
**Water quality — Selection and application
of ready-to-use test kit methods in water
analysis**

*Qualité de l'eau — Choix et application des méthodes utilisant des kits
prêts à l'emploi en analyse de l'eau*

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 17381 was prepared by Technical Committee ISO/TC 147, *Water quality*.

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Introduction

In water and waste-water monitoring, an appropriate, standardized procedure exists for practically every parameter to be investigated. However, in certain circumstances, the employment of a simpler, faster and often more economical method is preferred, provided that this does not entail a breach of legislation.

This International Standard refers to methods for the analysis of water samples which can be undertaken outside the analytical laboratory, either on-site or as a field test, when the purpose of the test is to characterize the water under test for either quality or control purposes. In the case of determinands which are unstable after sampling, and which cannot be stabilized, ready-to-use methods provide the most suitable means of obtaining reliable test results. The test methods are simple procedures for use by a non-chemist after suitable training as well as by the trained chemist.

The methods described in this International Standard are not intended as a substitute for, or alternative to, other standards on the quantitative analysis of waters, which remain the reference methods for use in the laboratory.

The choice of the most suitable method depends upon the type of analysis required, and on the necessary quality of the results. This International Standard is intended to set out boundary conditions for selecting a non-standardized analytical method and to define the requirements with regard to both the application and the production of ready-to-use methods.

When applying the information contained in this International Standard, highly specialized expert knowledge is required when selecting suitable methods, whereas less stringent demands are made upon the subsequent application, in particular of simplified methods.

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Water quality — Selection and application of ready-to-use test kit methods in water analysis

WARNING — Persons using this standard should be familiar with normal laboratory practice. This standard 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.

1 Scope

This International Standard gives guidance on the selection, and requirements for the application, of ready-to-use methods in water analysis. The so-called "ready-to-use methods" are of increasing interest because, compared to standard methods, they allow fast and often inexpensive results for analytical problems. Under certain conditions these methods can be applied in routine control of water quality, provided they give reliable results.

This International Standard deals with practical aspects concerning quantitative ready-to-use methods. Statistical evaluations for establishing the equivalence of ready-to-use methods and standard methods are only mentioned briefly.

As the available ready-to-use methods are based on different analytical principles and also show different degrees of accuracy, they are classified into several groups. The aim of this International Standard is to set up criteria as to when the different kinds of ready-to-use methods may be applied for the analysis of distinct parameters in water samples (e.g. potable water, river water, process water, waste water) and which steps are necessary to prove their suitability for a certain application.

Ready-to-use methods have to meet special requirements because they are often used by non-chemists. This International Standard lists requirements for the producers of these tests, concerning safety and environmental aspects as well as handling and a description of the procedure. There are also several requirements concerning the training and supervision of the users of ready-to-use methods.

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.

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*

ISO/TR 13530, *Water quality — Guide to analytical quality control for water analysis*

3 Terms and definitions

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

- 3.1 reference method**
analytical method that is stipulated by law and is usually standardized
- 3.2 ready-to-use method**
analytical method that is ready-made for use, and may be employed in the field with no need for a laboratory

NOTE A more familiar name is "field method".

- 3.3 decision value**
discrete indication of concentration derived from legal, technical and other requirements

- 3.4 accuracy**
degree of agreement of the observed value with the true value of the quantity of interest

NOTE Both random and systematic errors can contribute to a reduction in accuracy.

4 Classification of ready-to-use methods

Ready-to-use methods are characterized by their readiness for use and their suitability for use in the field. As a rule they require less expenditure, less technical equipment and less expertise than the corresponding reference method. Depending upon the nature of the task involved and the method employed, the quality of the analytical results obtained using ready-to-use methods may equal the result gained when applying the corresponding standardized methods.

Ready-to-use methods may be classified according to various different aspects:

- a) according to the type of method (e.g. photometric cuvette test, comparator test, test sticks, simple volumetric determination);
- b) according to the accuracy of the reading
 - of a discrete analytical finding, or
 - of a range of results.

Ready-to-use methods are frequently based on standard methods that have been miniaturized to allow their direct application. They may also differ in part from the standard method in their method of detection.

5 Typical areas for the application of ready-to-use methods

5.1 General

Case studies outlining the use of ready-to-use methods in the different areas of application are contained in Annex B. Ready-to-use methods constitute a useful addition to standard procedures in the following areas.

5.2 Screening

Ready-to-use methods may be used for

- preselection of samples for analysis in the laboratory, and
- selection of the most suitable analytical method (concentration range, interferences).

5.3 Faults in waste-water facilities

Ready-to-use methods may be used for rapid detection of the uncontrolled ingress of pollutants in waste-water facilities.

5.4 Accidents with damaging consequences for surface water and ground water

Ready-to-use methods are a particularly useful means of limiting the amount of damage in the event of accidents, due to the rapid availability of the analytical information that they provide.

5.5 Control measurements in waste water, drinking water, swimming-pool water, surface water, water containing fish, and water for maintaining aquatic animal and plant life

Ready-to-use methods are employed, for example, for monitoring compliance with the permissible concentration range for a given parameter.

5.6 Monitoring of processes

Ready-to-use methods can be used to monitor and control processes (e.g. in waste-water facilities, production plants, internal water treatment plants and disinfection systems).

5.7 Testing for the presence of a given substance

The question as to whether or not a given substance (e.g. cyanide in waste water) is present may also be answered by means of ready-to-use methods. The desired detection limit and ability of the test to overcome possible interference from other components in the test sample are the decisive factors in selecting the most suitable ready-to-use method.

6 Selecting an analytical method

6.1 Selection criteria

The following criteria should be taken into consideration when selecting the appropriate analytical method. The decision-making process (see flow chart in Annex A) shall be documented.

A prerequisite is a known parameter.

- a) Basic premises:
 - question posed by analysis/aim of determination;
 - parameter definition (individual species, e.g. total Fe, Fe²⁺, Fe³⁺).
- b) Field of application:
 - concentration range;
 - matrix;
 - method limitations/interferences.

- c) Boundary conditions:
- rapidity (in relation to aim of determination);
 - mobility (in the field, etc.);
 - cost;
 - quality target of analysis;
 - frequency of use (continuous, once only);
 - qualification of personnel;
 - legal stipulations;
 - availability and/or ease of acquisition.

The criteria shall be weighted differently depending on the intended application. In the case of tasks which are frequently repeated, the most suitable ready-to-use method should be determined, the necessary equipment kept ready, and the procedure documented in a standard work guideline.

6.2 Quality targets

The general quality target of analytical questions is to be able to establish the relationship between the analytical result and its confidence interval on the one hand, and the decision values on the other.

This relationship with the decision values means that the analytical method to be used is subject to requirements regarding the quality of the analytical results. These requirements are task related and shall be defined before the ready-to-use method is applied. The definition of these quality targets forms the basis for the selection of the appropriate method.

7 Requirements for the application of ready-to-use methods

7.1 Requirements for the environment

The environmental conditions and technical facilities should be adequate for the analytical method selected. The relevant laws concerning health and safety at work shall be observed.

Operating procedures for putting methods into practice and the documents mentioned in Clause 8 regarding the quality assurance of analysis shall be kept to hand at the site of analysis.

7.2 Requirements for personnel

7.2.1 Requirements for decision makers

Decision makers are responsible for selecting the analytical method to be employed and for making sure that it is performed correctly, by ensuring that personnel are trained and familiarized with their tasks and by encouraging further training or providing this themselves. They shall also monitor execution of the analysis and the quality assurance measures. The necessary prerequisite for decision makers is that they have recognized qualifications and/or competencies and experience gained in the specific field of work.

Decision makers shall ensure that basic training courses and further training measures for personnel performing analyses are documented in a suitable manner and in such a way that they can be verified at any time.

Together with their subordinate personnel, decision makers determine measures for quality assurance and documentation and agree suitable control measures.

7.2.2 Requirements for personnel performing the analysis

Persons entrusted with performing analyses in accordance with this International Standard shall have passed a basic training course (provided by the manufacturer or the company) demonstrating abilities in and knowledge of the following items:

- performance of tests;
- scope of parameters and matrix influences;
- method limitations/interferences;
- sampling;
- dangers and how to avoid them;
- disposal of waste and waste water;
- quality assurance.

The personnel performing the analysis should attend regular further training courses.

7.3 Requirements for the product

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7.3.1 General

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This subclause deals with the most important points that should be apparent from the accompanying documentation of a method. All information, either supplied or separately obtainable (enclosed leaflet, application documents, etc.) shall be easily comprehensible and should be written in the country's national language.

7.3.2 Field of application

- parameters (e.g. oxidation state of ion);
- measurement range/graduation; “zero” may not be stated for the lower limit of the operating range;
- matrix;
- matrix interferences, measures to be taken for their prevention or elimination;
- temperature range, pH range;
- storage;
- shelf life.

7.3.3 Basis of the method

- principle of reaction.

7.3.4 How to use the product

- description of supplied reagents (e.g. composition, indications of danger);