

# Maximize Confidence in Seized Drug Identification by GC-MS

By Corby Hilliard, Erica Pack, Ramkumar Dhandapani, and Colton Myers

- Next-generation TriMax column deactivation creates a robust neutral surface and exceptionally inert sample flow path.
- Maximum inertness improves peak symmetry for a wide range of challenging drug classes.
- Stable, symmetrical peaks mean more accurate identification for even the most problematic drugs.



Seized drug labs frequently analyze samples via GC-MS to determine if an unknown substance is an illicit drug, and GC column choice plays an integral role in data quality and method reliability. Since a wide variety of chemical compounds need to be identified, midpolarity columns, such as “5 type” columns, are a common choice for drug analysis. Silarylene polymers are structurally modified “5 type” phases that provide enhanced thermal stability, making a “5sil” column the perfect choice for extended lifetime and consistent performance with a mass spectrometer. When analyzing a wide range of drugs, some compound classes exhibit worse behavior than others, which can make drug identification more complex due to tailing peaks and drifting retention times. Acidic compounds (e.g., barbiturates) are prone to uneven phase

partitioning due to strong interactions between weakly acidic N-H groups and silanols on the surface of the GC column. Other drugs may have basic functionalities (e.g., amines) and form hydrogen bonds with the surface, again delaying partitioning out of the column phase, or sometimes being completely adsorbed. By preventing surface silanol interactions, seized drug labs can see improved performance for the most problematic compounds across a wide range of functionalities.

To minimize the impact of silanols, Restek has developed a next-generation TriMax deactivation that is applied to all columns in the RMX family. This revolutionary treatment creates a robust, highly inert surface that improves peak shape for a wide range of drug classes. Further, analysts can be confident in column performance because each column is individually QC tested with acidic, basic, and neutral compounds to ensure deactivation effectiveness and process control. This makes RMX-5Sil MS columns—which combine plug-in 5sil polarity, high thermal stability, and maximum surface inertness—ideal for improving seized drug identification (Figure 1). Further, as shown in Figure 2, the RMX-5Sil MS column outperforms a competitor’s premium column when comparing peak shape for several difficult basic analytes (doxylamine, cyclobenzaprine, codeine) as well as a weakly acidic analyte (alprazolam). Under the same instrument conditions, we can see an improvement in peak shape that can only be attributed to the maximum inertness of the RMX-5Sil MS column surface, which minimizes secondary analyte interactions with silanols that would otherwise cause peak tailing and poor symmetry.

## Want to customize a method?

Enter your target analytes into Restek’s free Pro EZGC chromatogram modeling software and instantly generate optimized method conditions for your specific compound list.

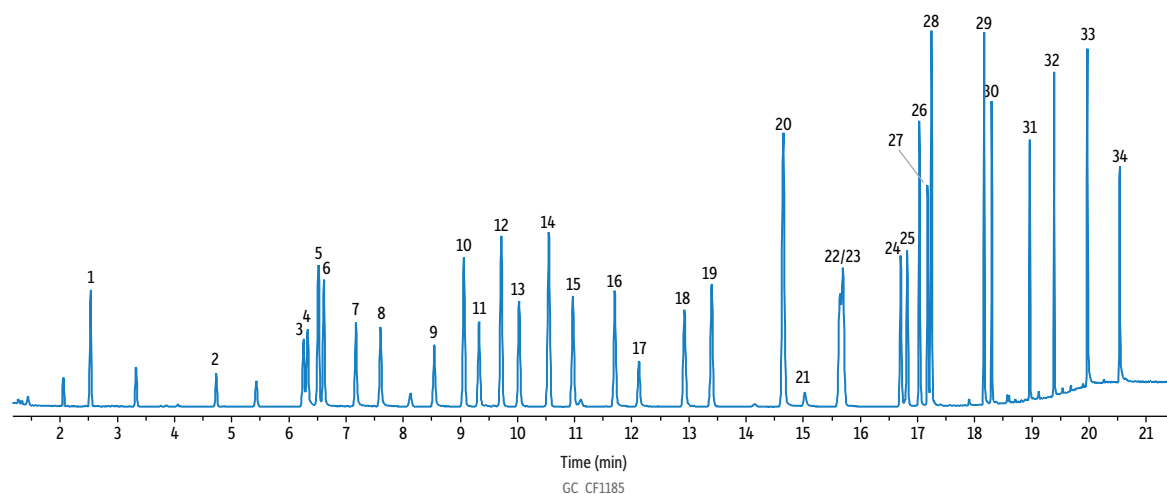
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**Figure 1:** RMX-5Sil MS columns provide excellent chromatographic results for 34 drugs of abuse analyzed by GC-MS in less than 21 minutes.



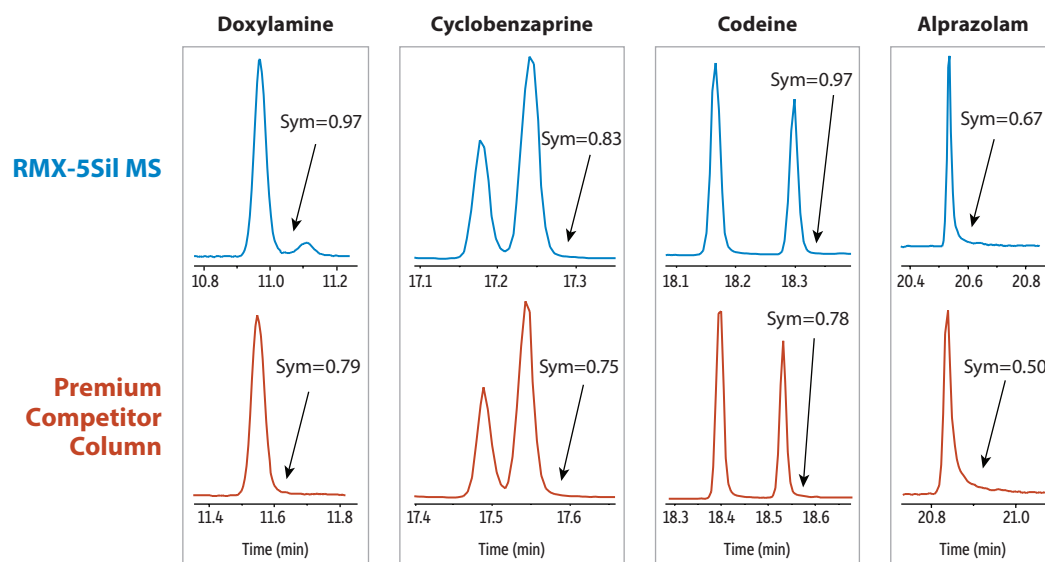
Peaks	tr (min)	Conc. (µg/mL)	Peaks	tr (min)	Conc. (µg/mL)	Peaks	tr (min)	Conc. (µg/mL)
1. Propofol	2.53	25	12. Ketamine	9.71	25	23. Dextromethorphan	15.69	25
2. Benzocaine	4.73	25	13. Diphenhydramine	10.02	25	24. Amitriptyline	16.70	25
3. Butabarbital	6.25	25	14. Phencyclidine (PCP)	10.54	25	25. Cocaine	16.82	25
4. Butalbital	6.33	25	15. Doxylamine	10.97	25	26. Imipramine	17.03	25
5. Phenacetin	6.52	25	16. Tramadol	11.7	25	27. Tetracaine	17.17	25
6. Cotinine	6.61	25	17. Phenobarbital	12.12	25	28. Cyclobenzaprine	17.24	25
7. Amobarbital	7.17	25	18. Chlorpheniramine	12.92	25	29. Sertraline	18.16	25
8. Pentobarbital	7.6	25	19. Procaine	13.39	25	30. Codeine	18.29	25
9. Secobarbital	8.54	25	20. Venlafaxine	14.65	25	31. 6-Acetylmorphine	18.96	25
10. Norketamine	9.06	25	21. Brompheniramine	15.02	25	32. Heroin	19.38	25
11. Prilocaine	9.33	25	22. Methadone	15.64	25	33. Zolpidem	19.97	25
						34. Alprazolam	20.53	25

**Column** RMX-5Sil MS, 30 m, 0.25 mm ID, 0.25 µm (cat.# 17323)  
**Standard/Sample**  
 Diluent: Ethyl acetate  
 Conc.: 25 ppm  
**Injection**  
 Inj. Vol.: 1 µL split (split ratio 10:1)  
 Liner: Topaz 4 mm single taper inlet liner with wool (cat.# 23303)  
 Inj. Temp.: 250 °C  
 Split Vent Flow Rate: 25 mL/min  
**Oven**  
 Oven Temp.: 150 °C (hold 1.0 min) to 210 °C at 4 °C/min to 320 °C at 30 °C/min (hold 2.0 min)  
**Carrier Gas**  
 Flow Rate: He, constant flow  
 2.0 mL/min  
 Linear Velocity: 54 cm/sec @ 150 °C  
**Detector**  
 Mode: MS  
 Scan Program: Scan  

Group	Start Time (min)	Scan Range (amu)	Scan Rate (scans/sec)
1	1.0	40-500	1562

 Transfer Line Temp.: 280 °C  
 Analyzer Type: Quadrupole  
 Source Temp.: 230 °C  
 Electron Energy: 70 eV  
 Tune Type: PFTBA  
 Ionization Mode: EI  
**Instrument** Agilent 7890A GC & 5975C MSD  
**Sample Preparation** Individual standards (100 ppm) were combined into a final 25 ppm solution in ethyl acetate.

**Figure 2:** Highly inert RMX-SSil MS columns improve peak shape for challenging acidic and basic drugs, allowing for more confidence in identification.



GC CF1186

Peaks	Conc. (µg/mL)	t <sub>R</sub> (min) for RMX-5Si1 M5	t <sub>R</sub> (min) for Premium Competitor Column
1. Doxylamine	25	10.97	11.54
2. Cyclobenzaprine	25	17.24	17.54
3. Codeine	25	18.29	18.53
4. Alprazolam	25	20.53	20.83

See notes for names, 30 m, 0.25 mm ID, 0.25 µm

<b>Column Standard/Sample</b>	
Diluent:	Ethyl acetate
Conc.:	25 ppm
<b>Injection</b>	
Inj. Vol.:	1 µL split (split ratio 10:1)
Liner:	Topaz 4 mm single taper inlet liner with wool (cat.# 23303)
Inj. Temp.:	250 °C
Split Vent Flow Rate:	25 mL/min
<b>Oven</b>	
Oven Temp.:	150 °C (hold 1.0 min) to 210 °C at 4 °C/min to 320 °C at 30 °C/min (hold 2.0 min)
<b>Carrier Gas</b>	He, constant flow
Flow Rate:	2.0 mL/min
Linear Velocity:	54 cm/sec @ 150 °C
<b>Detector</b>	MS
Mode:	Scan
Scan Program:	

Group	Start Time (min)	Scan Range (amu)	Scan Rate (scans/sec)
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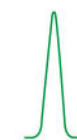
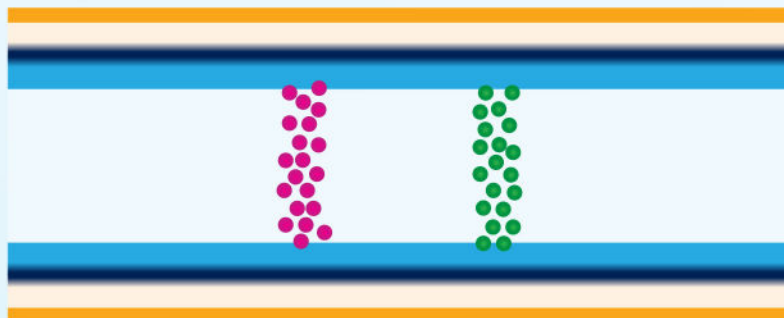
Transfer Line Temp.: 280 °C  
Analyzer Type: Quadrupole  
Source Temp.: 230 °C  
Electron Energy: 70 eV  
Tune Type: PFTBA  
Ionization Mode: EI  
**Instrument** Agilent 7890A GC & 5975C MSD  
**Sample Preparation Notes** Individual standards (100 ppm) were combined into a final 25 ppm in ethyl acetate. Columns tested: RMX-5Si MS (cat.# 17323) and a premium competitor column

# What Makes RMX Columns Better?

Highly Effective TriMax Deactivation Protects Analytes From Surface Interactions, Improving Peak Shape and Sensitivity for a Wide Range of Compound Chemistries



## TriMax Deactivation

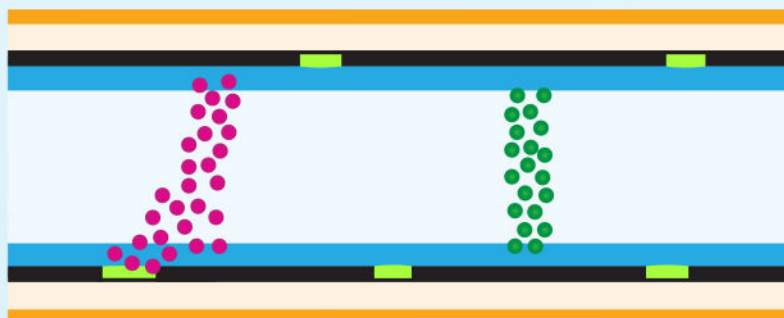


Inactive



Active

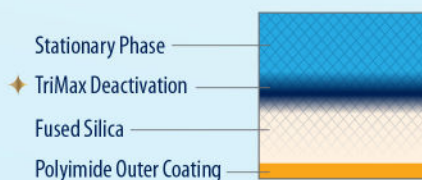
## Non-TriMax Deactivation



Inactive



Active



- Inactive compounds:  
*alkanes, alkenes, alkynes, etc.*
- Active compounds:  
*acids, bases, alcohols, esters, ethers, etc.*
- Residual active site

Learn More About  
RMX Columns Today!



## Featured Products

### RMX-5SiI MS GC Capillary Column

Catalog No.	Product Name	Units
17323	RMX-5SiI MS GC Capillary Column, 30 m, 0.25 mm ID, 0.25 µm	ea.



### Topaz Single Taper Inlet Liner

Catalog No.	Product Name	Units
23303	Topaz, Single Taper Inlet Liner, 4.0 mm x 6.5 x 78.5, for Agilent GCs, w/Quartz Wool, Premium Deactivation	5-pk.



### Restek Electronic Leak Detector

Catalog No.	Product Name	Units
28500	Restek Electronic Leak Detector (includes carrying case; universal AC power adaptor [U.S., UK, Europe, Australia, Japan]; 6-ft USB charging cable)	ea.



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