SHIMADZU
Excellence in Science

Application Data Sheet

No.117

GC-MS
Gas Chromatograph Mass Spectrometer

# High-Sensitivity Analysis of Phenols in Drinking Water Using Nitrogen Carrier Gas

Analysis of phenols in drinking water using nitrogen carrier gas

With the sudden rise in the price of helium in recent years, carrier gases that can be used in place of helium are sought after. Hydrogen and nitrogen are potential substitute gases for helium. Though nitrogen is safer than hydrogen and easier to handle, there is a reduction in the sensitivity compared to helium and that makes it difficult to maintain analytical precision for trace analyses.
The GCMS-QP2020, however, features a large-volume differential vacuum system that is able to minimize the reduction in sensitivity caused by using nitrogen as a carrier gas.
This Application Data Sheet demonstrates the advantages of the GCMS-QP2020 by reporting the results of analyzing phenols in drinking water using nitrogen as a carrier gas.

## Experiment

A phenol standard mixture sample of trimethylsilylated with BSTFA was measured using the GCMS-QP2020 with conditions shown in Table 1.

Table 1 Analysis Conditions

| | |
|---|---|
| GC-MS: | GCMS-QP2020 |
| Column: | Rxi-5MS (length: 20 m, 0.18 mm I.D., df = 0.36 µm) |
| Glass Insert: | Splitless insert with wool (P/N: 221-48876-03) |
| [GC] | |
| Injection quantity: | 1.0 µL |
| Injection Unit Temp.: | 250 °C |
| Column Oven Temp.: | 60 °C (1 min) → (10 °C /min) → 250 °C (3 min) |
| Carrier Gas: | Nitrogen |
| Carrier Gas Control: | Constant linear velocity (30.3 cm/sec) |
| Injection Mode: | Splitless |
| Sampling Time: | 1 min |
| [MS] | |
| Interface Temp.: | 250 °C |
| Ion Source Temp.: | 200 °C |
| Measurement Mode: | SIM |
| Event Time: | 0.3 sec |

Ions Monitored

| | |
|---|---|
| Phenol-TMS: | *m/z* 151,166 |
| 2-Chlorophenol-TMS: | *m/z* 185,200 |
| 4-Chlorophenol-TMS: | *m/z* 185,200 |
| 2,6-Dichlorophenol-TMS: | *m/z* 219,234 |
| 2,4-Dichlorophenol-TMS: | *m/z* 219,234 |
| 2,4,6-Trichlorophenol-TMS: | *m/z* 253,268 |
| Acenaphthene-d10(I.S.): | *m/z* 162,164 |

## Analysis Results

SIM chromatograms at 0.05 µg/L are shown in Fig. 1, and analytical precision in terms of repeatability is shown in Table 2. The lowest measured sensitivity was for 2,4,5-Trichlorophenol-TMS, which is the same result as when using helium carrier gas. Nevertheless, chromatograms with good sensitivity were obtained for all phenols examined. Analytical precision in terms of repeatability was also demonstrated to be favorable, with CV values below 5 %

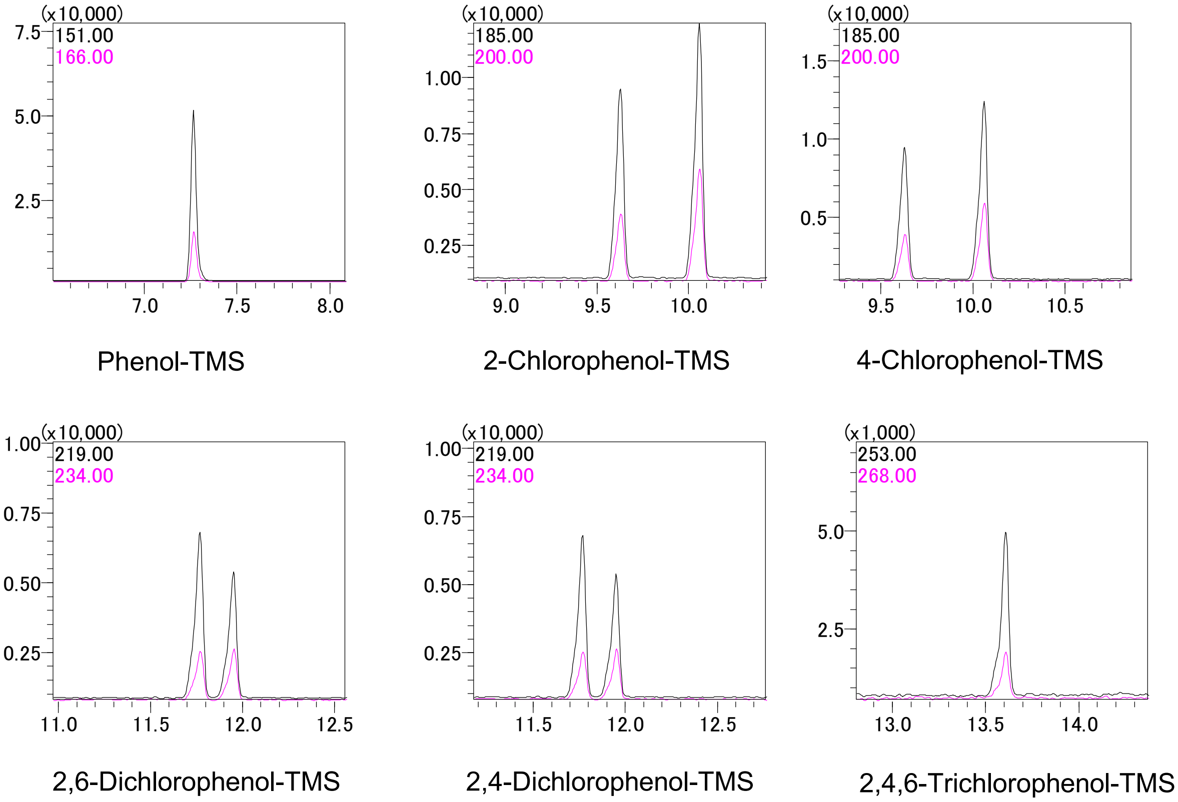


Fig. 1 SIM Chromatograms at 0.05 µg/L

Table 2 Analytical Precision in Terms of Area Ratio Repeatability (0.05 µg/L, n=5)

| | Area Ratio 1 | Area Ratio 2 | Area Ratio 3 | Area Ratio 4 | Area Ratio 5 | CV Value (%) |
|---|---|---|---|---|---|---|
| Phenol | 1.29689 | 1.29474 | 1.28757 | 1.26925 | 1.25547 | 1.39 |
| 2-Chlorophenol | 0.302674 | 0.303895 | 0.298466 | 0.297732 | 0.291126 | 1.68 |
| 4-Chlorophenol | 0.410166 | 0.403981 | 0.4105 | 0.389598 | 0.394093 | 2.36 |
| 2,6-Dichlorophenol | 0.224068 | 0.219572 | 0.216554 | 0.219759 | 0.218445 | 1.26 |
| 2,4-Dichlorophenol | 0.168732 | 0.167688 | 0.164369 | 0.164181 | 0.165625 | 1.22 |
| 2,4,6-Trichlorophenol | 0.156111 | 0.156102 | 0.156196 | 0.148737 | 0.151547 | 2.23 |
| Acenaphthene-d10 | 1 | 1 | 1 | 1 | 1 | - |

## Summary

Use of the GCMS-QP2020 with nitrogen carrier gas for the analysis of phenols in drinking water was examined. The results confirmed favorable sensitivity and repeatability even when using nitrogen carrier gas.
This demonstrates the ability of the large-volume differential vacuum system in the GCMS-QP2020 to minimize the reduction in sensitivity caused by using nitrogen as a carrier gas.
The GCMS-QP2020 is the optimal GC/MS system in terms of compatibility with using nitrogen as a carrier gas, considering the anticipated shortage of helium in the future.

First Edition: Oct, 2015

SHIMADZU
Shimadzu Corporation
www.shimadzu.com/an/

For Research Use Only. Not for use in diagnostic procedures.
The content of this publication shall not be reproduced, altered or sold for any commercial purpose without the written approval of Shimadzu. The information contained herein is provided to you "as is" without warranty of any kind including without limitation warranties as to its accuracy or completeness. Shimadzu does not assume any responsibility or liability for any damage, whether direct or indirect, relating to the use of this publication. This publication is based upon the information available to Shimadzu on or before the date of publication, and subject to change without notice.

© Shimadzu Corporation, 2015