

HJ

INDUSTRY STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

HJ 1240-2021

**Stationary source emission - Determination of gaseous
pollutants (SO₂, NO, NO₂, CO, CO₂) - Portable Fourier transform
infrared spectroscopy method**

固定污染源废气 气态污染物 (SO₂、NO、NO₂、CO、CO₂) 的测定 便携式傅立
叶变换红外光谱法

(English Translation)

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1 Scope of application

This standard specifies a portable Fourier transformer for the determination of gaseous pollutants (SO₂, NO, NO₂, CO, CO₂) in waste gas from stationary pollution sources.

Switch to infrared spectroscopy.

This standard is applicable to the determination of gaseous pollutants (SO₂, NO, NO₂, CO, CO₂) in waste gas from stationary pollution sources.

The detection limits of SO₂, NO, CO are all 1 mg/m³. The lower limit of determination is 4 mg/m³; the detection limit of NO₂ is 3 mg/m³, the lower limit of determination is 12 mg/m³; the method detection limit for CO₂ is 1 g/m³. The lower limit of determination is 4 g/m³.

2 Normative references

This standard refers to the following documents or clauses thereof. For dated references, only the dated version applies to this standard.

For undated references, the latest edition (including all amendments) applies to this standard.

GB/T 16157 Determination of particulate matter in exhaust gas from stationary pollution sources and sampling methods for gaseous pollutants HJ 75 Technical Specification for Continuous Monitoring of Flue Gas (SO₂, NO_x, Particulate Matter) Emissions from Stationary Pollution Sources HJ/T 373 Technical Specifications for Quality Assurance and Quality Control of Stationary Pollution Source Monitoring (Trial) HJ/T 397 Technical Specification for Stationary Source Waste Gas Monitoring HJ 1011 Technical requirements and testing for portable Fourier transform infrared monitors for volatile organic compounds in ambient air and waste gas method

3 Terms and Definitions

The following terms and definitions apply to this standard.

Calibration span calibration span the standard gas concentration value for calibration (represented by CS below) should be less than or equal to the highest concentration point corresponding to the standard spectrum in the analyzer's memory.

error of indication

The absolute error or relative error between the measurement result of the standard gas directly introduced into the analyzer and the reference concentration value of the standard gas.

systematic error

The standard gas is directly introduced into the analyzer (direct measurement mode) and the measurement results obtained by the standard gas are introduced into the analyzer through the sampling tube (system the absolute error or the percentage of the absolute error and the calibration range between the measurement results obtained in the measurement mode).

zero drift

Before and after the measurement, the difference between the measurement results of the analyzer for the same zero point gas and the percentage of the calibration range.

span drift

Before and after the measurement, the difference between the measurement results of the standard gas at the same calibration range concentration point by the analyzer and the percentage of the calibration range.

4 Principles of the method

When infrared light with continuous wavelengths irradiates the molecules of the substance to be tested, the infrared light with the same frequency as the natural vibration of the molecules is absorbed, resulting in wave the number is the abscissa and the absorbance is the ordinate of the infrared absorption spectrum. Different substances absorb infrared light differently, which is a wave with characteristic absorption peaks the numbers are different. Fourier transform infrared spectroscopy is to convert the light emitted by the infrared light source into interference light by a Michelson interferometer, and then use the interference illumination.

The gas sample is irradiated to obtain the infrared interferogram, and the infrared absorption spectrum is obtained after Fourier transform processing by the computer system. By comparing gas the infrared absorption spectrum of the sample and the infrared absorption spectrum of the standard substance in the standard spectrum library can be used for qualitative analysis of the sample. Under certain conditions, the characteristic absorption peak intensity of the target compound in the infrared absorption spectrum and its concentration follow the Lambert-Beer law, according to the absorption Peak intensities allow quantitative analysis of target compounds.

5 Interference and cancellation

5.1

When the infrared absorption spectra of gaseous water and the target compound and different compounds overlap, it is easy to determine the target compound the measurement interferes. In quantitative calculation, the appropriate spectral analysis interval can be selected, or the least squares method or partial least squares-based method can be used.

The built-in analysis program of the multiplication algorithm eliminates or overcomes the interference and ensures the accuracy of the measurement results.

5.2

The particulate matter in the gas sample is easy to block the sampling pipeline or contaminate the optical components of the instrument, and a particulate matter filter needs to be installed in the sampling system.

6 Reagents and Materials

6.1

Commercially available certified standard gases. SO₂, NO, NO₂, CO, CO₂, with N₂ as the balance gas, the relative expanded uncertainty $U_r \leq 2\%$ ($k=2$); or use a gas distribution device that meets the requirements of 6.3 to prepare the required concentration of gas.

6.2

Zero gas. nitrogen (purity $\geq 99.999\%$), or clean air that does not interfere with the determination of the target compound.

6.3

Air distribution device. the maximum output flow is ≥ 5 L/min. The flowmeter should meet. when the flow is less than 50% of the full scale, the maximum allowable flow the error is within $\pm 0.5\%$ of the full scale; when the flow is greater than or equal to 50% of the full scale, the maximum allowable error of the flow should be $\pm 1.0\%$ of the set flow within.

7.1.1 System Composition

Fourier transform infrared gas analysis system is generally composed of sampling unit, preprocessing device, analyzer and data processing unit.

Among them, the sampling unit includes a sampling tube (including a particulate filter, with heating and heat preservation functions), an air duct, an air pump, etc.; pretreatment the device can choose a constant temperature heating device with a heating temperature of ≥ 180 °C; the analyzer consists of an infrared light source, an interferometer, a sample chamber and a detector;

The data processing unit includes computer, analysis software and reference spectrum.

7.1.2 Performance requirements**7.1.2.1**

Indication error. when SO_2 , NO, NO_2 and CO are in the calibration range > 60 $\mu\text{mol/mol}$, the relative error is within $\pm 5\%$;

When the range is less than or equal to 60 $\mu\text{mol/mol}$, the absolute error is within ± 3 $\mu\text{mol/mol}$; the relative error of CO_2 is within $\pm 5\%$.

7.1.2.2

System error. when the calibration range of SO_2 , NO, NO_2 , and CO is greater than 60 $\mu\text{mol/mol}$, the relative error is within $\pm 5\%$;

When the range is less than or equal to 60 $\mu\text{mol/mol}$, the absolute error is within ± 3 $\mu\text{mol/mol}$; the relative error of CO_2 is within $\pm 5\%$.

7.1.2.3

Zero drift. within $\pm 3\%$.

7.1.2.4

Range drift. within $\pm 3\%$.