Australian Standard®

Methods for sampling and analysis of ambient air

Method 13.1: Determination of fluorides—Gaseous and acid-soluble particulate fluorides—Automated, double paper tape sampling

PREFACE

This Standard was prepared by the Standards Australia Committee on Methods for Examination of Air to supersede AS 2618.1—1983, *Ambient air— Determination of gaseous and particulate fluorides— Selective ion electrode method*, Part 1: *Gaseous fluorides and acid-soluble particulate fluorides (1 µg/m^3 or greater)—Automated double paper tape sampling*. This Standard is based on ASTM D 3266 –79, *Methods for automated separation and collection of particulate and acidic gaseous fluoride in the atmosphere (double paper tape sampler method).*

This Standard is part of a series for the determination of fluorides in ambient air. One other method in the series is published at present and is titled AS 3580.13.2, *Methods for sampling and analysis of ambient air*, Method 13.2: *Determination of fluorides— Gaseous and acid-soluble particulate fluorides—Manual, double filter paper sampling.* Another method proposed for the series is for the determination of gaseous and acid-soluble airborne particulate fluoride by a sodium acetate coated tube absorption method.

This Standard differs from the 1983 edition by the inclusion of additional information on fluoride measurement technique and information on the precision of measurement. It has also been reformatted to align with the AS 3580 series of Standards.

FOREWORD

Gaseous and particulate fluorides may be released to the atmosphere from a number of industrial processes. Industries emitting fluoride include aluminium smelters, steel works, power stations and hydrofluoric acid, brick, tile, glass and frit, and superphosphate fertilizer manufacturers. Fluorides are the most phytotoxic of the recognized air pollutants and, at atmospheric concentrations of less than 0.5 µg/m^3, may cause injury to susceptible plant species.

In view of the relative phytotoxicities of the different forms of fluoride, separate collection and analysis of the particulate and gaseous components is necessary.

In general, the health effects on animals are produced through ingestion of vegetation contaminated by particulate fluorides whereas the health of vegetation is affected by gaseous fluorides such as hydrogen fluoride, silicon tetrafluoride and fluorosilicic acid.

METHOD

1 SCOPE This Standard sets out a method for the collection and separation of acidic gaseous and acid-soluble particulate fluorides from ambient air and their determination using a fluoride ion-selective electrode.

This method is applicable to the measurement of acidic gaseous and acid-soluble particulate fluorides suspended in ambient air at concentrations of 1 $\mu g/m^3$ and greater.

NOTES:

1 This method is subject to certain interferences. Particulate metallic salts such as those of aluminium, iron, magnesium, calcium and rare-earths collected on the initial filter tape may retain some or all of the gaseous fluorides. The presence of fluorophosphates or fluoroborates could contribute varying amounts of fluorides as they dissociate unpredictably.

Acidic aerosols or gases may neutralize or acidify the alkali-impregnated final-filter tape thus preventing the quantitative collection of acidic gaseous fluorides. Although a citric acid impregnated Whatman No. 52 initial filter tape has been shown to allow passage of gaseous hydrofluoric acid, it may permit passage of fluoride particles smaller than about 1 µm. Hence these may impinge on the alkali-impregnated final tape. If initial tapes of higher retentivity are required for removal of particles of size less than 1 µm, citric acid impregnated tapes of Whatman No. 42 filter paper or equivalent may be used.

2 The addition of total ionic strength adjustment buffer (TISAB) eliminates a number of possible interferences. The effects of metallic ions are minimized by complexing agents. Variation in ionic strength is overcome by maintaining a high concentration of sodium chloride in the TISAB solution. The TISAB solution is buffered to pH 5 to [illegible] to avoid negative interference from the formation of complexes containing fluoride ions and positive interference from hydroxide ions being measured.

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

AS
2162 Code of practice for the use of volumetric glassware

2164 One-mark volumetric flasks

2165 Burettes and bulb burettes

2166 One-mark pipettes

2922 Ambient air—Guide for the siting of sampling units

3 PRINCIPLE Ambient air is drawn through an inlet tube and passed through an acid-impregnated paper tape (initial filter tape) to collect particulate fluorides and then through an alkali-impregnated paper tape (final filter tape) to collect acidic gaseous fluorides. The sampler is programmed to collect and store samples over selected time periods of up to 3 h.

The fluorides from the exposed filter tapes are extracted into aqueous solution and determined using a fluoride ion-selective electrode.

4 REAGENTS

4.1 General requirements Only reagents of recognized analytical reagent grade and only distilled water, or water of equivalent purity, containing less than 0.005 µg of fluoride per millilitre shall be used.