

## Improved Resolution of Triazine Herbicides with Kinetex® Core-Shell HPLC/UHPLC Columns and Zebron™ GC Columns

Kory Kelly and Kali Tudela  
Phenomenex, Inc., 411 Madrid Ave., Torrance, CA 90501 USA

Environmental laboratories are continuously pushed to deliver lower detection levels and faster sample throughput. A common analysis performed by these labs is triazine herbicides. This analysis can be performed by LC/MS/MS or GC/MS, for which Kinetex core-shell UHPLC/HPLC columns and Zebron GC columns provide resolution and sensitivity improvements as well as time savings.

### Introduction

Often used for weed control, triazine herbicides have been found to have detrimental environmental and health effects. Much debate has focused on the level at which these compounds negatively impact health. To monitor and control human exposure to these herbicides, regulatory bodies have established allowable limits of triazines in drinking water and wastewater. This study presents two methods for triazine herbicide analysis. The method parameters follow the Environmental Protection Agency's Method 536 for drinking water and Method 619 for wastewater, using LC/MS/MS and GC/MS respectively.

### Materials and Methods

A Kinetex XB-C18 column was used for the LC/MS/MS method, and a Zebron ZB-50 GC column was used for the GC/MS method. The column dimensions and running conditions are detailed in the figure captions. The EPA Method 536 chromatogram in Figure 1 was obtained using an Applied Biosystems API 3000™ LC/MS/MS. The EPA Method 619 chromatogram for Figure 2 was obtained using an Agilent® 6890/5975.

### Results and Discussion

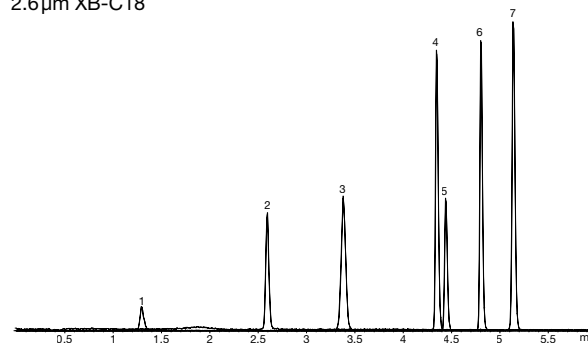
LC/MS/MS provides the sensitivity needed to accurately quantify and verify the identity of triazine herbicides in EPA Method 536. The suggested conditions provide full resolution in less than 6 minutes, as shown in **Figure 1**. The sharp peaks observed result from the ultra-high efficiency of the Kinetex 2.6 µm XB-C18 column. The short run time improves laboratory productivity and minimizes sample backlogs.

EPA Method 619 detects a longer list of triazine herbicides by GC/MS, as shown in **Figure 2**. The Zebron ZB-50 column provides separation of all compounds, delivering confidence in qualitative and quantitative results.

### Conclusions

Two successful methods have been presented to monitor triazine herbicides. The narrow peaks achieved with the Kinetex 2.6 µm XB-C18 core-shell technology column increased throughput without sacrificing resolution for LC-based EPA Method 536. The Zebron ZB-50 column provides separation of all 11 triazine herbicides for GC-based EPA Method 619.

**Figure 1.**  
Resultant LC/MS/MS chromatogram of EPA Method 536 using Kinetex 2.6 µm XB-C18



**Column:** Kinetex 2.6 µm XB-C18  
**Dimensions:** 50 x 2.1 mm  
**Mobile Phase:** A: 5 mM Ammonium Acetate  
B: Methanol  
**Gradient:**

Time (min)	% B
0	5
0.25	40
2	40
3	75
4	75
4.1	5

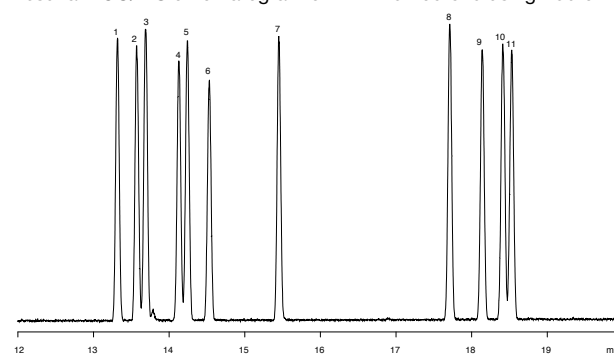
**Flow Rate:** 0.3 mL/min  
**Temperature:** 25 °C

**Detection:** MS/MS

**Note:** SecurityGuard™ ULTRA Cartridge System extends column lifetime

**Sample:** 1. Atrazine-desethyl-desisopropyl  
2. Atrazine-desisopropyl  
3. Atrazine-desethyl  
4. Cyanazine (Fortrol)  
5. Simazine  
6. Atrazine  
7. Propazine

**Figure 2.**  
Resultant GC/MS chromatogram of EPA Method 619 using Zebron ZB-50



**Column:** Zebron ZB-50 GC Column  
**Dimensions:** 30 m x 0.32 mm x 0.5 µm  
**Oven Profile:** 150 °C to 250 °C at 4 °C/min for 5 min  
**Carrier Gas:** Constant Flow Helium, 1.1 mL/min  
**Injection:** Split 40:1, 1 µL @ 250 °C  
**Detection:** Mass Selective (MSD) @ 240 °C

**Note:** Easy Seals™ Inlet Base Seals improve reproducibility while decreasing peak tailing and response loss

**Sample:** 1. Prometon  
2. Atraton  
3. Propazine  
4. Atrazine  
5. Terbutylazine  
6. Simazine  
7. Secbumeton  
8. Promatryn  
9. Ametryn  
10. Terbutryn  
11. Simetryn

# TN-2052 APPLICATIONS

## Ordering Information

### Kinetex<sup>®</sup> Core-Shell HPLC/UHPLC Columns

SecurityGuard<sup>™</sup>  
ULTRA  
Cartridges\*

2.6 µm Minibore Columns (mm)					
Phases	50 x 2.1	75 x 2.1	100 x 2.1	150 x 2.1	3/µk
XB-C18	00B-4496-AN	00C-4496-AN	00D-4496-AN	00F-4496-AN	AJO-8782

for 2.1 mm ID

\* SecurityGuard ULTRA cartridges require holder, Part No. AJO-9000

## GC Columns

Zebron <sup>™</sup> ZB-50 GC Columns			
ID (mm)	df (µm)	Temp. Limits °C	Part No.
<b>10-Meter</b>			
0.10	0.10	40 to 320/340	7CB-G004-02
0.53	2.00	40 to 320/340	7CK-G004-32
<b>15-Meter</b>			
0.25	0.15	40 to 320/340	7EG-G004-05
0.25	0.25	40 to 320/340	7EG-G004-11
0.32	0.25	40 to 320/340	7EM-G004-11
0.32	0.50	40 to 320/340	7EM-G004-17
0.53	1.00	40 to 320/340	7EK-G004-22
<b>30-Meter</b>			
0.25	0.25	40 to 320/340	7HG-G004-11
0.25	0.50	40 to 320/340	7HG-G004-17
0.32	0.25	40 to 320/340	7HM-G004-11
0.32	0.50	40 to 320/340	7HM-G004-17
0.53	1.00	40 to 320/340	7HK-G004-22
<b>60-Meter</b>			
0.25	0.25	40 to 320/340	7KG-G004-11
0.25	0.50	40 to 320/340	7KG-G004-17

Note: If you need a 5 in. cage, simply add a (-B) after the part number, e.g., 7HG-G004-11-B. Some exceptions may apply. Agilent<sup>®</sup> 6850 some SRI and process GC systems use only 5 in.

## Recommended GC Accessories

Part No.	Description	Dimensions	Unit
AG0-8172	Split/Splitless Liner with Wool	4 mm ID x 78.5 mm L x 6.45 mm OD	5/pk
AG0-8620	Easy Seals <sup>™</sup> Inlet Base Seal, Gold-Plated	Single-Groove, 0.8mm	10/pk
AG0-4696	PhenoRed <sup>™</sup> -400 Injector Septa	7/16 in. (11 mm) Diameter	50/pk

Note: Additional GC accessories available at [www.phenomenex.com/GC](http://www.phenomenex.com/GC)



If Phenomenex products in this technical note do not provide at least an equivalent separation as compared to other products of the same phase and comparable dimensions, return the product with comparative data within 45 days for a FULL REFUND.

### Terms and Conditions

Subject to Phenomenex Standard Terms and Conditions which may be viewed at <http://www.phenomenex.com/TermsAndConditions>.

### Trademarks

Kinetex is a registered trademark of Phenomenex. Zebron, Easy Seals, Guardian, and SecurityGuard are trademarks of Phenomenex. Agilent is a registered trademark of Agilent Technologies, Inc. API 3000 is a trademark of AB Sciex Pte. Ltd.

### Disclaimer

Phenomenex is not affiliated with Agilent Technologies.

© 2012 Phenomenex, Inc. All rights reserved.

**Australia**  
t: 02-9428-6444  
f: 02-9428-6445  
auinfo@phenomenex.com

**Austria**  
t: 01-319-1301  
f: 01-319-1300  
anfrage@phenomenex.com

**Belgium**  
t: 02 503 4015 (French)  
t: 02 511 8666 (Dutch)  
f: +31 (0)30-2383749  
beinfo@phenomenex.com

**Canada**  
t: (800) 543-3681  
f: (310) 328-7768  
info@phenomenex.com

**Denmark**  
t: 4824 8048  
f: +45 4810 6265  
nordicinfo@phenomenex.com

**Finland**  
t: 09 4789 0063  
f: +45 4810 6265  
nordicinfo@phenomenex.com

**France**  
t: 01 30 09 21 10  
f: 01 30 09 21 11  
franceinfo@phenomenex.com

**Germany**  
t: 06021-58830-0  
f: 06021-58830-11  
anfrage@phenomenex.com

**India**  
t: 040-3012 2400  
f: 040-3012 2411  
indiainfo@phenomenex.com

**Ireland**  
t: 01 247 5405  
f: +44 1625-501796  
eireinfo@phenomenex.com

**Italy**  
t: 051 6327511  
f: 051 6327555  
italiainfo@phenomenex.com

**Luxembourg**  
t: +31 (0)30-2418700  
f: +31 (0)30-2383749  
nlinfo@phenomenex.com

**Mexico**  
t: 001-800-844-5226  
f: 001-310-328-7768  
tecnicomx@phenomenex.com

**The Netherlands**  
t: 030-2418700  
f: 030-2383749  
nlinfo@phenomenex.com

**New Zealand**  
t: 09-4780951  
f: 09-4780952  
nzinfo@phenomenex.com

**Norway**  
t: 810 02 005  
f: +45 4810 6265  
nordicinfo@phenomenex.com

**Puerto Rico**  
t: (800) 541-HPLC  
f: (310) 328-7768  
info@phenomenex.com

**Sweden**  
t: 08 611 6950  
f: +45 4810 6265  
nordicinfo@phenomenex.com

**United Kingdom**  
t: 01625-501367  
f: 01625-501796  
ukinfo@phenomenex.com

**United States**  
t: (310) 212-0555  
f: (310) 328-7768  
info@phenomenex.com

**All other countries:**  
**Corporate Office USA**

t: (310) 212-0555  
f: (310) 328-7768  
info@phenomenex.com