

Sensor Gas Chromatograph

**VOC Analyzer
Model: SGVA-P2**

Technical Information

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1. Sensor Gas Chromatograph (SGC)	Page 3
1) Measurement principle	
2) Features	
3) Quantitative measurement	
4) Data analysis	
2. Basic performance	Page 6
1) Accuracy	
2) Interference gases	
3. To maintain high accuracy	Page 8
1) Initial stabilization time after power-on	
2) Carrier gas amount	
3) Ambient temperature	
4) Ambient atmosphere	
5) Measurement after a long time of non operation	

1. Sensor Gas Chromatograph (SGC) SGVA-P2

1. Measurement principle

SGVA-P2 is a gas chromatograph using a semiconductor gas sensor as a detector. Toluene, ethylbenzene, xylene, and styrene are separated from a gas mixture through chromatography, and measured with a semiconductor gas sensor showing high sensitivity to VOC.

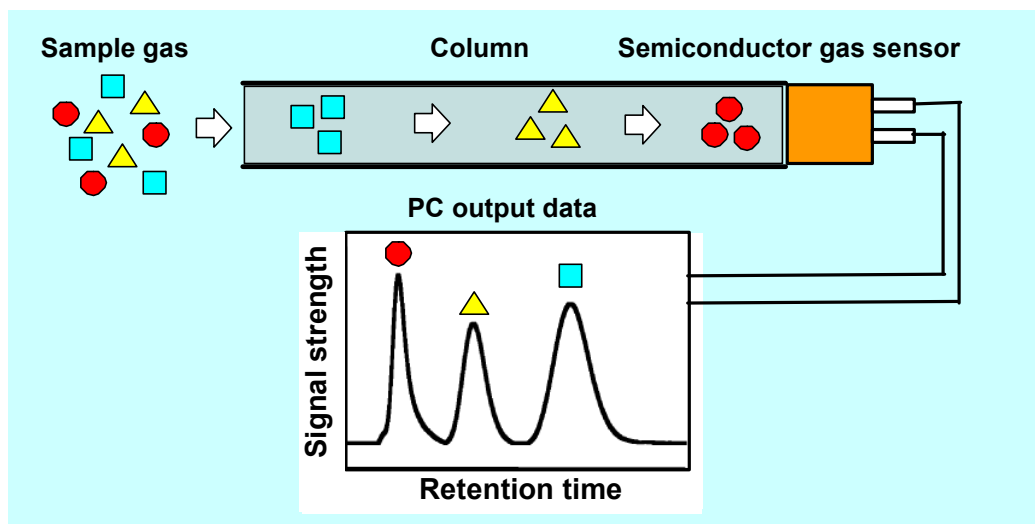


Fig. 1 Measurement principle

2. Features

- Toluene, ethylbenzene, xylene, and styrene can be measured from 5 to 1000ppb.
- Injecting the sampling gas with a syringe will automatically start the measurement and the measurement will be completed in 8 minutes.
- Automatic and continuous sample gas injector is optionally available.
- The following measurement is ready in one minute from the previous measurement completion.
- High purity cylinder air is used as carrier gas to measure small amounts of VOC in ambient air.
- Small, light and portable.

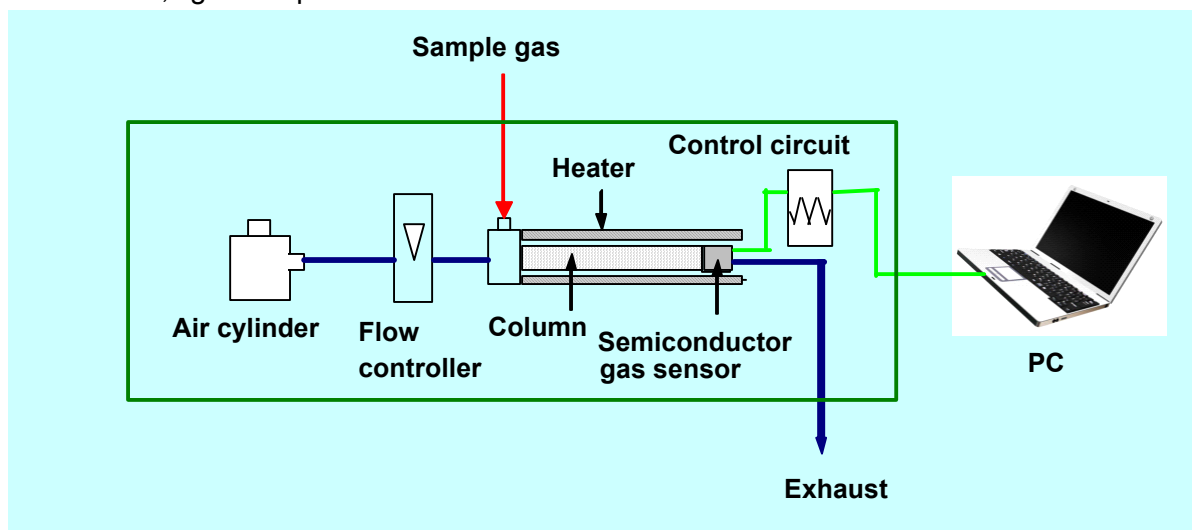


Fig. 2 Block diagram

3. Quantitative measurement

Fig. 3 shows the SGC chromatogram of 5 to 1000 ppb of VOC.

Fig. 4 shows the relation between the peak height (signal strength) and concentration in Fig. 3.

The relation should be linear in log-log scale because of semiconductor characteristics. Other concentrations can be calculated based on this relation.

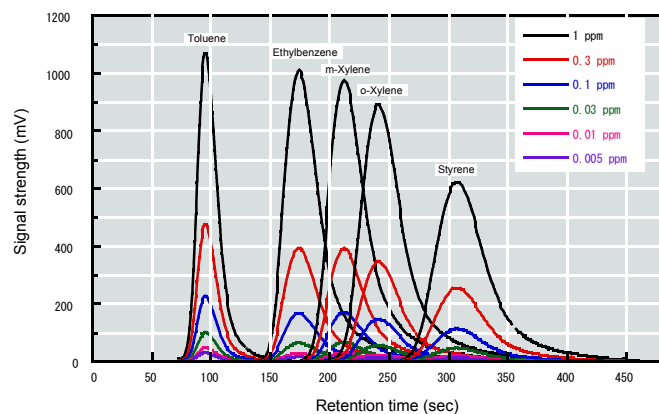


Fig. 3 VOC chromatogram

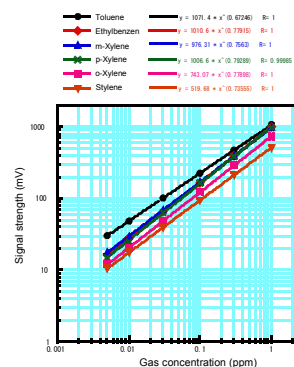


Fig. 4 Gas conc and signal strength

4. Data analysis

Measured data is analyzed with our original software “SGC Analyzing Software” which is supplied with the device.

- General gas chromatograph (GC) uses a peak area for quantitative measurement. But SGC uses the peak height. This method has almost no effect of interference gases of which retention time is near to the target gas. The measurement accuracy and reproducibility is the same as those of peak area calculation.
- The base line of the measured chromatogram is corrected to obtain the precise peak height. Small incline of the base line will not influence the measurement accuracy.
- Other gas peaks may appear before the target gas peak. Such peaks cannot be separated by the column used in the SGC. If the sample gas includes a large amount of such gases, their peak may override the target peak. In order to solve this, the interference gas pattern can be separated from the target gas pattern as shown in Fig. 5..

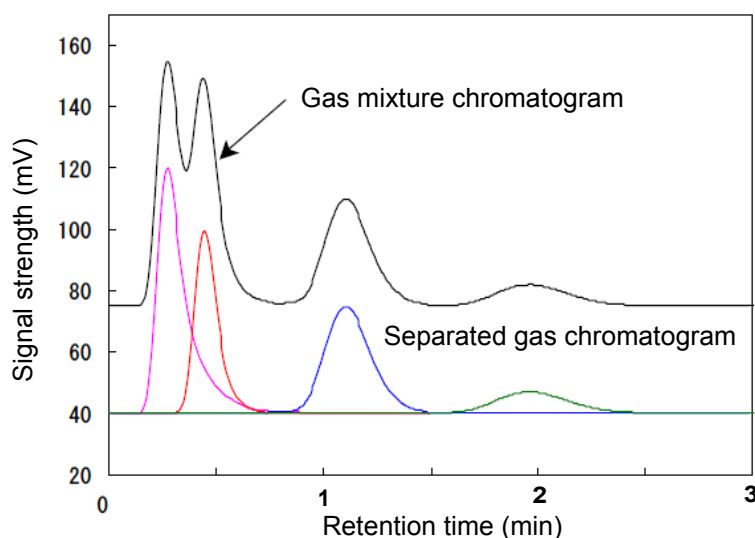
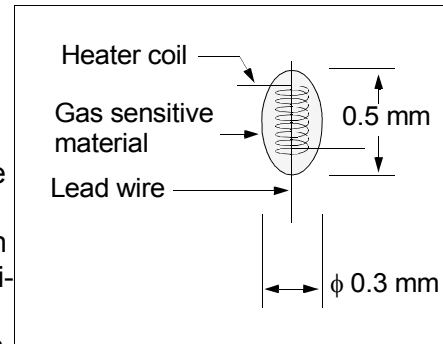


Fig. 5 Chromatogram of gas mixture and separated gases

Semiconductor gas sensor

SGC uses an SB type semiconductor gas sensor which is developed by FIS. The semiconductor gas sensor uses metal oxides such as tin dioxide for gas sensing material. The electric resistance of this material is changed when the gas is adsorbed on its surface. The sensor makes use of this property for gas detection. The SB sensor has features suitable to the detector of gas chromatograph; small size, low power consumption, high sensitivity, and quick response. Especially, the SB sensitivity is much higher than the sensitivity of the detector used in general GC. This feature has realized highly sensitive GC with a small amount of sample gas.



Terms

Gas chromatograph

Gas chromatography is a technology to separate mixture gas into each component with a column and carrier gas. The instrument used to perform gas chromatography is called a gas chromatograph. The resulted chart is called a chromatogram.

Column

A tubing filled with filler material having different adsorbing capability. The material and heating temperature (column temperature) are selected according to the target gas.

Detector

Device to detect the separated gases and change to an electric signal. SGC uses a semiconductor gas sensor as a detector.

Carrier gas

Gas always passing through a column and moving the sample gas. Usually, inert gas such as hydrogen, helium, and nitrogen is used. SGC uses air because the semiconductor gas sensor as a detector needs oxygen.

Baseline

A part of a line on the chromatogram showing only carrier gas without sampled gas.

Peak, Peak height

A mountain shape output wave on the chromatogram is called a peak. The distance between the top of the peak to the baseline is called peak height.

Retention time

Time required for the specified compound in the sampled gas to detect from the time of injection. Retention time determines the kind of detection gas.

Sensor output (Vs)

Voltage to which electric conductivity change of highly sensitive semiconductor gas sensor is converted.

Signal strength

Voltage equal to "Vs(0) - Vs" where Vs(0) is the Vs when the measurement starts.

1. Accuracy

Measured concentration accuracy immediately after the calibration is +/-15%.

Fig. 6 shows the correlation between standard gas concentration and the measured result. The result is within +/- 15% and the correlation coefficient is more than 0.98, indicating high accuracy..

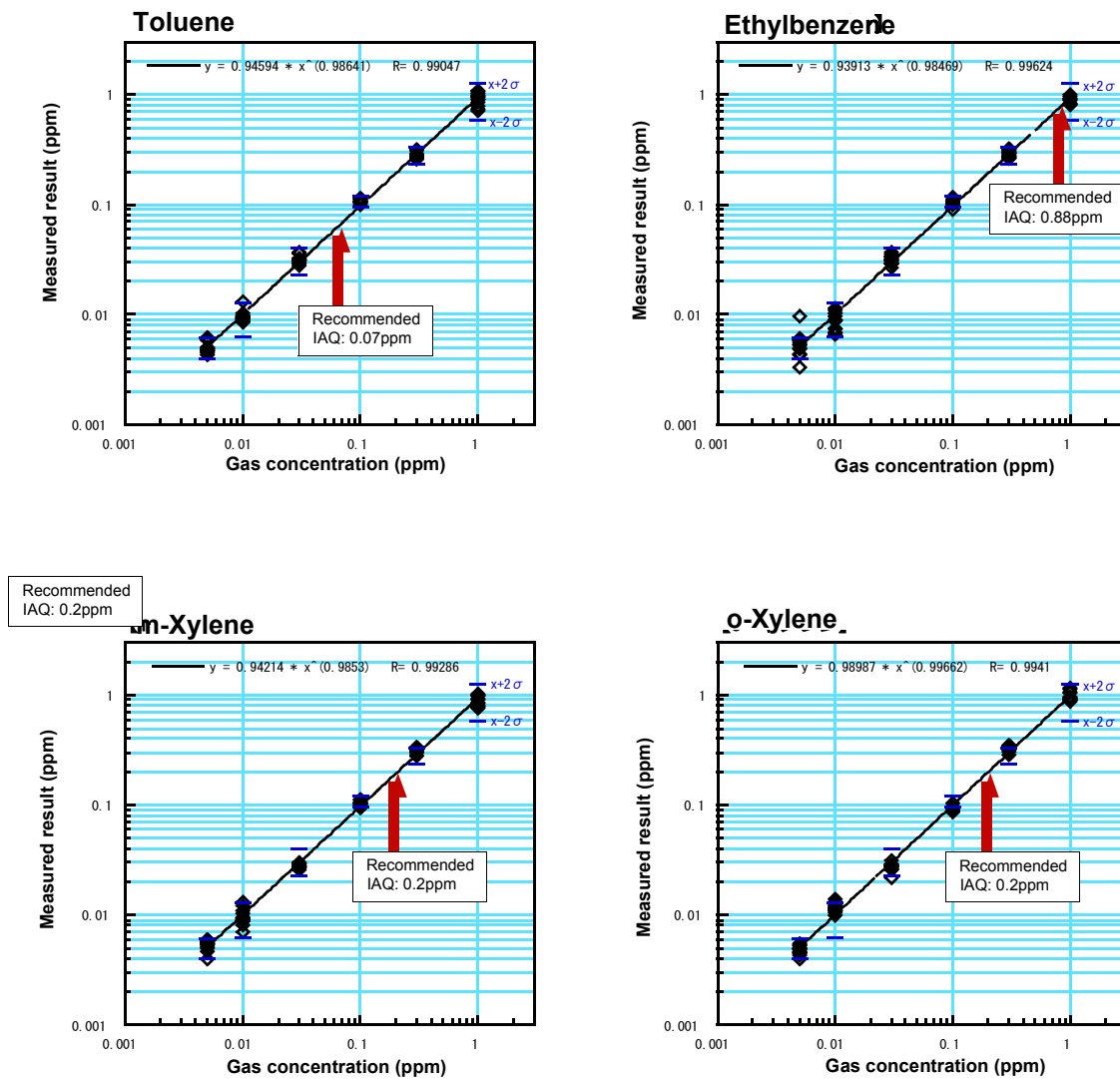


Fig. 6 Gas conc and measured result

2. Interference gases

SGVA-P2 responds to some other gases than target gases.

Table 1 shows the retention time for various gases. Please use the retention time in the table just as a reference because they depend more or less on the individual device.

Table 1: Retention time for various gases

Gas	Molecular mass	Retention time (sec)
Hexane	86.18	24
Acetone	58.08	26
Ethanol	46.07	26
Ethyl acetate	88.1	32
Chloroform	119.38	35
n-Heptane	100.20	36
Benzene	78.11	44
Trichloroethylene	131.39	49
1, 2-Dichloroethane	98.96	61
n-Octane	114.23	67
n-Butanol	74.12	68
1,1,1-Trichloroethane	133.40	75
4-Methyl-2-Pentanone	100.16	79
Toluene	92.14	86
Tetrachloroethene	165.83	94
n-Butyl acetate	116.16	104
n-Nonane	128.26	137
Ethylbenzene	106.17	158
(1S)-(-)Alpha-pinene	136.23	182
p-Xylene	106.16	191
m-Xylene	106.16	191
o-Xylene	106.16	222
Styrene	104.15	292
n-Decane	142.28	299
n-Undecane	156.31	728
n-Dodecane	170.33	more than 1020
Carbon tetrachloride	153.82	No peak

1. Interference gases

Initial stabilization time after power-on

It takes 10 to 30 minutes for the READY lamp to turn on immediately after power-on. This time is required for the stabilization of column temperature and sensor. It would be better to power on the SGC for more than 1 hour before measurement for higher accuracy.

2. Interference gases

Carrier gas amount

The retention time largely depends on the carrier gas amount. If the retention time largely shifts, measurement accuracy will be lower, and peak position may not be detected. If the carrier gas flow rate is shifted +/- 3cc from the initial setting, adjust the flow rate. Confirm the initial setting in the CD supplied with the device.

3. Ambient temperature

Rapid temperature change such as power-on the air-conditioner will cause the baseline drift. Use the SGC under as small a temperature change as possible. Large baseline drift will cause the SGC to be in a WAIT status. Start the measurement after the status is READY.

4. Ambient atmosphere

Since the ambient air is used as a carrier gas, the measurement accuracy for the sulfide will become lower if large amount of interference gas co-exists in the ambient atmosphere. Avoid such atmosphere for the measurement. Do not worry about the influence of temporarily existing gas such as sprayed gas.

SGC enters a WAIT status when detecting the polluted atmosphere. Start the measurement after the status is READY.

5. Measurement after a long time of non operation

When you use the SGC after a long time of non operation, the measurement data may show a bit lower results. If the non operation time is more than two weeks, power on the SGC for several hours on the previous day of the measurement to obtain higher accuracy.

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