromatogram.

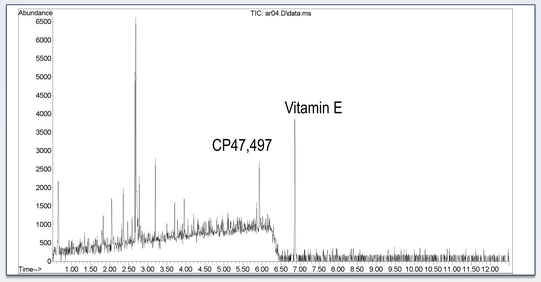

Figure 4. Spice Diamond ash extract total ion chromatogram.

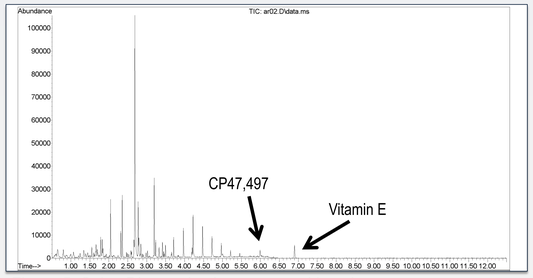

Figure 5. Spice Diamond ash extract total ion chromatogram.

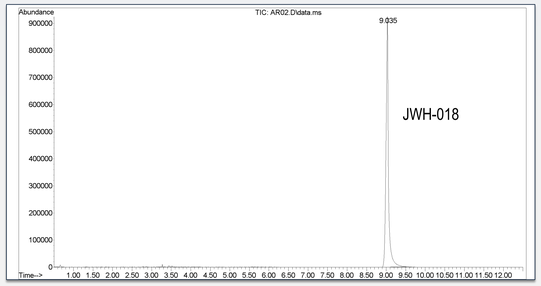

Figure 6. Space methanol extract total ion chromatogram.

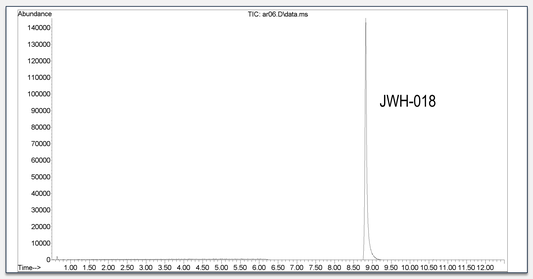

Figure 7. Atomic Bomb methanol extract total ion chromatogram.

Table 1. Summary of substances identified in tested samples along with their respective library matches and retention times.

Sample	Source	MS Library Match	GC Retention Time (min)
K2 Summit	Huntington, WV	JWH-073 JWH-018	8.366 8.974
Space	Huntington, WV	JWH-018	9.035
Spice (Diamond and Gold)	Internet	CP 47,497(C8) Vitamin E	5.973 6.895
Atomic Bomb	Internet	JWH-018	8.816

CONCLUSIONS

•All extraction methods performed in this study yielded the same identification of cannabinoid content.

•Cannabinoid content was detected in both the ash and oily residue extracts of each sample.

•Burned samples exhibited additional peaks at lower retention times when analyzed on the GC/MS.

•All cannabinoids were detected within the burned extracts well above threshold level.

DISCUSSION

•Methanol extraction is considered the optimal extraction method due to its relative ease, speed and safety.

•Ash and burned residue exhibit great potential for use in cannabinoid detection.

•This will potentially allow for the detection of controlled substances within already consumed samples of synthetic cannabinoids or within paraphernalia commonly utilized in the consumption in these products.

•The unidentified peaks within the ash and residue extracts may be pyrolysis products of the synthetic cannabinoids themselves or of the other contents within the sample mixture.

•Further analysis of pyrolysis products may lead to increased methods of detection in instances where minimal or trace amounts of the burned ash or residue is available.

REFERENCES

Auwarter, V., Dresen, S., Weinmann, W., Muller, M., Putz, M., Ferreiros, N. JMS Letter: ‘Spice’ and other herbal blends: Harmless incense or cannabinoid designer drugs? Journal of Mass Spectrometry. 2009; 44, 832-837.

DEA Public Affairs. DEA Moves to Emergency Control Synthetic Marijuana. News Release. November 24, 2010.

Emanuel, C., Ellison, B., Banks, C. Spice up your life: screening the illegal components of ‘Spice’ herbal products. Analytical Methods. 2010; 2, 614-616.

Lindigkeit, R., Boehme, A., Eiserloh, I., Luebbecke, M., Wiggerman, M., Ernst, L., Beuerle, T. Spice: A never ending story? Forensic Science International. 2009; 191 58-63.

Microgram Bulletin: “Spice”-Plant materials laced with synthetic cannabinoids or cannabinoid mimicking compounds. Microgram Bulletin. March, 2009.

Understanding the ‘Spice’ phenomenon. European Monitoring Centre for Drugs and Drug Addiction (EMCDDA). 2009.

Zimmerman, U., Winkelmann, P., Pilhatsch, M., Nees, J., Spanagel, R., Schultz, K. Withdrawal phenomena and dependence syndrome after the consumption of “Spice Gold”. Ktsch Arztebl International, 2009; 106(27): 464-67.

ACKNOWLEDGMENTS

The authors would like to thank the Forensic Sciences Foundation’s Emerging Forensic Scientist Award competition for their consideration of this presentation. Also, thank you to Wes Gibson for his assistance with graphic design.