Volatile organic compounds in water by purge and trap/capillary column GC with photoionization and electrolytic conductivity detectors in series

Application Note

Environmental

Authors

Agilent Technologies, Inc.

Introduction

The 1986 amendments to the Safe Drinking Water Act require the determination of eight newly regulated Volatile Organic Compounds (VOCs) in addition to the trihalomethanes, and the monitoring of fifty-one other VOCs in finished drinking water, raw source water, or drinking water in any treatment stage. This analysis is performed using EPA Method 502.2.

The VOCs are purged and subsequently trapped on a Tenax-silica gel-charcoal trap, as in the Method 601*, but after desorption the analysis is carried out on a capillary column and the VOCs are detected on a Photoionization Detector (aromatics) connected to an Electrolytic Conductivity Detector (halocarbons) in series. The 624-type (0.53 mm x 30 m, 3 µL film) or CP-Select 624 CB column provides improved resolution of the many VOCs and also ensures lower detection limits than was attainable with the packed column. Figure 1 shows a dual channel chromatogram of selected VOCs.

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Peak identification

1. dichlorodifluoromethane
2. chloromethane
3. vinyl chloride
4. bromomethane
5. chloroethane
6. trichlorofluoromethane
7. 1,1-dichloroethene
8. methylene chloride
9. T-1,2-dichloroethene
10. 1,1-dichloroethane
11. chloroform
12. 1,1,1-trichloroethane
13. tetrachloromethane
14. benzene
15. 1,2-dichloroethane
16. trichloroethene
17. 1,2-dichloropropane
18. bromodichloromethane
19. C-1,3-dichloropropene
20. toluene
21. T-1,3-dichloropropene
22. 1,1,2-trichloroethane
23. tetrachloroethene
24. dibromochloromethane
25. chlorobenzene
26. ethylbenzene
27. m/p-xylene
28. o-xylene
29. bromoform
30. 1,1,2,2-tetrachloroethane
31. bromobenzene
32. p-chlorotoluene
33. 1,3-dichlorobenzene
34. 1,4-dichlorobenzene
35. 1,2-dichlorobenzene
36. 1,2,4-trichlorobenzene
37. hexachlorobutadiene

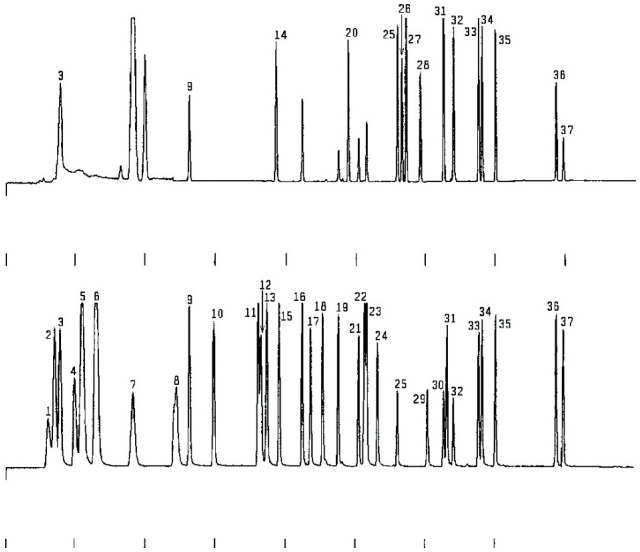

Figure 1. The Analysis of Volatile Organic Compounds Employing a 624 -type Column and PID/ELCD Detectors

The chromatograms shown in Figures 1 and 3 were obtained using the column selector. Different retention times on the 624-type columns, and in a few cases reversed elution orders help provide positive identification by two column confirmation. Additional confirmatory information can be acquired for some compounds by result ratioing of VOCs which respond to both detectors, for example, halogenated aromatic and unsaturated compounds. The result ratio of 1 indicates the presence of these dual detected contaminants.

The column selector system is fully automatic in the sequence mode allowing unattended operation. Blank, calibration, and analysis runs may be executed first with the primary column and then with the confirmatory column.

Conditions

Column	: 6% cyanopropylphenyl 94% methyl, 0.53 mm x 30 m, 3 µm
Oven	: 10 °C/10 min, 5 °C/min to 160 °C/0 min
Carrier Gas	: Helium, 6.0 mL/min
Trap	: Tenax/Silica Gel/Charcoal, 11 min purge
Concentration	: 20 ppb each component

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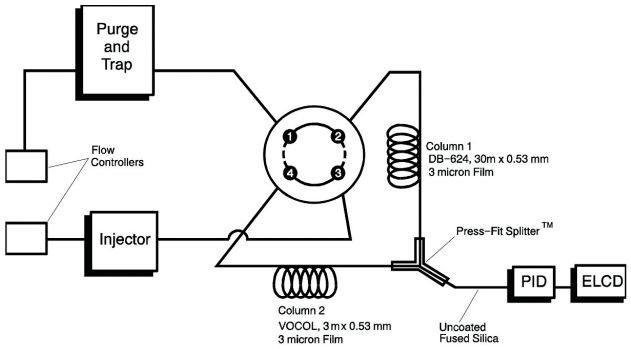

Figure 2. Column Selector for VOC Analysis

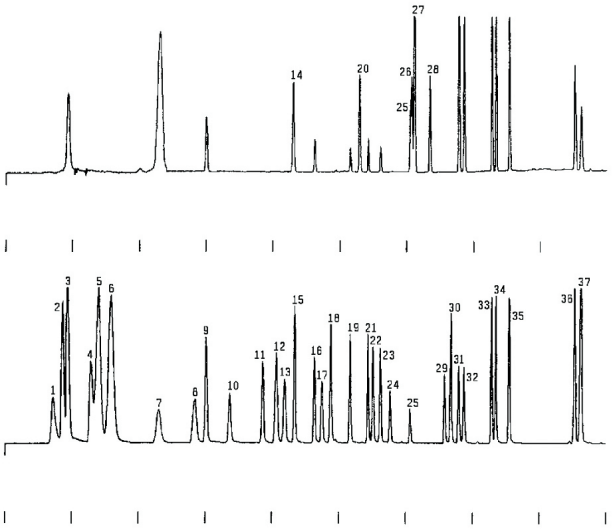

Figure 3. The Analysis of Volatile Organic Compounds optimized Column and PID/ELCD Detectors

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