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Ambient air quality - Atmospheric measurements near ground with FTIR spectroscopy

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English Version

Ambient air quality - Atmospheric measurements near ground with FTIR spectroscopy

Qualité de l'air ambiant - Mesurages de l'air ambiant à proximité du sol par spectroscopie à transformée de Fourier (FTIR)

Luftqualität - Messungen in der bodennahen Atmosphäre mit FTIR-Spektroskopie

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Foreword

This document (EN 15483:2008) 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of an identical text or by endorsement, at the latest by May 2009, and conflicting national standards shall be withdrawn at the latest by May 2009.

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Introduction

Fourier transform infrared spectroscopy (FTIR spectroscopy) has been successfully developed from an established laboratory analytical method to a versatile remote sensing method for atmospheric gases.

In this method, the long-path absorption of IR radiation by gaseous air pollutants is measured over an open path between an artificial IR source and an IR spectrometer and used to calculate the integrated concentration over the monitoring path. Since IR radiation is used for remote sensing, the measurements can be made without contact, that is to say without direct sampling, and can be made in various directions. These measurements include monitoring diffuse emissions from large-area sources, for example landfills, road traffic routes, sewage treatment plants, areas used for industrial or agricultural purposes, and in addition the minimization of production losses by tracing leaks in plant sections or piping systems. FTIR spectroscopy is thus suitable for a great number of analytical tasks which cannot adequately be performed using in-situ methods that make point measurements.

Generally, using a suitable measuring arrangement, an overview of the local air pollution may be obtained on site in a short time. This also includes measurements in areas to which access is difficult or impossible, or where the direct presence of staff or set-up of instruments is dangerous. FTIR spectroscopy can be used to determine different compounds at the same time.

This European Standard presents the function and performance of FTIR analytical systems. At the same time, operational notes are given, so that reproducible and valid measurements can be obtained. In addition, questions of measurement planning are discussed and the appendices give a selection of typical applications.

In some circumstances (e. g. CO) the method might be applicable for measurement of air quality as required by European legislation [1].

1 Scope

This European Standard is applicable to open-path absorption measurements of 'concentration × path length' product using the Fourier transform infrared (FTIR) technique with an artificial radiation source. It is applicable to the continuous measurement of infrared active organic and inorganic compounds in the gaseous state in ambient air using fixed tropospheric open paths up to approximately 1 km in length and provides a spatial average.

2 Normative references

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

EN ISO 6142, *Gas analysis - Preparation of calibration gas mixtures - Gravimetric method (ISO 6142:2001)*

EN ISO 6144, *Gas analysis - Preparation of calibration gas mixtures - Static volumetric method (ISO 6144:2003)*

EN ISO 9169, *Air quality - Definition and determination of performance characteristics of an automatic measuring system (ISO 9169:2006)*

ISO 6145 (all parts), *Gas analysis – Preparation of calibration gas mixtures using dynamic volumetric methods*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
absorbance
the negative logarithm of the transmission, $A(\nu) = -\lg(I(\nu)/I_0(\nu))$, where $I(\nu)$ is the spectral transmitted intensity of the radiation and $I_0(\nu)$ is the incident spectral intensity

NOTE $\lg = \log_{10}$

3.2
apodisation
application of a weighting function to interferogram data to alter the instrument's response function

3.3
background spectrum
with all other conditions being equal, that spectrum taken in the absence of the particular absorbing species of interest

3.4
instrument line shape (ILS)
mathematical function which describes the effect of the instrument's response on a monochromatic line.

3.5
intensity
radiant power per unit solid angle (non-collimated beam) or per unit area (collimated beam)

3.6
interferogram
effects of interference that are detected and recorded by a two-beam interferometer