

HJ

INDUSTRY STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

HJ 1100-2020

Technical guide for automatic monitoring by beta ray method for particulate matter in ambient air (PM10 and PM2.5)

环境空气中颗粒物 (PM10和 PM2.5) β 射线法自动监测技术指南
(English Translation)

Issued on: January 1, 1970

Implemented on: April 12, 2020

Issued by: Ministry of Ecology and Environment

Table of Contents

Foreword

1 Scope of application

2 Normative references

3 Principles of the method

4 Interference and cancellation

5 Reagents and materials

6 Instruments and equipment

7 Analysis steps

8 Calculation and presentation of results

9 Precision and accuracy

10 Quality Assurance and Quality Control

11 Precautions

Appendix A (informative appendix) schematic diagram of the composition of different types of particulate matter instrument systems

Appendix B (informative appendix) Determination of detection limit

Foreword

To implement the Environmental Protection Law of the People's Republic of China and the Air Pollution Prevention and Control Law of the People's Republic of in order to protect human health, regulate the automatic determination method of particulate matter (PM10 and PM2.5) in the ambient air, and formulate this standard.

This standard specifies the beta-ray method for the automatic determination of particulate matter (PM10 and PM2.5) in the ambient air.

Appendix A and Appendix B of this standard are informative appendices.

This standard is issued for the first time.

This standard was formulated by the Department of Ecological Environment Monitoring and the Department of Regulations and Standards of the Ministry of Ecology and Environment.

Drafting organization of this standard. Dalian Ecological Environment Monitoring Center, Liaoning Province.

Verification unit of this standard. Guangzhou Environmental Monitoring Center Station, Harbin Environmental Monitoring Center Station, Ecological Environment of Liaoning

Province Monitoring Center, Shenyang Ecological Environment Monitoring Center of Liaoning Province, Fushun City Environmental Monitoring Center Station and Yingkou City Environmental Monitoring Center Station.

This standard was approved by the Ministry of Ecology and Environment on February 12, 2020.

This standard will be implemented on April 12, 2020.

This standard is interpreted by the Ministry of Ecology and Environment.

Technical Guidelines for Automatic Monitoring of Particulate Matter (PM₁₀ and PM_{2.5}) in Ambient Air by beta-ray Method

1 Scope of application

This standard specifies the beta-ray method for the automatic determination of particulate matter (PM₁₀ and PM_{2.5}) in the ambient air.

This standard applies to the automatic determination of particulate matter (PM₁₀ and PM_{2.5}) in the ambient air.

When the instrument range is 0 µg/m³~1000 µg/m³, the detection limit of this standard method is 1 µg/m³, and the lower limit of determination is 4 µg/m³.

The mass concentration in this standard refers to the concentration in the actual state (atmospheric temperature and pressure during monitoring).

2 Normative references

This standard refers to the following documents or their clauses. For undated reference documents, their valid versions are applicable to this standard.

HJ 93 Ambient air particulate matter (PM₁₀ and PM_{2.5}) sampler technical requirements and detection methods
HJ 618 Determination of PM₁₀ and PM_{2.5} in ambient air gravimetric method
HJ 653 Technical requirements and detection methods for continuous automatic monitoring system of ambient air particulate matter (PM₁₀ and PM_{2.5})
HJ 655 Technical Specification for Installation and Acceptance of Ambient Air Particulate Matter (PM₁₀ and PM_{2.5}) Continuous Automatic Monitoring System
HJ 656 Technical Specification for Manual Monitoring Method (Gravimetric Method) of Ambient Air Particulate Matter (PM_{2.5})
HJ 663 Technical Specification for Environmental Air Quality Evaluation (Trial)
HJ 817 Ambient air particulate matter (PM₁₀ and PM_{2.5}) continuous automatic monitoring system operation and quality control technical specifications

3 Principles of the method

The sample air passes through the sampling tube at a constant flow rate through the cutter, and particles are trapped on the filter belt. Beta rays pass through the filter band when the energy is attenuated, the mass of the particulate matter is calculated by measuring the attenuation.

4 Interference and elimination

4.1

The irregular spatial distribution of the beta-ray electron flow or the uneven particle retention caused by the abrasion of the sampling system will cause A measurement error occurs.

4.2

The elemental composition and chemical composition of particulate matter have little effect on the absorption coefficient per unit mass k .

4.3

The radiation of particulate matter has little effect on beta rays. Some instruments can detect radon alpha emission value and subtract its production Beta-ray effects.

4.4

Humidity has a certain impact on the determination of particulate matter, and dynamic heating can be used to reduce the impact of humidity, but at the same time Control the heating power and heating temperature to reduce the loss of volatile organic compounds.

5 Reagents and materials

5.1

Filter belt (membrane). you can choose inorganic materials such as glass fiber material, quartz material, or polyvinyl chloride, polypropylene, polytetrafluoroethylene, etc.

Organic materials such as vinyl fluoride and mixed cellulose. The filter belt (membrane) should have flat edges, uniform thickness, no burrs, no pollution, and no There must be pinholes or any damage. Under the specified membrane surface flow rate, the PM10 sampling filter belt (membrane) requires the interception of 0.3 μm particles Retention efficiency $\geq 99\%$, PM2.5 sampling filter belt (membrane) requires that the retention efficiency of 0.3 μm particulate matter is $\geq 99.7\%$.

5.2

Zero diaphragm. It is made of inert materials (such as polycarbonate, aluminum, gold, etc.), and has basically the same Area quality.

5.3

Standard film. made of inert materials (such as polycarbonate, aluminum, gold, etc.), divided into two types, one nominal value is actual Area mass, another nominal value is the difference between the actual area mass of the diaphragm minus the area mass of the zero diaphragm.

6.1 Beta Radiometer

The measuring device should include a cutter, a sampling tube, a sealing device, a filter belt holder, a beta-ray measurement system, and a flow control device.

The flow control device should be able to control the sampling flow within the range of $\pm 5\%$ of the set value for parts such as setting, pump, flow meter or flow meter.

Inside, see Appendix A for the schematic diagrams of different types of beta-ray instrument systems. The performance index of the instrument should meet the requirements of HJ 653.

Note: The sampling tube needs to be equipped with a dynamic heating device, and the heating temperature range is generally set between 40°C and 50°C according to actual conditions.

6.2 Balance

The division value does not exceed 0.01 mg.

7.1 Selection of cutter

Choose a suitable cutter according to the measured particle size. When measuring PM₁₀ and PM_{2.5}, cutter performance refers to the standard shall comply with the geometric standard deviation requirements of HJ 93 regarding the trapping efficiency of the cutter.

7.2 Installation and commissioning of the instrument

After the newly purchased instrument is installed, the parameters should be set according to the operation manual and commissioned. Debug indicators include temperature Measurement error, atmospheric pressure measurement error, flow test, calibration film reproducibility and comparison and debugging of reference methods, etc., adjust the test methods and indicators are implemented in accordance with HJ 655. The reference conditions for instrument settings are as follows.

Injection tube heating control. turn on heating control when humidity is high. Heating control parameters adopt HJ 655 reference method to compare and adjust the conditions for passing the test or the conditions for passing the HJ 817 accuracy audit.

Sampling time or average concentration time. set according to the monitoring purpose, 1 min to 60 min.

Sampling flow rate. Under working environment conditions, the gas production flow rate