

# Application Data Sheet

## No.34

### GCMS

Gas Chromatograph Mass Spectrometer

## Shortening Cycle Times for Analyzing Volatile Compounds

### Introduction

Shortening analysis cycle times requires reviewing everything from the GC-MS measurement time to the preparation time required before the next measurement starts. The GC oven in the GCMS-QP2010 Ultra features a double-shot cooling system that significantly reduces the time for cooling the column. This datasheet reports the results of a study to shorten the cycle time of analyzing volatile organic compounds (VOCs) in water using headspace GC/MS.

### Analysis Conditions and Results

Table 1 shows the analysis conditions and Fig. 1 shows the total ion current chromatogram. All 28 VOCs (3 of which were internal standards) were detected within a GC-MS measurement time of 5.8 seconds. Only 3.8 minutes were required for cooling the column after analysis, including an equilibration time of 1 minute.

Table 1: Analysis Conditions

|                         |                     |                           |                                                          |
|-------------------------|---------------------|---------------------------|----------------------------------------------------------|
| HS                      | : TurboMatrix HS    |                           |                                                          |
| GC-MS                   | : GCMS-QP2010 Ultra |                           |                                                          |
| [HS]                    |                     | [GC]                      |                                                          |
| Head space mode         | : Constant          | Vaporization chamber temp |                                                          |
| Injection time          | : 0.15 min*         |                           | : 200°C                                                  |
| Zone temp. settings     | : (O/N/T)           | Column                    | : Rtx®-624 (length 20 m, 0.18 mm I.D., df=1.0 µm Restek) |
| Oven temperature        | : 70°C              | Column oven temp.         | : 50°C (0.5min)→(35°C/min)→200°C (1min)                  |
| Needle temperature      | : 100°C             | Carrier gas               | : Helium                                                 |
| Transfer temperature    | : 150°C             |                           |                                                          |
| Sample shaker           | : OFF               | [MS]                      |                                                          |
| GC cycle time           | : 10min             | Interface temp.           | : 230°C                                                  |
| Pressurization time     | : 1min              | Solvent elution time      | : 0.7 min                                                |
| Uptake time             | : 0min              | Measurement mode          | : SIM                                                    |
| Warming time            | : 30min             | Emission current          | : 150 µA (high sensitivity)                              |
| HS carrier gas pressure | : 180 kPa           | Ion source temp.          | : 200°C                                                  |
|                         |                     | Data sampling time        | : 1.2 – 5.8 min                                          |
|                         |                     | Event time                | : 0.2 sec                                                |

Note: The headspace sampler injection time can vary depending on the instrument status. Therefore, optimization is required.

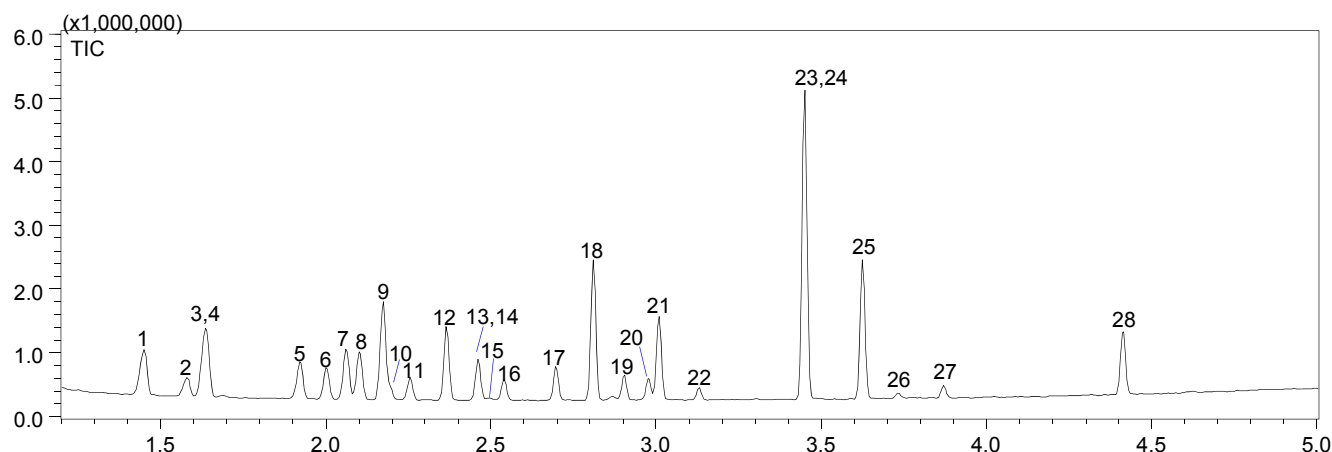


Fig. 1: Total Ion Current Chromatogram

1. 1,1-Dichloroethene, 2. Dichloromethane, 3. Methyl tert-butyl ether, 4. trans-1,2-Dichloroethylene, 5. cis-1,2-Dichloroethylene, 6. Chloroform, 7. 1,1,1-Trichloroethane, 8. Carbon tetrachloride, 9. Benzene, 10. 1,2-Dichloroethane, 11. Fluorobenzene, 12. Trichloroethylene, 13. 1,2-Dichloropropane, 14. 1,4-Dioxane-d8, 15. 1,4-Dioxane, 16. Bromodichloromethane, 17. cis-1,3-Dichloropropene, 18. Toluene, 19. trans-1,3-Dichloropropene, 20. 1,1,2-Trichloroethane, 21. Tetrachloroethylene, 22. Dibromodichloromethane, 23,24. *m,p*-Xylene, 25. *o*-Xylene, 26. Bromoform, 27. 4-Bromofluorobenzene, 28. 1,4-Dichlorobenzene

## Sensitivity and Reproducibility

Fig. 2 shows typical SIM chromatograms of 0.1 µg/L concentrations (5 µg/L for 1,4-dioxane). Table 2 indicates the accuracy for 7 repetitions of measuring 0.1 µg/L concentrations (5 µg/L for 1,4-dioxane). Good repeatability was obtained, even for high-speed analysis, with the %RSD for area ratios within 7 % for all compounds.

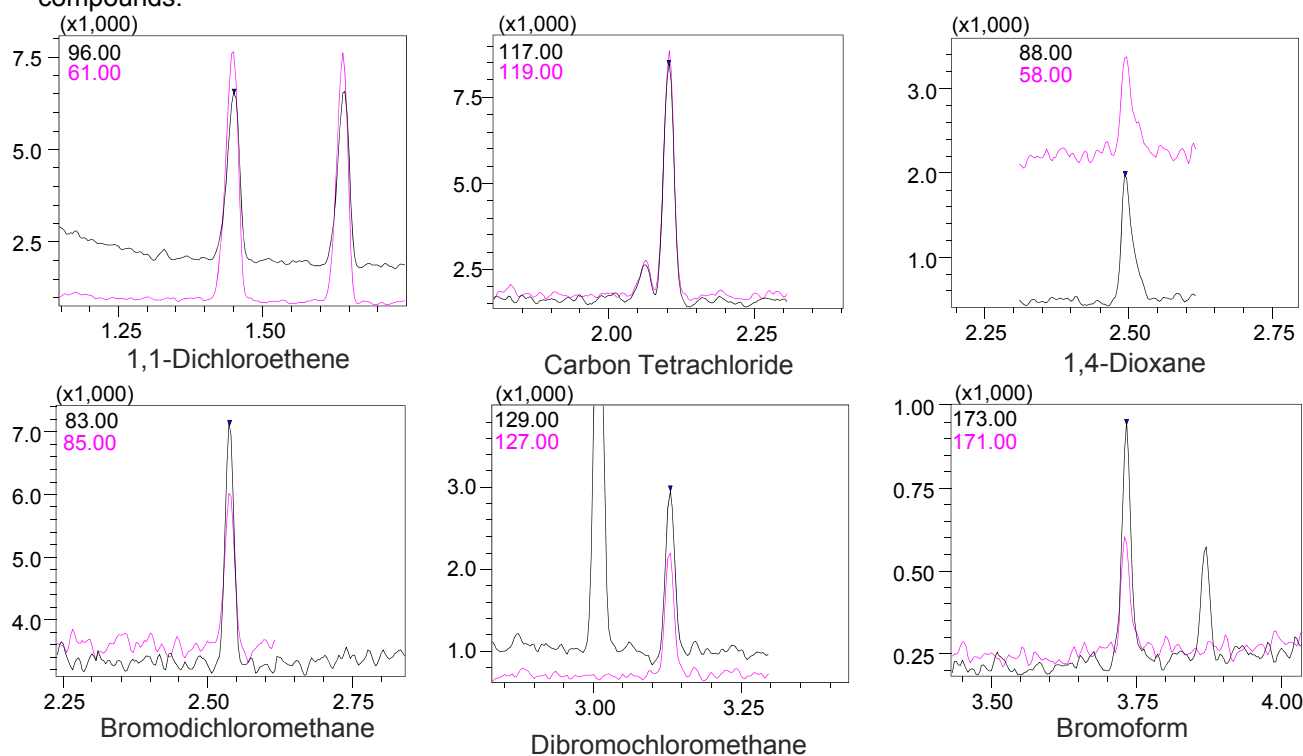


Fig. 2: SIM Chromatogram

Table 2: Area Ratio Repeatability (%RSD, n = 7)

| ID | Compound Name              | %RSD | ID | Compound Name             | %RSD |
|----|----------------------------|------|----|---------------------------|------|
| 1  | 1,1-Dichloroethene         | 1.24 | 15 | 1,4-Dioxane               | 6.48 |
| 2  | Dichloromethane            | 6.43 | 16 | Bromodichloromethane      | 2.18 |
| 3  | Methyl tert-butyl ether    | 2.14 | 17 | cis-1,3-Dichloropropene   | 4.05 |
| 4  | trans-1,2-Dichloroethylene | 4.14 | 18 | Toluene                   | 5.09 |
| 5  | cis-1,2-Dichloroethylene   | 4.17 | 19 | trans-1,3-Dichloropropene | 4.60 |
| 6  | Chloroform                 | 3.17 | 20 | 1,1,2-Trichloroethane     | 4.59 |
| 7  | 1,1,1-Trichloroethane      | 1.01 | 21 | Tetrachloroethylene       | 3.25 |
| 8  | Carbon tetrachloride       | 2.68 | 22 | Dibromodichloromethane    | 4.61 |
| 9  | Benzene                    | 1.45 | 23 | <i>m,p</i> -Xylene        | 2.31 |
| 10 | 1,2-Dichloroethane         | 4.44 | 24 | <i>o</i> -Xylene          | 1.39 |
| 11 | Fluorobenzene              | -    | 25 | Bromoform                 | 6.86 |
| 12 | Trichloroethylene          | 1.93 | 26 | 4-Bromofluorobenzene      | -    |
| 13 | 1,2-Dichloropropane        | 3.18 | 27 | 1,4-Dichlorobenzene       | 1.30 |
| 14 | 1,4-Dioxane-d8             | -    |    |                           |      |

## Summary

TurboMatrix HS enables overlapped heating of up to 12 vials. In combination with fast-GC/MS methods, it enables measuring six samples per hour.

