Australian/New Zealand Standard™

Methods for sampling and analysis of ambient air

Method 16: Determination of polycyclic aromatic hydrocarbons (PAH)

PREFACE

This Standard was prepared by the joint Standards Australia/Standards New Zealand Committee EV-007, Methods for Examination of Air. This Standard deals with the method for the determination of polycyclic aromatic hydrocarbons (PAH) utilizing a modified high volume sampler and quartz filter, together with a sorbent bed containing polyurethane foam (PUF), styrene/divinylbenzene polymer resin (XAD-2) or a combination thereof.

The objective of this Standard is to provide regulatory and testing bodies with a standard method for the determination of PAH in ambient air.

The term 'normative' has been used in this Standard to define the application of the appendix to which it applies. A 'normative' appendix is an integral part of a Standard.

FOREWORD

For the purposes of this standard, PAH consist of two or more fused aromatic rings, with vapour pressures ranging from 10^{-2} kPa to 10^{-13} kPa at 25°C. PAH with vapour pressures greater than 10^{-8} kPa may be distributed between the gas and particle phases. During summer, volatilization from the filter is reported to be as high as 90% for PAH with vapour pressures greater than 10^{-6} Pa. At temperatures of 30°C and above, as much as 20% of benzo(a)pyrene and perylene have been found in the sorbent bed. Consequently, separate analyses of the filter and PUF/XAD-2 resin will not reflect the phase distribution in the atmosphere.

PAH in the environment principally result from the incomplete combustion of organic material, mainly fuel and waste, or emissions to air from industrial processes. Important anthropogenic sources include domestic solid fuel burning, motor vehicles, coal fired power stations, petroleum refineries, coal-tar production plants, coking plants, bitumen and asphalt production plants, paper mills, wood product manufacturers and aluminium smelters.

PAH concentrations in urban environments typically range from low ng/m^3 to several hundred ng/m^3, depending on the compound.

A number of PAH have been classified by the International Agency for Research on Cancer as human carcinogens, probable human carcinogens or possible human carcinogens.

Historically, Australian and New Zealand studies have utilized a range of techniques to measure PAH in ambient air making it difficult to compare results.

This Standard describes the test procedures to be followed when measuring PAH in ambient air, together with appropriate quality control measures.

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METHOD

1 SCOPE

This Standard specifies a high volume sampling method for the determination of both gas phase and particle phase polycyclic aromatic hydrocarbons (PAH) in ambient air. The method provides a measure of the mean concentration of PAH over the sampling period employed.

Due to their relatively high vapour pressures, naphthalene and acenaphthene may not be efficiently collected by this method. The sampling efficiencies for the PAH of interest may be estimated by determining the dynamic retention efficiency of the sorbent bed. Mean concentrations of 0.05 ng/m^3 and greater may be determined using a 24 h sampling period.

NOTE: Sampling is normally of 24 h duration to average diurnal variation in PAH concentrations and enable the collection of sufficient PAH mass for subsequent laboratory analysis.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS/NZS

3580 Methods for sampling and analysis of ambient air

3580.1.1 Method 1.1: Guide to siting air monitoring equipment

3580.9.3 Method 9.3: Determination of suspended particulate matter—Total suspended particulate matter (TSP) –High volume sampler gravimetric method

ISO

12884 Ambient air—Determination of total (gas and particle-phase) polycyclic aromatic hydrocarbons—Collection on sorbent-backed filters with gas chromatographic/mass spectrometric analyses

ISO/IEC

Guide 98 Uncertainty of measurement

Guide 98-3 Part 3: Guide to the expression of uncertainty in measurement (ISO GUM 2008)

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 unit density 1 g/cm^3 that exhibits the same aerodynamic behaviour as the particle in question.

3.2 Dynamic retention efficiency

The ability of the sorbent to retain a given PAH when air is drawn through the sampler under normal conditions for a period equal to or greater than that required for the intended use.

3.3 Measurement uncertainty

A variable associated with the result of a measurement that characterizes the dispersion of the values that could be reasonably attributed to the measurand.

NOTE: The variable may, for example, be a standard deviation (or given multiple of it), or the half width of an interval having a stated level of confidence. ISO/IEC Guide 98-3 provides a basis for evaluating the uncertainty in the output of a measurement system.