

# APPLICATIONS

## Volatile Amine Analysis Using a Zebron™ ZB-624PLUS™ GC Column

Ramkumar Dhandapani, Yuri Belov, and Rola El abaji  
Phenomenex, Inc., 411 Madrid Ave., Torrance, CA 90501 USA



**Ramkumar Dhandapani, Ph.D.**  
Product Manager - Gas Chromatography

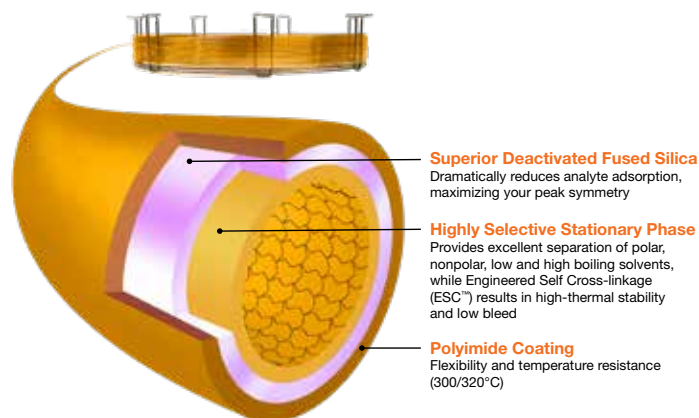
*He has a PhD in Analytical Chemistry and a total of 14 years experience in chromatographic method development and troubleshooting. Ramkumar loves to write poems, read Shakespeare, and attend Shakespeare plays.*

### Introduction

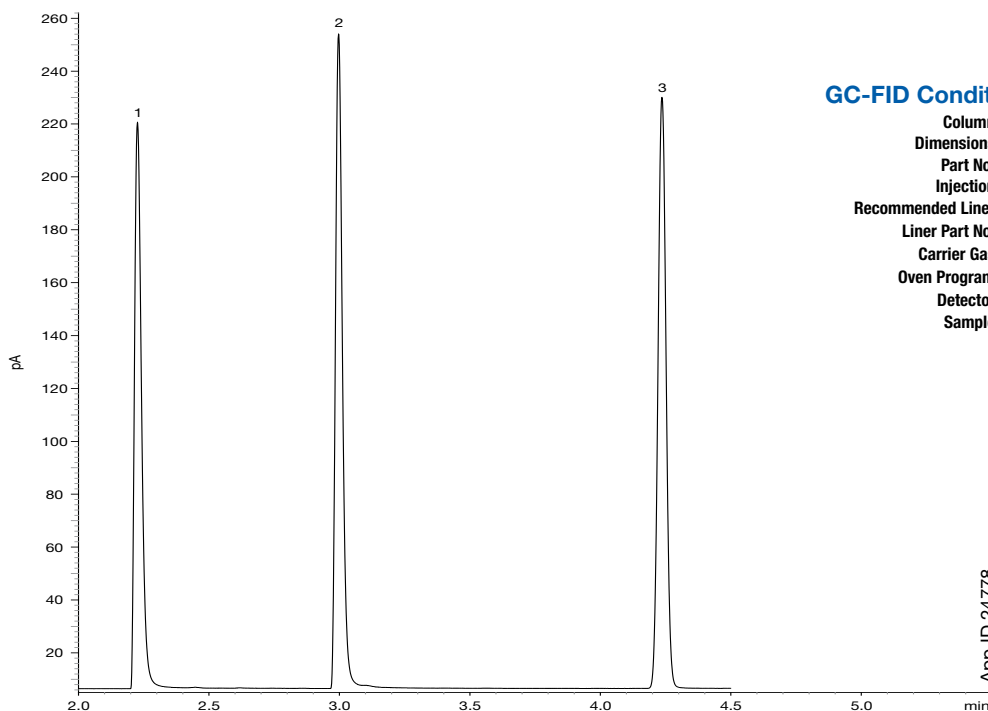
Volatile Amines are the characteristic compounds that exhibit a fishy odor. In pharmaceutical ingredient manufacturing, it is common to use some of these amines as reagents for synthesis. Once the finished product active pharmaceutical ingredient is ready, it is tested for residual amounts of amines and has to be less than the permitted daily exposure, considering risk based assessments. While triethylamine is listed in Q3C(R6) of the ICH guideline, under class 3 solvent, there are a few amines that don't have established classification.

Chromatographically, the biggest challenge with amines are the active functional group that makes them adsorb to any secondary polar interaction in a GC column. Since these amines are lighter, it is easy to introduce them into a GC inlet via neat solvent injection or by headspace for quantitation. However, because of active sites in traditional GC phases, they tend to tail. Especially, for residual solvent analysis, a G43 type phase provides the right balance of retention and selectivity for low and high boiling as well as polar and nonpolar solvents. Having the volatile amine analysis on a G43 selectivity without analyte peak adsorption onto the column is a challenge. In this study, we have employed a Zebron ZB-624PLUS GC column for volatile amine analysis. This study demonstrates that superior deactivation of Zebron ZB-624PLUS provides symmetric peak shape for volatile amines.

**Figure 2.**  
Zebron ZB-624PLUS advantages



**Figure 1.**  
Volatile Amines on Zebron ZB-624PLUS by GC-FID



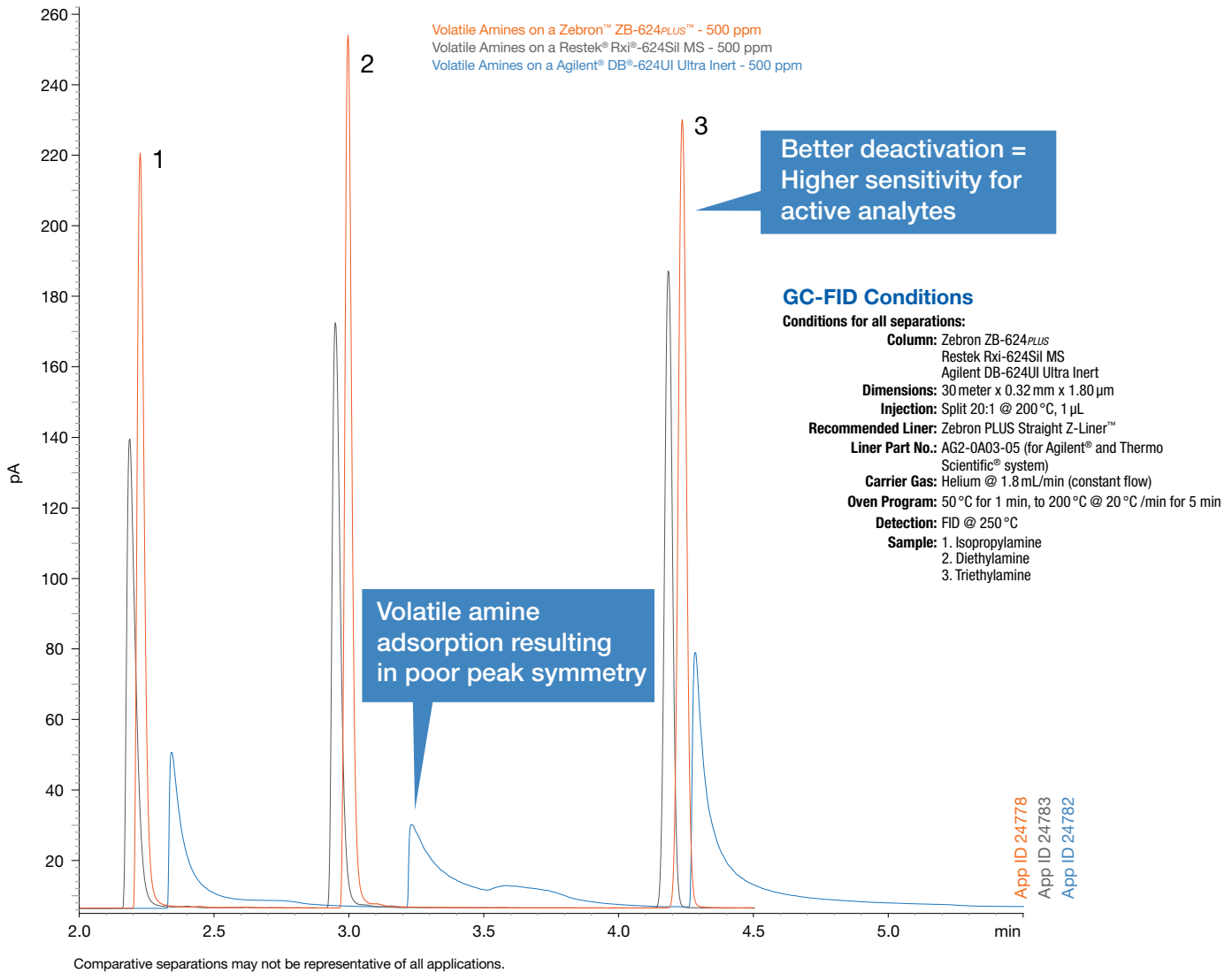
### GC-FID Conditions

**Column:** Zebron ZB-624PLUS  
**Dimensions:** 30 meter x 0.32 mm x 1.80 µm  
**Part No.:** 7HM-G040-31  
**Injection:** Split 20:1 @ 200 °C, 1 µL  
**Recommended Liner:** Zebron PLUS Straight Z-Liner™  
**Liner Part No.:** AG2-0A03-05 (for Agilent® and Thermo Scientific® systems)  
**Carrier Gas:** Helium @ 1.8 mL/min (constant flow)  
**Oven Program:** 50 °C for 1 min, to 200 °C @ 20 °C /min for 5 min  
**Detector:** FID @ 250 °C  
**Sample:** 1. Isopropylamine  
 2. Diethylamine  
 3. Triethylamine

App ID 24778

# APPLICATIONS

**Figure 3.**  
Comparison of Volatile Amines on various 624 columns



**Table 1.**  
Peak symmetry values for Volatile Amines on Zebtron ZB-624PLUS

Peak No.	Analyte	Peak Skew
1	Isopropylamine	1.3
2	Diethylamine	1.2
3	Triethylamine	1.0

**Table 2.**  
Peak symmetry comparison for Volatile Amines on various 624 phases

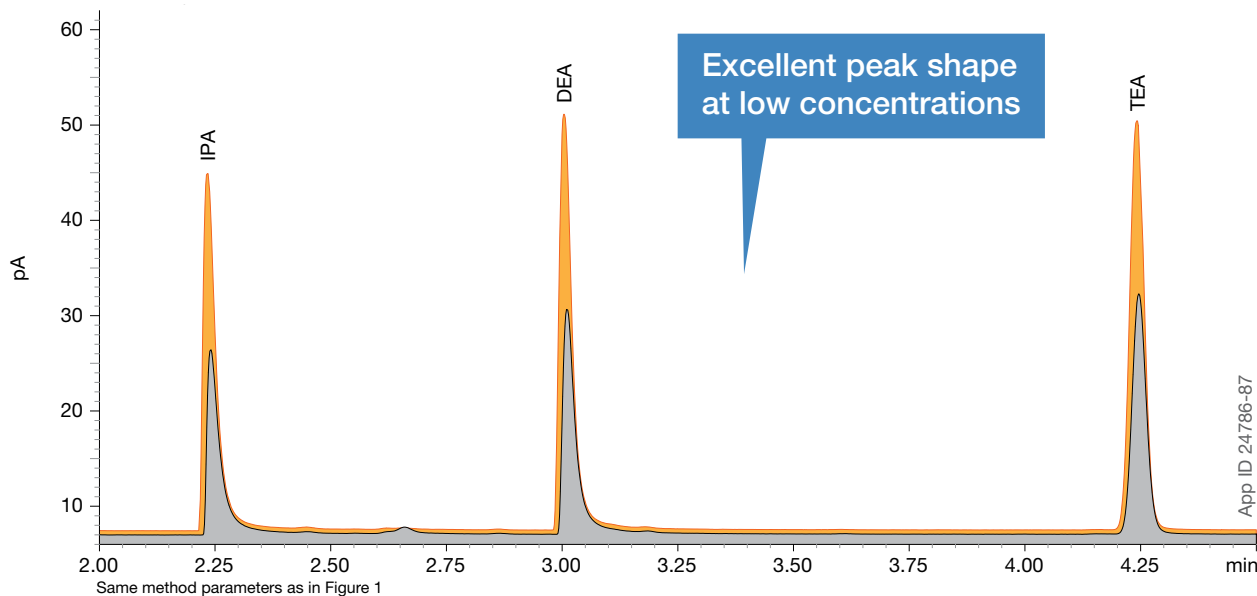
Peak No.	Analyte (500 ppm)	Peak Skew		
		ZB-624PLUS	Rxi-624SiIMS	DB-624UI
1	Isopropylamine	1.3	1.6	4.1
2	Diethylamine	1.2	1.3	7.9
3	Triethylamine	1.0	1.0	5.1

# APPLICATIONS

**Figure 4.**

Volatile Amines on a ZB-624<sup>PLUS</sup>™ - @ 100 ppm (App ID 24787)

Volatile Amines on a ZB-624<sup>PLUS</sup> - @ 50 ppm (App ID 24786)



## Results and Discussion

Presented in **Figure 1** is the analysis of isopropylamine, diethylamine, and triethylamine, on a Zebtron™ ZB-624<sup>PLUS</sup> at 500 ppm analyte concentration. Due to the superior deactivation (**Figure 2**) of ZB-624<sup>PLUS</sup>, symmetric peak shapes are produced for volatile amines. While acceptable peak skew is between 0.8 to 1.5 for consistent quantitation, ZB-624<sup>PLUS</sup> provides excellent peak symmetry for active analytes as shown in **Table 1**.

Presented in **Figure 3** is a comparison of volatile amines on Zebtron ZB-624<sup>PLUS</sup>, Restek® Rxi®-624Sil MS and Agilent® DB®-624UI and peak skew values are presented in **Table 2**. Based on the chromatogram, ZB-624<sup>PLUS</sup> not only provides symmetric peak shape but also exhibits higher sensitivity. This is possible because of the superior deactivation and higher efficiency specifications of ZB-624<sup>PLUS</sup>. While ZB-624<sup>PLUS</sup> gives the most sensitivity and symmetric peak, Agilent DB-624 UI provides extreme peak tailing for volatile amines.

Presented in **Figure 4** is the comparison of volatile amines at 50 and 100 ppm concentration. In general, amine peaks tail at lower concentration, however ZB-624<sup>PLUS</sup> undergoes a superior deactivation that provides excellent peak shape for active compounds even at lower concentration. After the deactivation process is complete, ZB-624<sup>PLUS</sup> columns are QC tested with acid and base analytes, so that every column you get is ready to provide symmetric peak shape for active analytes in your lab.


## Conclusion

Zebtron ZB-624<sup>PLUS</sup> not only provides symmetric peaks for volatile amine analysis but also exhibits higher sensitivity for volatile amine analysis. These columns undergo superior deactivation and are quality tested with active amines. The innovative deactivation from the Zebtron R&D team and stringent quality measure in production, ensures that every individual ZB-624<sup>PLUS</sup> column you receive is ready to provide symmetric peak for active volatile amines.



# APPLICATIONS

## Ordering Information Zebtron™ PLUS GC Inlet Liners

Description	Application	Inlet Style	Dimensions ID x L (mm)	Deactivation	Part No.	Unit
<b>For 5890, 6890 and 7890 Models</b>						
Straight Z-Liner™ 	Dirty samples, Volatiles, High initial oven temperatures	S/SL	4 x 78.5	PLUS Inert	AG2-0A03-01 AG2-0A03-05 AG2-0A03-25	ea 5/pk 25/pk

## Ordering Information Zebtron™ ZB-624PLUS™ GC Columns

ID(mm)	df(µm)	Temp. Limits °C	Part No.
<b>20-Meter</b>			
0.18	1.00	-20 to 300/320	7FD-G040-22
<b>30-Meter</b>			
0.25	1.40	-20 to 300/320	7HG-G040-27
0.32	1.80	-20 to 300/320	7HM-G040-31
0.53	3.00	-20 to 300/320	7HK-G040-36
<b>60-Meter</b>			
0.25	1.40	-20 to 300/320	7KG-G040-27
0.32	1.80	-20 to 300/320	7KM-G040-31
0.53	3.00	-20 to 300/320	7KK-G040-36

Note: If you need a 5 in. cage, simply add a (-B) after the part number, e.g., 7HG-G040-27-B. Some exceptions may apply. Agilent 6850 and some SRI and process GC systems use only 5 in. cages.

### Australia

t: +61 (0)2-9428-6444  
f: +61 (0)2-9428-6445  
auinfo@phenomenex.com

### Austria

t: +43 (0)1-319-1301  
f: +43 (0)1-319-1300  
anfrage@phenomenex.com

### Belgium

t: +32 (0)2 503 4015 (French)  
t: +32 (0)2 511 8666 (Dutch)  
f: +31 (0)30-2383749  
beinfo@phenomenex.com

### Canada

t: +1 (800) 543-3681  
f: +1 (310) 328-7768  
info@phenomenex.com

### China

t: +86 400-606-8099  
f: +86 (0)22 2532-1033  
cninfo@phenomenex.com

### Denmark

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

### Finland

t: +358 (0)9 4789 0063  
f: +45 4810 6265  
nordicinfo@phenomenex.com

### France

t: +33 (0)1 30 09 21 10  
f: +33 (0)1 30 09 21 11  
franceinfo@phenomenex.com

### Germany

t: +49 (0)6021-58830-0  
f: +49 (0)6021-58830-11  
anfrage@phenomenex.com

### India

t: +91 (0)40-3012 2400  
f: +91 (0)40-3012 2411  
indiainfo@phenomenex.com

### Ireland

t: +353 (0)1 247 5405  
f: +44 1625-501796  
eireinfo@phenomenex.com

### Italy

t: +39 051 6327511  
f: +39 051 6327555  
italiainfo@phenomenex.com

### Luxembourg

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

### Mexico

t: 01-800-844-5226  
f: 001-310-328-7768  
tecnicomx@phenomenex.com

### The Netherlands

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

### New Zealand

t: +64 (0)9-4780951  
f: +64 (0)9-4780952  
nzinfo@phenomenex.com

### Norway

t: +47 810 02 005  
f: +45 4810 6265  
nordicinfo@phenomenex.com

### Portugal

t: +351 221 450 488  
f: +34 91-413-2290  
info@phenomenex.com

### Spain

t: +34 91-413-8613  
f: +34 91-413-2290  
espinfo@phenomenex.com

### Sweden

t: +46 (0)8 611 6950  
f: +45 4810 6265  
nordicinfo@phenomenex.com

### Switzerland

t: +41 61 692 20 20  
f: +41 61 692 20 22  
swissinfo@phenomenex.com

### United Kingdom

t: +44 (0)1625-501367  
f: +44 (0)1625-501796  
ukinfo@phenomenex.com

### USA

t: +1 (310) 212-0555  
f: +1 (310) 328-7768  
info@phenomenex.com

### All other countries Corporate Office USA

t: +1 (310) 212-0555  
f: +1 (310) 328-7768  
info@phenomenex.com



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 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

Zebtron, Z-Liner, ESC, and 624PLUS are trademarks of Phenomenex. Agilent and DB are registered trademarks of Agilent Technologies, Inc. Restek and Rxi are registered trademarks of Restek Corp. Thermo Scientific is a registered trademark of Thermo Fisher Scientific Inc.

### Disclaimer

Comparative separations may not be representative of all applications. Phenomenex is not affiliated with Agilent, Restek, or Thermo.

FOR RESEARCH USE ONLY. Not for use in clinical diagnostic procedures.

© 2018 Phenomenex, Inc. All rights reserved.

## www.phenomenex.com

Phenomenex products are available worldwide. For the distributor in your country, contact Phenomenex USA, International Department at [international@phenomenex.com](mailto:international@phenomenex.com)