



BSI Standards Publication

Water quality — Determination of fluoride using flow analysis (FIA and CFA)

Part 2: Method using continuous flow analysis (CFA) with automated in-line distillation

National foreword

This Published Document is the UK implementation of ISO/TS 17951-2:2016.

The UK participation in its preparation was entrusted to Technical Committee EH/3/2, Physical chemical and biochemical methods.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2016. Published by BSI Standards Limited 2016

ISBN 978 0 580 94114 6

ICS 13.060.50

Compliance with a British Standard cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 30 September 2016.

Amendments issued since publication

Date	Text affected
------	---------------

**Water quality — Determination of
fluoride using flow analysis (FIA and
CFA) —**

**Part 2:
Method using continuous flow
analysis (CFA) with automated in-line
distillation**

*Qualité de l'eau — Dosage des fluorures par analyse en flux (FIA et
CFA) —*

*Partie 2: Méthode par analyse en flux continu (CFA) avec distillation
in situ automatique*



COPYRIGHT PROTECTED DOCUMENT

© ISO 2016, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Principle	2
4 Interferences	2
5 Reagents	2
6 Apparatus	5
7 Sampling and sample preparation	5
8 Procedure	5
8.1 Setting up the system.....	5
8.2 Reagent blank measurement.....	5
8.3 Adjustment of sensitivity.....	6
8.4 Confirmation of repeatability.....	6
8.5 Calibration.....	6
8.6 Measurement of samples.....	6
9 Calculation	7
10 Expression of results	7
11 Test report	7
Annex A (informative) Example of continuous flow analysis (CFA) with an in-line distillation unit and spectrometric detection	8
Annex B (informative) Determination of fluoride by automatic distillation continuous flow analysis (CFA) and ion selective detection	9
Annex C (informative) Examples of flow systems	12
Annex D (informative) Results of interlaboratory trial	13
Annex E (informative) Recovery test for fluoride	14
Annex F (informative) Analytical precision of fluoride	15
Bibliography	16

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 147, *Water quality*, Subcommittee SC 2, *Physical, chemical and biochemical methods*.

ISO 17951 consists of the following parts, under the general title *Water quality — Determination of fluoride using flow analysis (FIA and CFA)*:

- *Part 1: Method using flow injection analysis (FIA) and spectrometric detection after off-line distillation* [Technical Specification]
- *Part 2: Method using continuous flow analysis (CFA) with automated in-line distillation* [Technical Specification]

Introduction

Fluorine compounds in waters and effluents exist in various chemical forms, such as fluoride ion, complexes of iron, aluminium, boron and etc., as well as insoluble forms, such as calcium and magnesium fluorides. Excess fluoride can cause bone damage and fluorosis. In order to ensure conversion of any insoluble fluorides into soluble fluoride for measurement, steam distillation is necessary.

This part of ISO 17951 describes a CFA method for flow analysis of fluoride with integrated in-line distillation and spectrometric detection.

A CFA method with ion-selective detection is described in [Annex B](#).

Water quality — Determination of fluoride using flow analysis (FIA and CFA) —

Part 2:

Method using continuous flow analysis (CFA) with automated in-line distillation

WARNING — Persons using this part of ISO 17951 should be familiar with normal laboratory practice. This part of ISO 17951 does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

IMPORTANT — It is absolutely essential that tests conducted in accordance with this part of ISO 17951 be carried out by suitably qualified staff.

1 Scope

This part of ISO 17951 specifies a method for the determination of fluoride in waters, waste waters and effluents by continuous flow analysis (CFA). Any insoluble or complexed fluoride is converted to fluoride ion by an automated continuous flow distillation procedure from sulfuric/phosphoric acid. Fluoride ion in the distillate is measured using flow analysis with lanthanum alizarin complexone and spectrometric detection. This method is applicable to industrial waste waters, effluents, surface waters, ground waters, leachates. When this method is applied to the analysis of drinking water, a heater and a distillation unit is unnecessary. Some drinking water contains high concentration of aluminium and iron. In the case of drinking water, this part of ISO 17951 is appropriate to drinking water with low interferences. It is not applicable to samples which contain large amount of suspended matter.

In this part of ISO 17951, two working ranges are described:

- working range I: 0,1 mg/l to 1,0 mg/l;
- working range II: 1,0 mg/l to 10 mg/l.

The specification of the calibration solutions are to be adapted accordingly.

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.

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 6353-2, *Reagents for chemical analysis — Part 2: Specifications — First series*

ISO 8466-1, *Water quality — Calibration and evaluation of analytical methods and estimation of performance characteristics — Part 1: Statistical evaluation of the linear calibration function*

ISO 8466-2, *Water quality — Calibration and evaluation of analytical methods and estimation of performance characteristics — Part 2: Calibration strategy for non-linear second-order calibration functions*