

# Comparison of Gas Chromatography Columns (Rtx<sup>®</sup>-5, Rxi<sup>®</sup>-1ms, and Rxi<sup>®</sup>-1HT) for the

## Qualitative Analysis of Synthetic Cannabinoids

Laurel Hardy, BS; Carrie Kirkpatrick, BS; Pamela Staton, PhD; Lauren Waugh, PhD

Marshall University & West Virginia State Police Forensic Laboratory Drug Identification Section



FORENSIC SCIENCE



### Abstract

As popularity of synthetic cannabinoids and the prevalence of their harmful side effects grow, so does the need to control such substances. For high throughput labs such as the West Virginia State Police (WVSP) Drug Identification Laboratory, the high molecular weight and low volatility of synthetic cannabinoids poses a problem for analysis as not all synthetic cannabinoids elute within the parameters of their standard GC-MS method. This study compares the Restek Rxi<sup>®</sup>-1ms and Rxi<sup>®</sup>-1HT GC columns to the Restek Rtx<sup>®</sup>-5 GC column (standard method in the WVSP Drug Laboratory) to determine if either column could improve the efficiency of synthetic cannabinoid detection and analysis using the standard GC-MS method. The reduced retention times and reproducibility of retention times observed indicate the Restek Rxi<sup>®</sup>-1HT and Rxi<sup>®</sup>-1ms columns could be promising possibilities for the qualitative analysis of synthetic cannabinoids in high throughput laboratories.

### Introduction

- Synthetic cannabinoids were first reported in the United States as recreational drugs in December 2008<sup>1</sup> and are quickly gaining popularity<sup>1,2</sup> due to “the desire for a ‘legal high’ and the ability to avoid detection on standard drugs-of-abuse testing such as those for THC”<sup>3</sup>.
- Synthetic cannabinoids present a danger to public health
  - Annual calls to poison control centers is currently increasing with 6,310 calls reported between Jan 1 and Aug 30, 2015
  - Emergency department visits involving synthetic cannabinoids: 11,406 (2010); 28,531 (2011)<sup>4</sup>
  - Synthetic cannabinoids were the second most used illegal drug among twelfth graders in 2012<sup>1</sup> and the third most used illegal drug among eighth graders in 2013<sup>5</sup>
- Individuals easily overdose on synthetic cannabinoids for several reasons
  - lack of information on the real composition<sup>6</sup> or the concentration of the drug they are buying<sup>6,7,8</sup>
  - higher potency of synthetic cannabinoids due to their higher affinity for CB1 and CB2 receptors<sup>6,7,8,9</sup> than THC
  - lack of correlation between brand name and the type of synthetic cannabinoid present on plant material<sup>6,7,10</sup>
  - inaccuracy of plant materials listed as ingredients on the packaging<sup>6,8</sup>
  - plants used to produce smoking mixtures could themselves be psychoactive<sup>3</sup> or be a source of adverse reactions.
- Legislation affecting synthetic cannabinoids
  - 2011 – emergency scheduling of five compounds due to threat to public health
  - 2012 – Synthetic Drug abuse prevention act of 2012 as part of the Safety and Innovation act of 2012
  - Additional scheduling of individual compounds in 2013, 2014, and 2015<sup>5,11</sup>
- Factors complicating the enforcement of synthetic cannabinoids
  - Lack of presumptive tests
  - Packages contain disclaimer “not for human consumption”
  - emergence of new synthetic cannabinoid compounds to bypass current bans on specific compounds
  - delay in scheduling new compounds and development of certified reference material
- Analytical difficulties
  - Large molecules with low volatility
  - Long throughput times
- The goal of this study is to determine if a different column could be used to reduce synthetic cannabinoid GC retention times and improve the efficiency of synthetic cannabinoid analysis in the laboratory.

### Materials & Methods

Rate (°C/min)	Temp (°C)	Hold (minutes)
---	115	0
20	290	4
Total run time		12.75 minutes

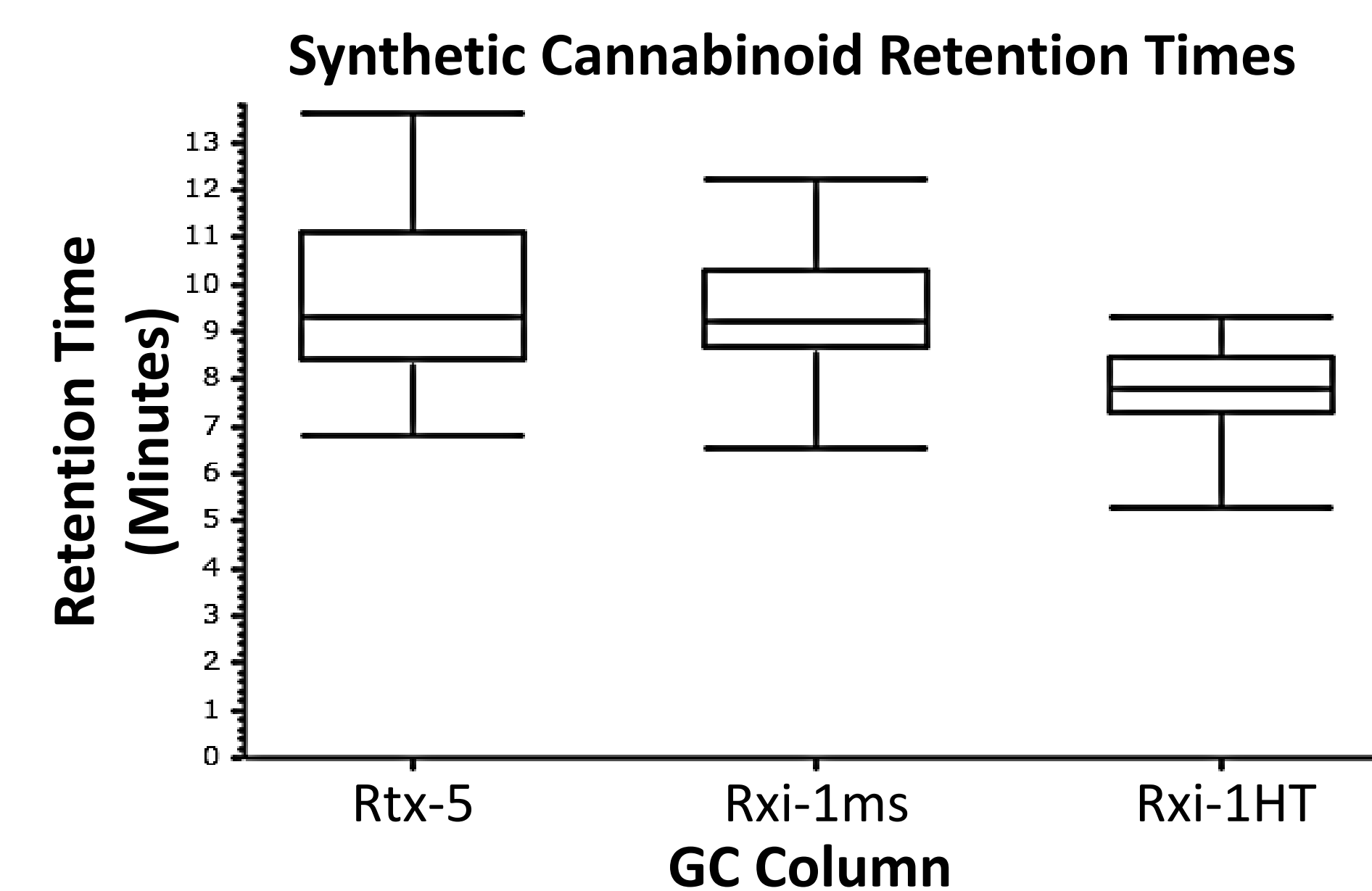
- Retention time shift study
- Retention time reproducibility study
- Agilent Technologies 7890A GC instrument
- Agilent Technologies 5975C inert MSD with triple-axis detector

**Table 1 (above).** GC parameters used for sample analysis.

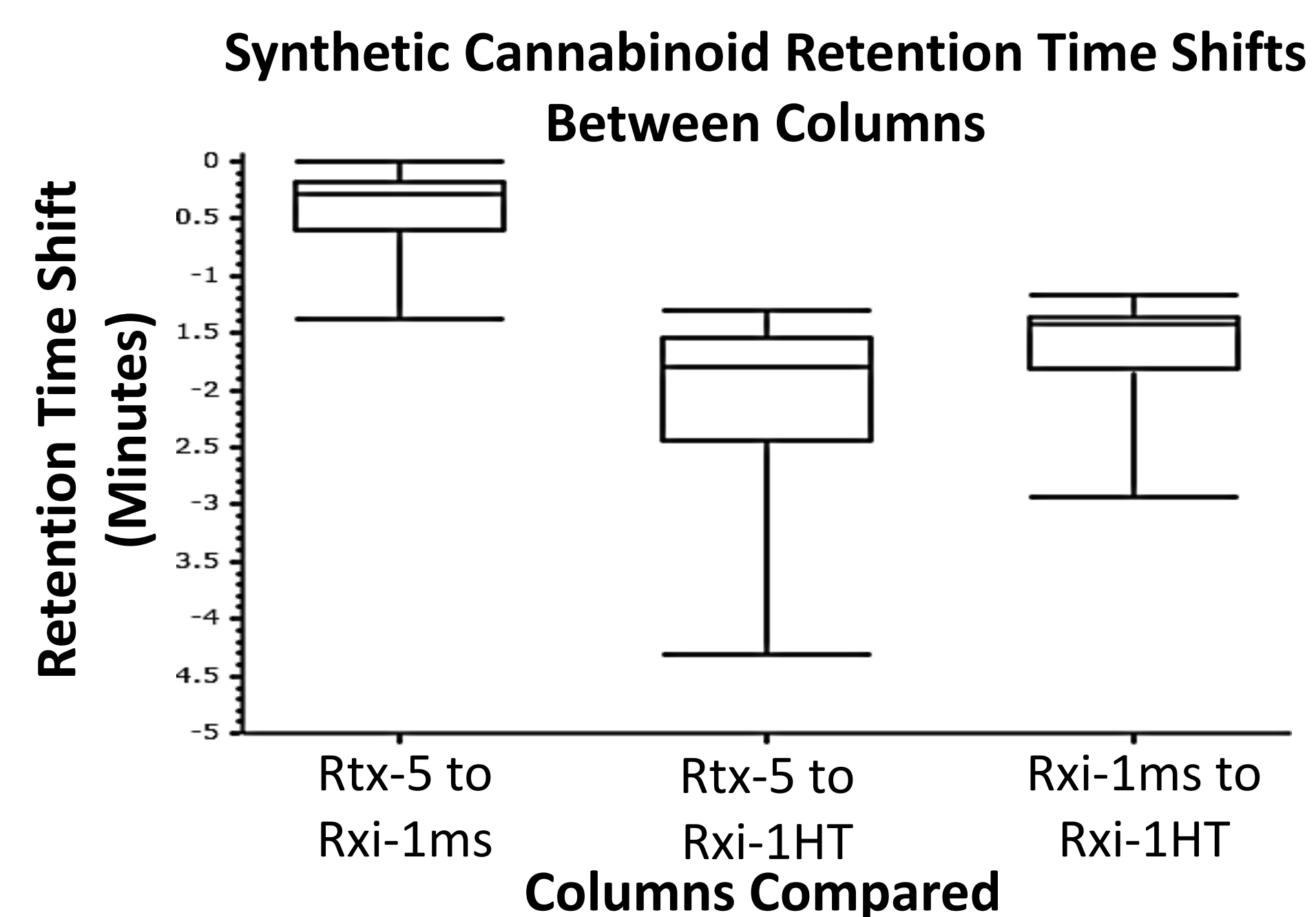
Compound	Reference	Reference
25B-NBOMe	CP 47,497 C8 HOMOLOG	JWH-203
25C-NBOMe	CP 55,940	JWH-203-3 chlorophenyl
25D-NBOMe	EAM2201	JWH-203-4 chlorophenyl
25H-NBOMe	FUB-PB-22	JWH-210
5-fluoro-AB-PINACA	HU-210	JWH-250
5-fluoro PB-22	HU-211	JWH-302
AB-CHMINACA	JWH-018	JWH-398
AB-FUBINACA	JWH-018	MAM-2201
AB-PINACA	ADAMANTYL CARBOXAMIDE	PB-22
AKB-48	JWH-019	RCS-4
AKB-48 N-(5-fluoropentyl)	JWH-022	RCS-4-C4 homolog
AM-1220	JWH-073	RCS-8
AM-2201	JWH-073 6-methoxyindole	STS-135
AM-2233	JWH-081	THJ-2201
AM-694	JWH-122	UR-144
CB-25	JWH-122 N(4-pentenyl)	UR-144-N-(5chloropentyl)
CB-52	JWH-200	URB-597
CP 47,497	JWH-201	XLR-11

— Used for retention time reproducibility studies

### Results

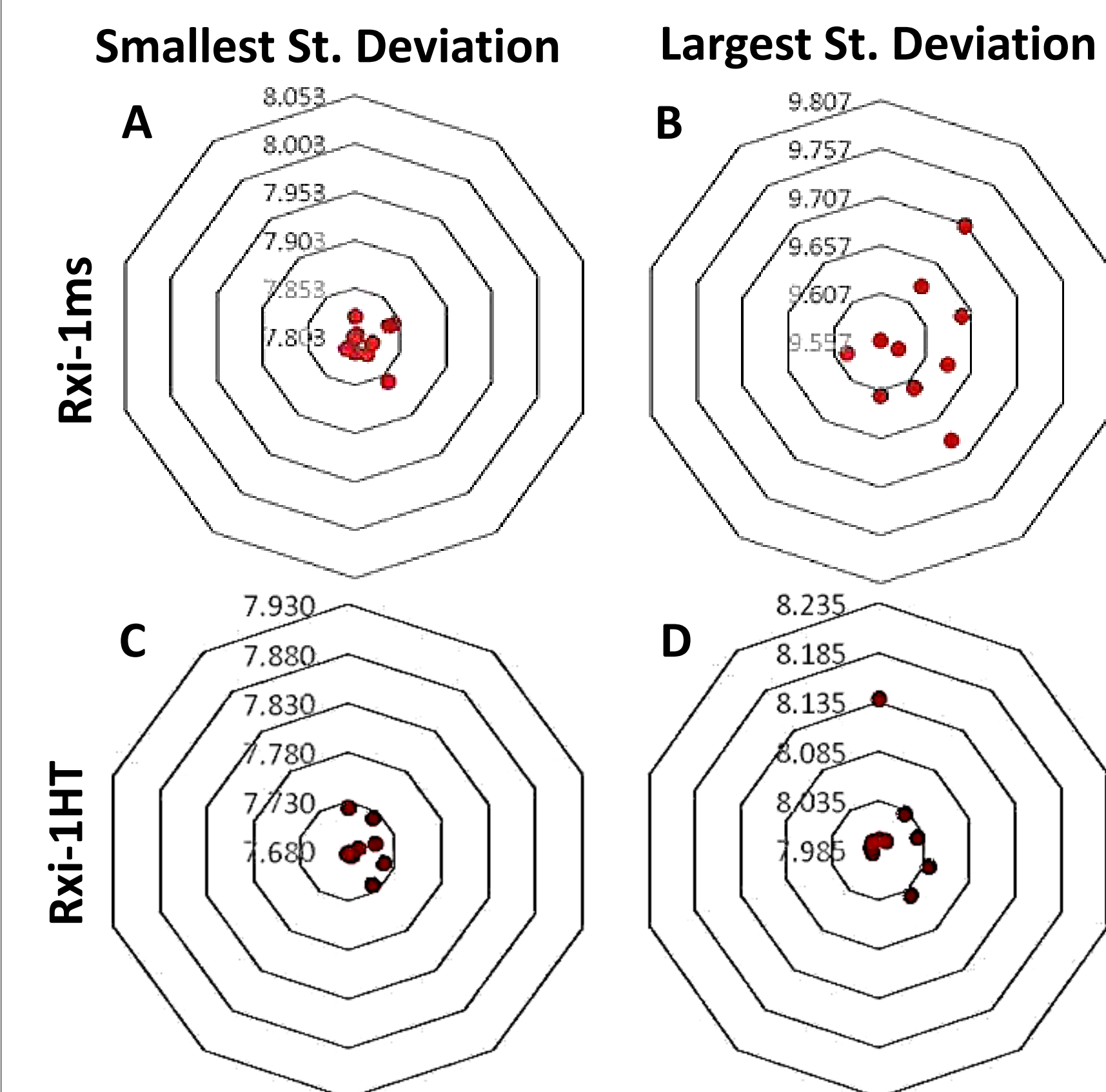


**Figure 1.** Box and whisker plot depicting the synthetic cannabinoid retention times obtained on the Restek Rtx<sup>®</sup>-5, Rxi<sup>®</sup>-1ms, and Rxi<sup>®</sup>-1HT GC columns.



**Figure 2.** Box and whisker plot depicting the retention time shifts between the GC columns being compared.

### Results



**Figure 3.** Target plots depicting the distribution of retention times for the synthetic cannabinoid compounds that displayed the smallest and largest standard deviations when run in duplicate on the Rxi-1ms GC column and Rxi-1HT GC column. The smallest and largest standard deviations observed using the Rxi-1ms column were (A) CP-47,497 C8 homolog (0.030) and (B) JWH-018 (0.085) and on the Rxi-1HT were (C) JWH-073 (0.030) and (D) JWH-022 (0.062).

### Conclusion/Discussion

- Results indicated a dramatic decrease in retention time (average of 2.106 minutes) when using the Restek Rxi<sup>®</sup>-1HT GC column for analysis and a slight decrease in retention time (average of 0.488 minutes) when using the Restek Rxi<sup>®</sup>-1ms GC column for analysis.
- Data from both the Restek Rxi<sup>®</sup>-1ms and Rxi<sup>®</sup>-1HT columns were determined to be significantly different from data obtained using the Restek Rtx<sup>®</sup>-5 column based on paired t tests with 95% confidence intervals ( $t = 7.378$  and  $19.688$  respectively).
- Both columns demonstrated adequate reproducibility of retention time for qualitative analysis required at the West Virginia State Police Drug Identification Laboratory
- The Restek Rxi<sup>®</sup>-1HT and Rxi<sup>®</sup>-1ms columns have proved to be a promising possibility for the qualitative analysis of synthetic cannabinoids in high throughput laboratories

### Acknowledgements

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