

Ambient air - Standard method for measurement of NO_3^- , SO_4^{2-} , Cl^- , NH_4^+ , Na^+ , K^+ , Mg^{2+} , Ca^{2+} in $\text{PM}_{2,5}$ as deposited on filters

EESTI STANDARDI EESSÕNA

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English Version

Ambient air - Standard method for measurement of NO_3^- , SO_4^{2-} , Cl^- , NH_4^+ , Na^+ , K^+ , Mg^{2+} , Ca^{2+} in PM_{2,5} as deposited on filters

Air ambiant - Méthode normalisée pour le mesurage de NO_3^- , SO_4^{2-} , Cl^- , NH_4^+ , Na^+ , K^+ , Mg^{2+} , Ca^{2+} dans la fraction PM_{2,5} telle que déposée sur des filtres

Außenluft - Messverfahren zur Bestimmung von NO_3^- , SO_4^{2-} , Cl^- , NH_4^+ , Na^+ , K^+ , Mg^{2+} , Ca^{2+} in PM_{2,5} nach Abscheidung auf Filtern

This European Standard was approved by CEN on 27 February 2017.

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European foreword

This document (EN 16913:2017) has been prepared by Technical Committee CEN/TC 264 "Air quality", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2017, and conflicting national standards shall be withdrawn at the latest by December 2017.

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Introduction

This European Standard describes how to measure a specified range of anions and cations in $PM_{2,5}$ as deposited on filters.

The EU Air Quality Directive 2008/50/EC [1] on ambient air quality and cleaner air for Europe requests the measurements of concentrations of NO_3^- , SO_4^{2-} , Cl^- , NH_4^+ , Na^+ , K^+ , Mg^{2+} , Ca^{2+} in $PM_{2,5}$ at rural background locations. In Annex IV of the Directive, guidance for these measurements is given.

Measurements of anions and cations in PM are being performed by the EMEP programme, mainly by using a filterpack with limited particle size selectivity. The cooperative programme for monitoring and evaluation of long-range transmission of air pollutants in Europe (EMEP) was launched in 1977 as a response to the growing concern over the effects on the environment caused by acid deposition. EMEP was organized under the auspices of the United Nations Economic Commission for Europe (UNECE). Today EMEP is an integral component of the cooperation under the Convention on Long-range Transboundary Air Pollution.

Directive 2008/50/EC requires that measurements at rural sites, where appropriate, are coordinated with the monitoring strategy and measurement programme of EMEP. Although, there are different sampling procedures involved, a common approach is used for the analytical procedure.

In order to keep the agreement between existing EMEP data and data to be produced using this European Standard as close as possible, the EMEP protocol has been taken as starting point for this European Standard. This European Standard differs from the EMEP protocol in the sense that measurement of anions and cations are done in $PM_{2,5}$, and that a number of critical parameters (e.g. choice of filter material) are fixed.

Additional attention is given to harmonizing these critical parameters with elemental carbon/organic carbon (EC/OC) measurements and with $PM_{2,5}$ measurements as well, as sampling is usually done simultaneously.

1 Scope

This European Standard specifies a method for the determination of the mass concentration of water soluble NO_3^- (nitrate), SO_4^{2-} (sulphate), Cl^- (chloride), NH_4^+ (ammonium), Na^+ (sodium), K^+ (potassium), Mg^{2+} (magnesium), Ca^{2+} (calcium) in $\text{PM}_{2,5}$ as deposited on filters.

This European Standard describes the analytical procedures for determining anions and cations as part of the $\text{PM}_{2,5}$ particulate phase, sample extraction and analysis of anions and cations by ion chromatography. Sampling onto filters will be done in accordance with EN 12341 for $\text{PM}_{2,5}$.

NOTE 1 Alternatively, cations, excluding ammonium, can be analysed by inductively coupled plasma optical emission spectrometry (ICP-OES). Ammonium can also be analysed by photometry or conductometry.

This European Standard can be used for the measurements of anions and cations as required by Directive 2008/50/EC. The method does not take into account the possible losses during sampling due to evaporation.

NOTE 2 NO_3^- , Cl^- , NH_4^+ are part of the volatile fraction of $\text{PM}_{2,5}$, and the concentrations determined using this standard can be used as minimum values for the concentrations of these ions in $\text{PM}_{2,5}$. NO_3^- , NH_4^+ , Cl^- are usually up to 30 % underestimated due to evaporational losses from the filter during sampling.

This European Standard may be used at rural and urban background sites and road sites that are in accordance with the siting criteria of Directive 2008/50/EC.

This European Standard is applicable to the measurement of anion/cations in $\text{PM}_{2,5}$ samples corresponding to $\text{PM}_{2,5}$ mass concentrations between approximately $1 \mu\text{g}/\text{m}^3$ (i.e. the limit of detection of the standard measurement method (EN 12341) expressed as its uncertainty) up to $120 \mu\text{g}/\text{m}^3$.

The validated range of the anion and cation concentrations based on the field validation measurements is presented in Table 1.

Table 1 — Validated range of anions and cations

Component	Minimum $\mu\text{g}/\text{m}^3$	Maximum $\mu\text{g}/\text{m}^3$
Cl^-	0,001	1,4
NO_3^-	0,002	29
SO_4^{2-}	0,05	13
Na^+	0,003	1,9
NH_4^+	0,04	11
K^+	0,003	0,49
Mg^{2+}	0,001	0,38
Ca^{2+}	0,002	0,72

See Annex A for the statistical analysis of the field validation measurements.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12341:2014, *Ambient air — Standard gravimetric measurement method for the determination of the PM₁₀ or PM_{2,5} mass concentration of suspended particulate matter*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12341:2014 and the following apply.

NOTE In particular, the following terms of EN 12341 are used in this document: calibration, combined standard uncertainty, coverage factor, expanded uncertainty, PM_x, standard uncertainty, uncertainty (of measurement).

3.1

field filter blank

filter that is taken through the same procedure as a sample, including transport to and from, and storage in the field, and analysis, but is not used for sampling air

Note 1 to entry: The filter is taken from the same batch as used for sampling.

3.2

laboratory filter blank

unused filter that does not leave the laboratory and is taken through the same procedure as a sample

Note 1 to entry: The filter is taken from the same batch as used for sampling.

3.3

reagent blank

solution that contains all the reagents used during the analysis of the sample, but without the sample and filter matrix

4 Symbols and abbreviations

For the purposes of this document, the following abbreviations apply.

EMEP	Cooperative programme for monitoring and evaluation of long-range transmission of air pollutants in Europe
CD	Conductivity Detector
FEP	Fluorinated Ethylene Propylene
HDPE	High Density PolyEthylene
HPLC	High Performance Liquid Chromatography
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
ICP-OES	Inductively Coupled Plasma Optical Emission Spectrometry
NIST	National Institute for Standards and Technology
PE	Polyethylene