

Improved Purge-Trap/GC Analysis of Volatiles in Drinking Water by US EPA Method 524.2

The VOCARB 3000 adsorbent trap is suitable for monitoring volatile organic compounds in drinking water samples, as well as in wastewater and hazardous waste samples. This adsorbent trap meets the requirements of US EPA Methods 502 and 524.2. Relative standard deviation values were less than 15% for all of the compounds listed, and less than 7% for most of the compounds. Recovery of each compound listed was greater than 80%. For certain problem compounds — vinyl chloride, 1,1,1-trichloroethane, and carbon tetrachloride — the VOCARB 3000 trap offered significantly better performance compared to the Tenax/silica gel/charcoal trap recommended by Method 524.

Analysts monitoring drinking water samples for volatile organic compounds (VOCs) using US EPA Methods 502 and 524.2 must concentrate their samples, using a purge and trap technique, prior to chromatographic analysis. The same technique is used for all of the volatiles methods, including 602/624 (wastewater) and 8260 (hazardous waste). Volatile compounds are purged from the water sample, collected on an adsorbent material, and delivered to the GC column by thermal desorption.

The EPA would allow laboratories using EPA Method 502.2 to use alternative sorbents to trap volatile organic compounds, provided they meet all quality assurance criteria specified in the method. This same option is already included in EPA Method 524.2 (EPA 1192a).[▲]

Key Words:

- adsorbent traps ● drinking water
- volatile organic compounds

[▲] Federal Register/Vol. 58, No. 239/Wednesday, December 15, 1993/Proposed Rules, p. 65627.

Table 1. Compounds with Established Maximum Contamination Levels (20ppb in 5mL water)

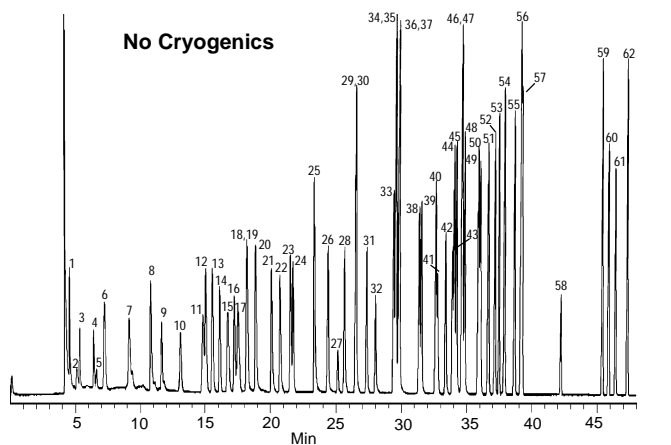
Compound	Response Factors [■]						Relative % Recovery	
	Avg.	VOCARB 3000 Std. Dev.	%RSD	Avg. Tenax/Silica Gel/Charcoal	Std. Dev.	%RSD	VOCARB 3000	Ten/SG/C
Vinyl Chloride	0.288	0.027	9.4	0.145	0.051	35.2	117.9	59.6
1,1-Dichloroethene	0.226	0.005	2.4	0.244	0.018	7.5	104.4	112.6
Methylene Chloride	0.294	0.016	5.4	0.319	0.018	5.6	106.1	114.9
trans-1,2-Dichloroethene	0.254	0.009	3.6	0.257	0.068	3.3	96.4	97.7
cis-1,2-Dichloroethene	0.297	0.013	4.2	0.270	0.036	13.5	96.8	88.3
Chloroform	0.539	0.032	5.9	0.539	0.079	14.6	97.5	97.6
1,1,1-Trichloroethane	0.347	0.019	5.4	0.192	0.009	4.7	93.8	52.0
Carbon tetrachloride	0.341	0.013	3.7	0.231	0.016	7.1	91.7	62.2
1,2-Dichloroethene	0.381	0.013	4.2	0.323	0.021	6.5	84.0	90.1
Benzene	0.690	0.015	2.2	0.722	0.017	2.4	86.1	90.2
Trichloroethane	0.364	0.012	3.2	0.395	0.009	2.2	86.5	93.9
1,2-Dichloropropane	0.367	0.009	2.5	0.369	0.016	4.3	90.6	91.2
Bromodichloromethane	0.531	0.006	1.2	0.549	0.030	5.4	93.8	96.9
Toluene	0.861	0.018	2.1	0.899	0.024	2.6	83.1	86.8
1,1,2-Trichloroethene	0.386	0.014	4.6	0.347	0.030	8.5	80.7	91.5
Tetrachloroethene	0.499	0.033	6.7	0.491	0.029	6.0	95.5	94.0
Dibromochloromethane	0.571	0.021	3.6	0.607	0.043	7.1	91.4	97.2
Chlorobenzene	1.443	0.077	5.3	1.466	0.078	5.3	92.8	94.2
Ethylbenzene	1.798	0.057	3.2	1.936	0.113	5.8	80.0	86.1
m- and p-Xylene	1.351	0.024	1.8	1.551	0.066	4.2	79.9	91.7
o-Xylene	0.722	0.019	2.6	0.779	0.023	3.0	84.5	91.1
Styrene	1.165	0.066	5.6	1.266	0.069	5.5	83.8	91.0
Bromoform	0.984	0.083	8.4	1.083	0.123	11.4	83.3	91.6
1,4-Dichlorobenzene	1.681	0.179	10.6	1.603	0.017	1.1	101.5	96.8
1,2-Dichlorobenzene-d ₄	1.500	0.000	0.0	1.500	0.000	0.0	100.0	100.0
1,2-Dichlorobenzene	1.626	0.018	1.1	1.624	0.011	0.7	103.4	103.3
1,2,4-Trichlorobenzene	1.311	0.052	3.9	1.514	0.064	4.2	84.2	97.2

[■]n = 6

Figure A. VOCARB 3000 Trap Provides Good Overall Response for Volatile Compounds

Sample: 10ppb each component in 5mL water
 Trap: VOCARB 3000
 Purge: 11 min, 40mL/min
 Dry: 3 min
 Desorb. Temp.: 250°C for 4 min
 Bake: 280°C for 10 min
 Column: **VOCOL, 105m x 0.53mm ID, 3.0µm film**
 Cat. No.: **25358**
 Oven: 35°C (10 min) to 200°C at 4°C/min, hold 10 min
 Carrier: helium, 10mL/min
 Det.: MS, Scan Range m/z = 35-260 at 0.6 sec/scan

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|-------------------------------|--|
| 1. Dichlorodifluoromethane | 32. 1,2-Dibromoethane |
| 2. Chloromethane | 33. Chlorobenzene |
| 3. Vinyl chloride | 34. 1,1,1,2-Tetrachloroethane |
| 4. Bromomethane | 35. Ethylbenzene |
| 5. Chloroethane | 36. m-Xylene |
| 6. Trichlorofluoromethane | 37. p-Xylene |
| 7. 1,1-Dichloroethane | 38. o-Xylene |
| 8. Methylene chloride | 39. Styrene |
| 9. trans-1,2-Dichloroethane | 40. Isopropylbenzene |
| 10. 1,1-Dichloroethane | 41. Bromoform |
| 11. 2,2-Dichloropropane | 42. 1,1,2,2-Tetrachloroethane |
| 12. cis-1,2-Dichloroethane | 43. 1,2,3-Trichloropropane |
| 13. Chloroform | 44. n-Propylbenzene |
| 14. Bromochloromethane | 45. Bromobenzene |
| 15. 1,1,1-Trichloroethane | 46. 1,3,5-Trimethylbenzene |
| 16. 1,1-Dichloropropene | 47. 2-Chlorotoluene |
| 17. Carbon tetrachloride | 48. 4-Chlorotoluene |
| 18. 1,2-Dichloroethane | 49. tert-Butylbenzene |
| 19. Benzene | 50. 1,2,4-Trimethylbenzene |
| 20. Fluorobenzene (int. std.) | 51. sec-Butylbenzene |
| 21. Trichloroethene | 52. p-Isopropyltoluene |
| 22. 1,2-Dichloropropane | 53. 1,3-Dichlorobenzene |
| 23. Bromodichloromethane | 54. 1,4-Dichlorobenzene |
| 24. Dibromomethane | 55. n-Butylbenzene |
| 25. cis-1,2-Dichloropropene | 56. 1,2-Dichlorobenzene-d ₄ (int. std.) |
| 26. Toluene | 57. 1,2-Dichlorobenzene |
| 27. trans-1,3-Dichloropropene | 58. 1,3-Dibromo-3-chloropropane |
| 28. 1,1,2-Trichloroethane | 59. 1,2,4-Trichlorobenzene |
| 29. 1,3-Dichloropropane | 60. Hexachlorobutadiene |
| 30. Tetrachloroethene | 61. Naphthalene |
| 31. Chlorodibromomethane | 62. 1,2,3-Trichlorobenzene |



92-0134

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Fused silica columns manufactured under HP US Pat. No. 4,293,415.

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Although purge traps are specified in US EPA methods, provisions for *best available technology* allow the selection of traps that offer improved performance, if they meet the QA/QC criteria stated in the method. (Consult your regional EPA office before using a non-specified trap.) Advanced materials, such as the adsorbents used in VOCARB traps, can offer superior adsorption/desorption characteristics, thermal stability, and hydrophobicity.

The VOCARB 3000 trap contains a combination of adsorbents that efficiently traps and releases the range of compounds listed in EPA Method 524.2. Good overall response for the Method 524.2 analytes was obtained using the VOCARB 3000 trap (Figure A). The thermal stability of the adsorbents used in the VOCARB 3000 trap allows a higher desorption temperature (250°C) than does the EPA-listed trap (180°C), so that the analytes are released more rapidly, in a focused plug rather than in a broad band, for improved peak shape and resolution.

We compared the performance of the VOCARB 3000 trap to that of the Tenax®/silica gel/charcoal trap specified by EPA Methods 524.2 and 502 (Table 1). Response factors, calculated with respect to fluorobenzene and 1,2-dichlorobenzene-d₄, show that the VOCARB 3000 trap meets performance requirements for Methods 502.2 and 524.2. Relative standard deviation (RSD) values were less than 15% for all of the compounds listed, and less than 7% for most of the compounds. Overall, the VOCARB 3000 trap's performance was comparable to that of the Tenax/silica gel/charcoal trap; Recovery of each compound listed was greater than 80%. For certain problem compounds — vinyl chloride, 1,1,1-trichloroethane, and carbon tetrachloride — the VOCARB 3000 trap offered significantly better performance.

The VOCARB 3000 trap offers superior performance for monitoring volatile compounds in water samples. Since EPA methods for volatiles analysis in drinking water, wastewater, and hazardous waste list the same compounds, the VOCARB 3000 trap can be used for all of the methods. However, we stress the importance of demonstrating the calibration requirements for each method when using the VOCARB 3000 trap to comply with the best available technology provisions of the methods.

Ordering Information: VOCARB 3000 Traps

10cm Carbopack™ B/6cm Carboxen™ 1000/ 1cm Carboxen 1001

Instrument	Description	Cat. No.
Tekmar®	straight, 30.5cm (12")	21066-U
Dynatech®	straight, 30.5cm (12") with attached thermocouple	21085-U
O.I. Analytical	U-shaped, 29.2cm (11.5") with attached thermocouple	21131-U
CDS	straight, 28.6cm (11.25")	21159

For VOCARB 3000 traps for other instruments, refer to the Supelco catalog.

VOCOL™ Fused Silica Capillary Column 105m x 0.53mm ID, 3.0µm film

2-5358

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