

APPLICATION NOTE

Detection of SO₂ in Air Using the INFICON 3000 Micro GC

ABSTRACT

A simple and rapid procedure for determining SO₂ in air was developed using the INFICON 3000 Micro GC with a special PLOT U (10 m × 0.32 mm × 10 μm) module. SO₂ was well separated from H₂O with good peak shape and an analytical time of less than 30 seconds.

INTRODUCTION

Sulfuric acid plants generate sulfur dioxide gas by burning sulfur in air. Proper burner operation controls the combustion reaction to maintain the ratio of sulfur to air within acceptable limits. This is to maintain the temperature within the sulfur burner and maintain proper conversion of sulfur dioxide to sulfur trioxide in the downstream catalyst beds. This ratio is unchanged during normal operation, but may be reduced during startup until the catalyst beds fully reach their operating temperature. Failure to maintain the proper ratio for the conditions of the catalyst may result in an unexpected release of sulfur dioxide gas. Gross loss of control may result in sublimation of elemental sulfur and damage to downstream equipment in addition to the high SO₂ emissions.

Analysis of SO₂ and O₂ converter gas streams, detecting leaks in gas-to-gas heat exchangers, identification of SO₂ gas bypassing, and measuring overall plant conversion performance are important for quality control of sulfuric acid plants.

The INFICON 3000 Micro GC is a modular designed, fast GC. Each channel or module is a self-contained GC comprising a micro-machined injector and detector and a high-resolution capillary column. As a result, you can simultaneously analyze your sample on up to four different columns, depending on the model you select, using four different sets of operating conditions —

expanding your separation capabilities without compromising speed. The 3000 Micro GC is now equipped with a new performance enhancement that can detect samples of less than 1 ppm. This enhanced sensitivity allows you to address very low concentration samples at sampling sites you desire with the same speed, ease of use, and reliability the 3000 Micro GC has been recognized for.

The new performance-enhanced module is fully compatible with existing 3000 modules, so you can upgrade modules in your existing system with the performance-enhanced version to capitalize on new application opportunities. In this application, the method of detecting SO₂ was developed on the INFICON 3000 Micro GC with performance enhancement.

EXPERIMENTAL SAMPLE

SO₂ standard at 0.06 percent (V/V) level was purchased from Shanghai Jiliang Reference Gas Ltd. (Shanghai, China). Nitrogen was used as the balance.

INSTRUMENT AND ANALYTICAL CONDITIONS

The INFICON 3000 Micro GC with performance enhancement was used in this experiment. A special PLOT U (10 m × 0.32 mm × 10 μm) module was used for the analysis of SO₂ in air. The analytical conditions are shown in [Table 1](#).

Table 1 Analytical Conditions

Channel	PLOT U
Sample inlet temperature (°C)	80
Injector temperature (°C)	80
Column temperature (°C)	80
Inject time (ms)	100
Column pressure (psi)	35
Note 1 psi = 6.894757293 kPa	

RESULTS AND DISCUSSION

Fast analysis of SO₂ is important for the sulfur-burning sulfuric acid plants to monitor SO₂ and O₂ converter gas streams, detect leaks in gas-to-gas heat exchangers, identify SO₂ gas bypassing, measure overall plant conversion performance, and calibrate existing plant analysis instrumentation.

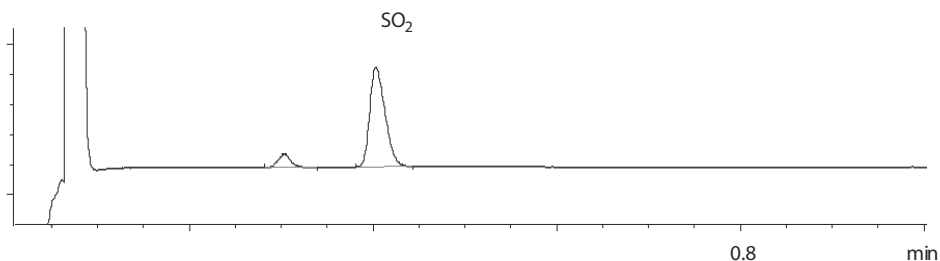
The separation was first done on an OV-1701 module, but the performance was not satisfactory because the peak shape was not symmetrical and the SO₂ and air were not baseline separated. The experiment was transferred to a PLOT U column, and a normal Micro GC PLOT U (10 m × 0.32 mm × 30 μm) module was used. The retention of SO₂ on the PLOT U column was very strong and the retention time of SO₂ was rather

long and not acceptable from the fast analysis point of view. A PLOT U column with a thinner coating (10 m × 0.32 mm × 10 μm) was chosen. Figure 1 shows the chromatogram obtained using this special column. Both the peak shape and retention time are better than those obtained on the normal PLOT U module.

CONCLUSIONS

A fast and simple method was developed on the INFICON 3000 Micro GC with performance enhancement for the detection of SO₂ in air. By using this method, sulfuric acid plants can reduce SO₂ emissions by leak-checking, increase production, and improve converter performance.

**Figure 1 Chromatogram of SO₂ on PLOT U column (10 m × 0.32 mm × 10 μm).
The run-to-run repeatability of this method is below 3% (represented by the RSDs, n = 6).**



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