Australian Standard®

Methods for sampling and analysis of ambient air

Method 9.7: Determination of suspended particulate matter—PM_{10} dichotomous sampler—Gravimetric method

PREFACE

This Standard was prepared by the Standards Australia Committee on Methods for Examination of Air under the direction of the Chemical Standards Board. This Standard deals with the determination of suspended particulate matter with an equivalent aerodynamic diameter (EAD) of less than approximately 10 μm.

Other methods in the AS 3580 series on the determination of particulate matter are as follows:

Method

9.1 Determination of deposited matter—Gravimetric method

9.2 Determination of suspended matter expressed as equivalent black smoke by filter paper soiling

9.3 Determination of total suspended particulates (TSP)—High volume sampler gravimetric method

9.4 Determination of light scattering—Integrating nephelometer method

9.5 Determination of impinged matter expressed as directional dirtiness, background dirtiness and/or area dirtiness (directional dust gauge method)

9.6 Determination of suspended particulate matter—PM_{10} high volume sampler with size-selective inlet—Gravimetric method

This Standard is based on the United States Code of Federal Regulations Title 40.

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FOREWORD

The dichotomous sampling procedure involves batch sampling and the gravimetric determination of fine (less than 2.5 μm) and coarse particles (2.5 μm to 10 μm), which when added, produce a measurement of PM_{10}.

Particles of size range less than 10 μm are respirable and hence may affect health.

They also can have a major effect on visibility because of their light scattering properties. Such particulate matter is generated by industrial processes, combustion of fuels, burning of vegetation, and incineration. The particles are also present in motor vehicle emissions, wind blown dust and salt air.

METHOD

1 SCOPE. This Standard sets out a gravimetric procedure for the determination of the PM_{10} fraction of suspended particulate matter in ambient air collected in a dichotomous sampler. The method provides a measure of the mean concentration of PM_{10} over the sampling period of the two size fractions, viz the fine fraction (less than approximately 2.5 μm) and the coarse fraction (2.5 μm to 10 μm). A procedure for assessing the performance of dichotomous samplers so that they comply with the sampling requirements of this method, is described in Appendix A.

NOTES:

1. Sampling is normally of 24 h duration to average out diurnal variations. Provided the mass of the filter is determined under carefully controlled laboratory conditions, concentrations of 1 $\mu g/m^3$ and greater may be determined using a 24 h sampling period.
2. It is possible that some particulate matter, depending upon its hygroscopicity, may alter slightly in mass from its initial as-sampled state because of the filter equilibration procedure referred to in Clause 7.1. Such slight and indeterminable changes, if they occur, are considered insignificant.

2 REFERENCED DOCUMENTS. The following documents are referred to in this Standard:

AS
2922 Ambient air—Guide for the siting of sampling units

USEPA Code of Federal Regulations: Title 40, Parts 50 and 53

3 DEFINITIONS. For the purpose of this Standard, the definitions below apply.

3.1 Equivalent aerodynamic diameter (EAD)—the diameter of a spherical particle of density 1000 kg/m^3 which exhibits the same aerodynamic behaviour as the particle in question.

3.2 PM_{10}—atmospheric suspended particulate matter having an EAD of less than approximately 10 μm, which is passed by a size classifier having performance characteristics as defined in US Code of Federal Regulations: 40 CFR, Part 50, Appendix J.

NOTE: One of the performance characteristics referred to is that there is a 50% collection efficiency of particles of 10 ±0.5 μm EAD.

3.3 Fine fraction—atmospheric suspended particulate matter having an EAD of less than approximately 2.5 μm, and which is passed by a size classifier having performance characteristics similar to the PM_{10} sampler but with 50% collection efficiency of particles at 2.5 μm EAD.

3.4 Coarse fraction—the particulate matter remaining after the fine fraction of suspended particulate matter has been separated from the PM_{10} fraction.

4 PRINCIPLE. Ambient air is drawn at a fixed known flow rate into a size-selective inlet. The PM_{10} fraction is split into fine and coarse fractions which are collected separately on preweighed filters in the sampling apparatus.

5 APPARATUS.

5.1 Dichotomous sampler—consisting of a two stage sizing device; the first stage allows only the PM_{10} particles to pass through to the second stage (virtual impactor); in the second stage, the PM_{10} is fractionated into coarse and fine fractions.

The equipment generally consists of a control module and a sampling module as illustrated in Figure 1. The principle of operation of the virtual impactor is shown in Figure 2.

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