

APPLICATION NOTE

Fast Analysis of Landfill Gas Using INFICON Micro 3000 GC with Performance-Enhanced System

ABSTRACT

A fast and accurate solution is provided for landfill gas component analysis by the INFICON 3000 Micro GC configured with two performance-enhanced modules. The individual components are baseline separated in less than 60 seconds using a two-channel configured Micro GC. With this solution, landfill gas can be easily monitored and controlled.

INTRODUCTION

Throughout the world, millions of tons of waste are deposited into landfills. The waste within the landfill will consist of a wide variety of substances, but a large proportion will be biodegradable, including animal and vegetable matter, paper, and wood. Landfill gas is a complex mixture of gases, but a few gases predominate. Generally, methane, carbon dioxide, and nitrogen are the main components that contribute more than 90 percent of landfill gas. Many other gases can be produced in trace amounts and the exact composition of the landfill gas will vary between different landfill sites; different parts of the same site; as well as over time. Clearly this gas has to be monitored and controlled. A level of 5 percent of methane in air is explosive. Some other components of landfill gas are dangerous to the health of people living nearby the landfill sites. Landfill operators are also legally required to monitor and control landfill gas on their site.

The INFICON 3000 Micro GC is a powerful tool for the fast analysis of gaseous analytes [1-3], and its robust construction and multiple channel configurations make analyzing complex samples quick and easy. The INFICON 3000 Micro GC with its newly developed performance-enhanced module is specially designed for the analysis of low-concentration components. In

this application, an efficient solution is developed to analyze gas components in landfill gas by the INFICON 3000 Micro GC with performance-enhanced modules.

EXPERIMENTAL

Sample

The landfill gas standard was provided by Beijing AP BAIF Gas Industry Co. Ltd. (Beijing, China). The compositions and concentrations are shown in [Table 1](#).

Table 1 Standard compositions and their concentrations

| Component | Concentration (µL/L) |
|-------------------------------|----------------------|
| CH ₄ | 399.5 |
| C ₂ H ₆ | 174.5 |
| CO ₂ | 132.5 |
| O ₂ | 100 |
| H ₂ S | 254 |
| N ₂ | Balance gas |

Configurations and Analytical Conditions

The INFICON 3000 Micro GC configured with two performance-enhanced modules is used for the fast analysis of landfill gas. The PLOT U column channel (PLOT U, 8 m × 0.32 mm × 30 µm) is responsible for the separation of CO₂, C₂H₆, and H₂S. The second channel is a molecular sieve (MS) column (PLOT-U, 3 m × 0.32 mm/MoISeive 5Å PLOT, 10 m × 0.32 mm) for the separation of O₂, N₂, and CH₄. The injectors used are the variable-volume type for PLOT U channel and backflush mode for MS channel; helium was used as the carrier gas. The analytical conditions are shown in [Table 2](#).

Table 2 Analytical conditions of two-channel micro GC

| Channel | Molecular sieve (PLOT-U, 3 m × 0.32 mm / MolSeive 5Å PLOT, 10 m × 0.32 mm) | PLOT U (8 m × 0.32 mm × 30 μm) |
|-------------------------|--|--------------------------------|
| Sample inlet temp. (°C) | 60 | 60 |
| Injector temp. (°C) | 80 | 80 |
| Column temp. (°C) | 70 | 70 |
| Inject time (ms) | 100 | 100 |
| Run time (s) | 100 | 100 |
| Column pressure (psi) | 30 | 30 |

Note: 1 psi = 6.894757293 kPa

RESULTS AND DISCUSSION

CO₂, C₂H₆, and H₂S were separated within 60 seconds. The analytical time for separation of O₂, N₂, and CH₄ was less than 60 seconds. Figure 1A shows the chromatogram of channel A, and Figure 1B shows the chromatogram of channel B.

Figure 1 Chromatograms of landfill gas on PLOT U channel (A) and MS channel (B)

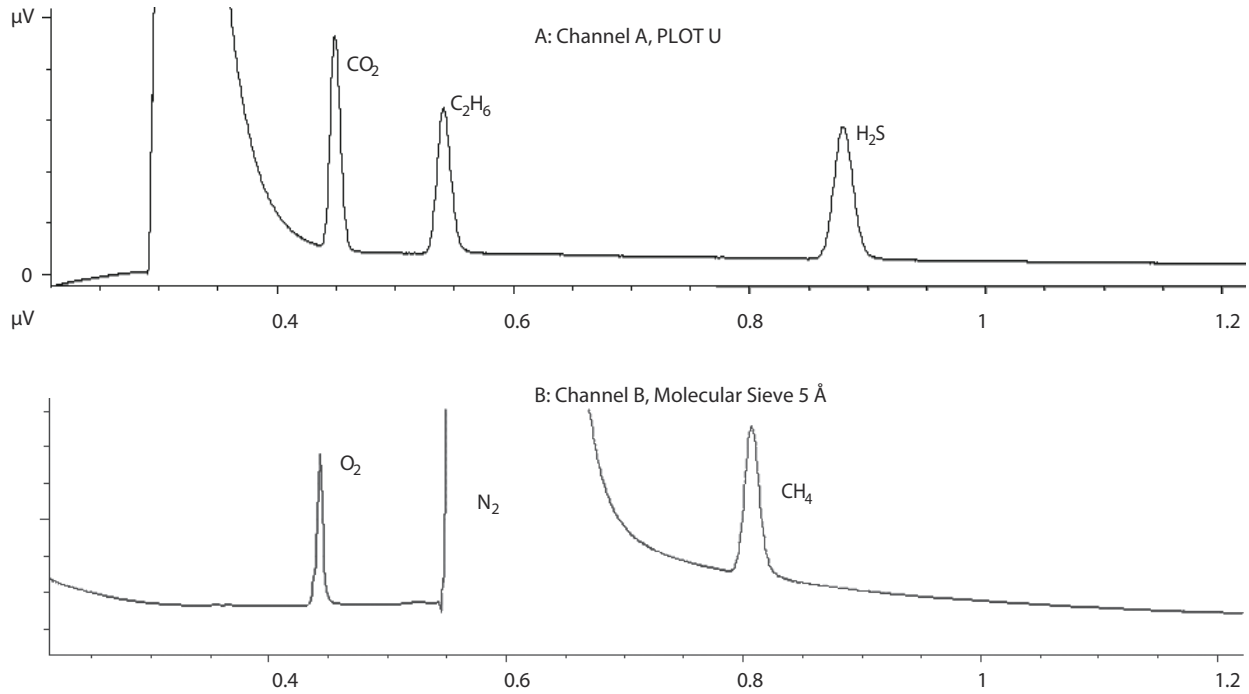


Table 3 shows the run-to-run repeatability by relative standard deviations (RSDs) of the peak height. The RSDs of separated components are all less than 1%, showing that the Micro GC is stable and reliable.

Table 3 Reproducibility of two-channel micro GC solution

| Compound | Avg. R.T. | Avg. peak height | Peak height S.D. | R. S. D. (N = 10) |
|------------------|-----------|------------------|------------------|-------------------|
| O ₂ | 0.443 | 193963.28 | 1671.26 | 0.86% |
| N ₂ | 0.553 | 1211399.24 | 6496.73 | 0.54% |
| CO ₂ | 0.447 | 1868.49 | 17.61 | 0.94% |
| CH ₄ | 0.807 | 1878.01 | 6.44 | 0.34% |
| H ₂ S | 0.811 | 1336.20 | 18.35 | 1.37% |

CONCLUSIONS

The INFICON 3000 Micro GC with performance-enhanced modules provides a fast and reliable method for the analysis of landfill gas samples. Six key components can be separated in less than 60 seconds with good repeatability. H₂S, the sulfur compound existing in landfill gas, can also be detected using this two-module micro GC with the detection limit of 20 ppm (V/V).

REFERENCES

1. "Analysis of Fuel Cell Reformer Gases in Seconds Using the INFICON 3000 Micro Gas Chromatograph," INFICON publication diae67a1.
2. "Complete Analysis of Refinery Gases in Seconds Using the INFICON 3000 Micro Gas Chromatograph," INFICON publication diae60a1.
3. "Micro GC Analysis of Natural Gas and LPG in Seconds Using the INFICON 3000 Natural Gas Analyzer," INFICON publication diae59a1.
4. "Fast Analysis of Coal Mine Gas Using the INFICON 3000 Micro GC," INFICON publication diae68a1.



www.inficon.com reachus@inficon.com

Due to our continuing program of product improvements, specifications are subject to change without notice.

diae69a1 ©2010 INFICON