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**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**

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

*Partie 1: Méthode par analyse avec injection en flux (FIA) et détection  
spectrométrique*



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## 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](http://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](http://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. The manual steam distillation method can be troublesome because of its complexity. It is necessary to ensure conversion of any insoluble fluorides into soluble fluoride for measurement.

Flow analysis with colourimetric detection is a rapid cost-effective method of determining of soluble (dissolved) fluoride in the method distillate.

This part of ISO 17951 describes FIA methods for flow analysis of fluoride.



# 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

**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 flow injection analysis (FIA). Any insoluble or complexed fluoride is converted to fluoride ion by a manual 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. It is not recommended for drinking waters where a distillation step is not required. In this part of ISO 17951, two working ranges are described:

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

## 3 Principle

Prior to the introduction of sample solution into the FIA system, the sample solution is manually distilled (see [Annex B](#)). Then, the distillate is introduced into a continuous carrier stream (water)