International Standard

ISO 5667-3

Sixth edition
2024-03

Water quality — Sampling —

Part 3: Preservation and handling of water samples

Qualité de l'eau — Échantillonnage —

Partie 3: Conservation et manipulation des échantillons d'eau

Reference number
ISO 5667-3:2024(en)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 147, *Water quality*, Subcommittee SC 6, *Sampling (general methods)*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 230, *Water analysis*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This sixth edition cancels and replaces the fifth edition (ISO 5667-3:2018), which has been technically revised.

The main changes are as follows:

— ISO/TS 5667-25 has been added as a reference;

— a flow diagram for preservation and storage of water samples has been added;

— references in Table A.1 have been updated;

— references in Tables A.2 and A.3 have been added;

— the previous Table A.1 has been split into Table A.1 on inorganic analytes and Table A.2 on organic analytes;

— Table A.4 on microbiological analysis has been added;

— types of water have been added to Tables A.1 to A.5;

— the added terms used in Tables A.1 to A.5 have been explained.

A list of all parts in the ISO 5667 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is intended to be used in conjunction with ISO 5667-1, which deals with the design of sampling programmes and sampling techniques.

Where possible, this document has been aligned with current standards. Where new research or validation results have provided new insights, the latest knowledge has been used.

Guidance on validation protocols can be found in ISO/TS 5667-25 and ISO 17034[87].

Tables A.1 to A.5 provide the validated preservation times or conditions as well as the descriptions of best practice. Tables A.1 to A.5 also refer, for each analyte, to references available at the time of publication of this document (i.e. ISO 5667-3:2024). This is however not an exhaustive list. Other preservation methods may be used when they have been validated. However, it is strongly recommended that, where a method validation is not available, the preservation times for the analyte listed in Tables A.1 to A.5 for ISO test methods be followed. In case more than one storage time is provided in Tables A.1 to A.5, the order of preferred use is:

— validated method;

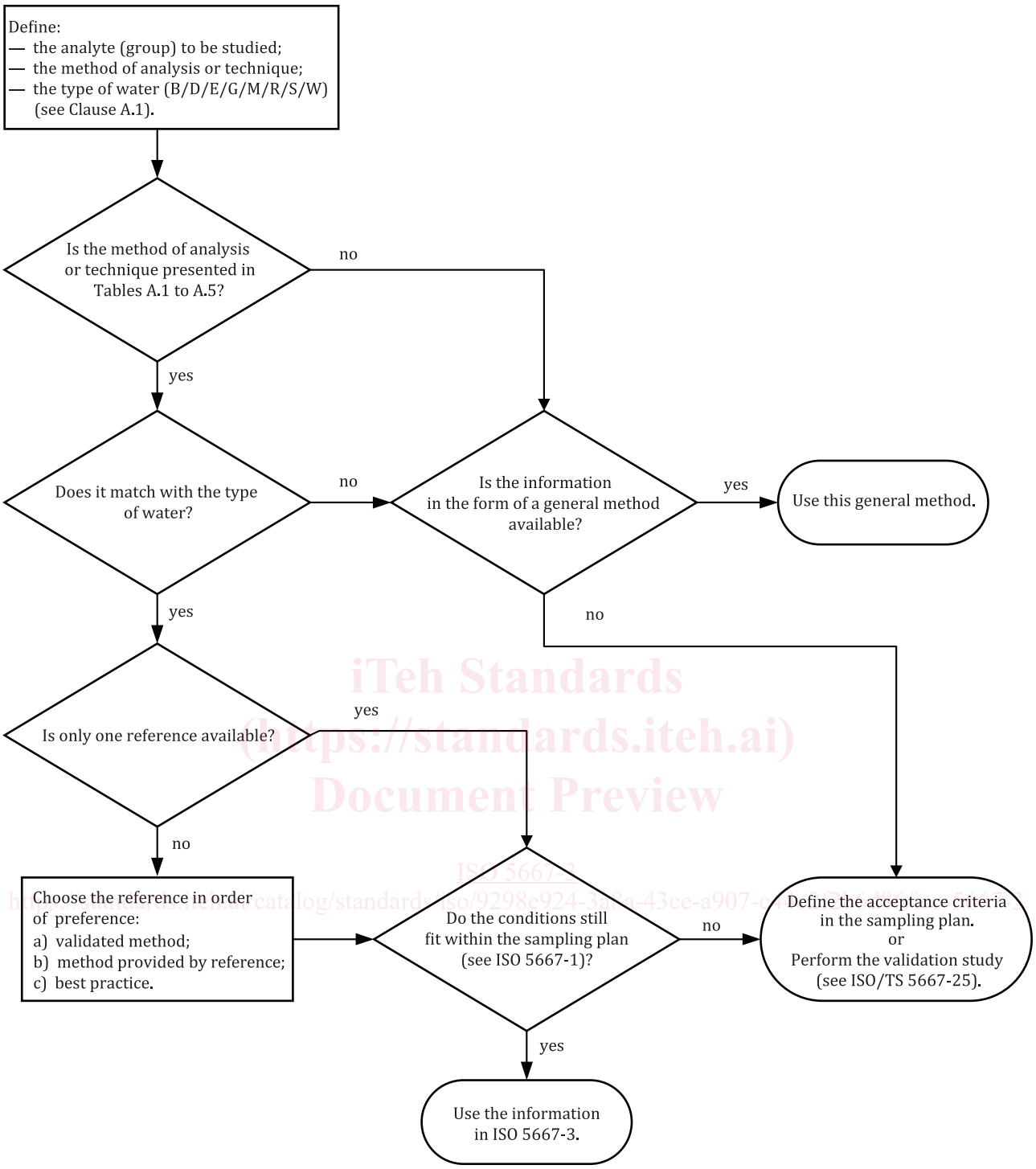
— method provided by reference;

— best practice.

The preservation and storage conditions and maximum storage times per analyte as listed in Tables A.1 to A.5 should be regarded as default conditions to be applied in the absence of any other information.

However, if validation of preservation techniques and holding times has been carried out, relative to specific circumstances and matrices, by a laboratory, then, provided that it can produce evidence of this validation where they differ from those set out in Tables A.1 to A.5, these validated preservation and storage conditions and maximum storage times are deemed acceptable for use by the validating laboratories. A national standard can contain information on preservation.

This document and the related analytical references can be used as presented in Figure 1.



WARNING — 'Method provided by reference' and 'validated method' can be based on previous standards and methods and therefore not be in line with ISO/TS 5667-25. This information can be interpreted by a qualified and experienced person.

Figure 1 — Flow diagram for the selection of a method for the preservation and storage of water samples

Attention is drawn to ISO/TS 5667-25, which contains guidelines and the elaboration of the required techniques of how to validate new storage times or preservative methods and details of the techniques described.

Water quality — Sampling —

Part 3: Preservation and handling of water samples

1 Scope

This document specifies the general requirements for sampling, preservation, handling, transport and storage of all water samples for physicochemical, chemical, hydrobiological and microbiological analyses and determination of radiochemical analytes and activities.

Guidance on the validation of storage times of water samples is provided in ISO/TS 5667-25.

This document is not applicable to water samples intended for ecotoxicological assays, biological assays (which is specified in ISO 5667-16), passive sampling (which is specified in ISO 5667-23) and microplastics (which is specified in ISO 5667-27).

This document is particularly appropriate when samples cannot be analysed on site and have to be transported to a laboratory for analysis.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 19458:2006, *Water quality — Sampling for microbiological analysis*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
best practice
method based upon consensus or general use and that can be referred to in literature

Note 1 to entry: Given the differences in conditions and circumstances as well as the impossibility to validate all parameters from a *validated method* (3.7) or technique or process, a best practice method based upon the corresponding properties of a validated parameter can be used.

3.2
integrity
property of the parameter(s) of interest, information or content of a sample stored in a container that has not been altered or lost in an unauthorized manner or that has been subject to loss of representativeness

3.3
method provided by reference
procedure or technique for the preservation of samples taken from the reference to which it refers

Note 1 to entry: It is not in all cases clear whether the preservation procedure provided by the reference was *validated method* (3.7), a *best practice* (3.1) or which procedure was used for its determination or validation. Where available, the information about the matrices is taken over.

3.4
sample preservation
procedure used to stabilize a sample in such a way that the properties under examination are maintained stable from the collection step until preparation for analysis

Note 1 to entry: Different analytes can require several samples from the same source that are stabilized by different procedures.

[SOURCE: ISO 11074:2015, 4.4.20, modified — Note 1 to entry has been added.]

3.5
sample storage
process and result of keeping a sample available under predefined conditions, usually for a specified time interval between collection and further treatment of a sample

Note 1 to entry: The specified time is the maximum time interval.

[SOURCE: ISO 11074:2015, 4.4.22, modified — Note 1 to entry has been added; “soil sample” has been changed to “sample”.]

3.6
storage time
period of time between filling of the sample container and further treatment of the sample in the laboratory, if stored under predefined conditions

Note 1 to entry: Sampling finishes as soon as the sample container has been filled with the sample. Storage time ends when the sample is taken by the analyst to start sample preparation prior to analysis.

Note 2 to entry: Further treatment is, for most analytes, a solvent extraction or acid destruction. The initial steps of sample preparation can be steps complementary to the storage conditions for the maintenance of analyte concentrations.

3.7
validated method
method for which the validity or correctness has been checked by verification or qualification against a number of predefined requirements

Note 1 to entry: A validated method indicates that a preservation method is capable of delivering the intended results with an acceptable degree of uncertainty for the parameter or group of parameters and water type.

4 Abbreviated terms for plastics

FEP	perfluoro(ethylene/propylene)
PE	polyethylene
PE-HD	high density polyethylene
PET	polyethylene terephthalate
PFA	perfluoroalkoxy (polymer)
PP	polypropylene

PTFE polytetrafluoroethylene

PVC poly(vinyl chloride)

5 Sampling and chain of custody

If there is a need to take samples, this is done according to a sampling programme. The first step is to design a sampling programme. Guidance on this topic is given in ISO 5667-1.

Depending on the sample type and matrix, the instruction found in the relevant part(s) of the ISO 5667 series and in ISO 19458 should be consulted.

The process of preservation and handling of water samples consists of several steps. During this process, the responsibility for the samples can change. To ensure the integrity of the samples, all steps involving the sample shall be documented.

6 Reagents and materials

WARNING — Certain preservatives (e.g. acids, alkalis, formaldehyde) need to be used with caution. Sampling personnel should be warned of potential dangers and appropriate safety procedures should be followed.

The following reagents are used for the sample preservation and shall only be prepared in accordance with individual sampling requirements. All reagents and waters used shall be of at least analytical grade. Acids referred to in this document are commercially available "concentrated" acids.

All reagents shall be labelled with a "shelf-life" representing the period for which the reagent is suitable for use, if stored correctly. Any reagents that are unused beyond the shelf-life shall be discarded.

NOTE The shelf-life of reagents is often supplied by the receiving laboratory.

Check reagents periodically, for example, by field blanks, and discard any reagent found to be unsuitable. For reagents that are unlikely to change over time in the specific conditions, check periodically if storage and packaging still meet the requirements.

Between on-site visits, reagents shall be stored separately from sample containers and other equipment in a clean, secure cabinet in order to prevent contamination.

Each sample shall be labelled accordingly, after the addition of the preservative. Otherwise, there is no visible indication as to which samples have been preserved and which have not.

6.1 Solids

6.1.1 Sodium thiosulfate pentahydrate, $Na_2S_2O_3 \cdot 5H_2O$, $w(Na_2S_2O_3 \cdot 5H_2O) > 99$ %.

6.1.2 Sodium hydroxide, NaOH, $w(NaOH) > 99$ %.

6.1.3 Sodium tetraborate decahydrate, $Na_2B_4O_7 \cdot 10H_2O$, $w(Na_2B_4O_7 \cdot 10H_2O) > 99$ %.

CAUTION — Sodium tetraborate decahydrate is known to be a reproductive toxin.

6.1.4 Hexamethylenetetramine (hexamine, urotropine), $C_6H_{12}N_4$, $w(C_6H_{12}N_4) > 99$ %.

6.1.5 Potassium iodide, KI, $w(KI) > 99$ %.

6.1.6 Iodine, I_2, $w(I_2) > 99$ %.

6.1.7 Sodium acetate, $C_2H_3NaO_2$, $w(C_2H_3NaO_2) > 99$ %.

6.1.8 Ethylenediamine, $C_2H_8N_2$, $w(C_2H_8N_2) > 99$ %.

6.2 Solutions

6.2.1 Zinc acetate solution $C_4H_6O_4Zn{\cdot}2H_2O$ (100 g/l).

Dissolve 10,0 g of zinc acetate dihydrate in approximately 90 ml of water. Dilute to 100 ml with water.

6.2.2 Orthophosphoric acid ($\rho \approx 1{,}7$ g/ml), H_3PO_4, $w(H_3PO_4) > 85$ %, $c(H_3PO_4) = 15$ mol/l.

6.2.3 Hydrochloric acid ($\rho \approx 1{,}2$ g/ml), HCl, $w(HCl) > 36$ %, $c(HCl) = 12{,}0$ mol/l.

6.2.4 Nitric acid ($\rho \approx 1{,}42$ g/ml), HNO_3, $w(HNO_3) > 65$ %, $c(HNO_3) = 15{,}8$ mol/l.

6.2.5 Sulfuric acid ($\rho \approx 1{,}43$ g/ml), H_2SO_4, $w(H_2SO_4) \approx 49$ %, $c(H_2SO_4) \approx 9$ mol/l.

Dilute concentrated sulfuric acid (H_2SO_4), $\rho \approx 1{,}84$ g/ml, $w(H_2SO_4) \approx 98$ % 1 + 1 by carefully adding the concentrated acid to an equal volume of water and mix.

WARNING — Adding the concentrated acid to the water can give violent reactions because of an exothermic reaction.

6.2.6 Sodium hydroxide solution (0,40 g/ml), NaOH.

6.2.7 Formaldehyde solution (formalin), CH_2O, $\varphi(CH_2O) = 37$ % (freshly prepared).

WARNING — Beware of formaldehyde vapours. Do not store large numbers of samples in small working areas.

6.2.8 Disodium salt of ethylenediaminetetraacetic acid (EDTA) (0,025 g/ml), $C_{10}H_{14}N_2Na_2O_8{\cdot}2H_2O$, $w(C_{10}H_{14}N_2Na_2O_8{\cdot}2H_2O) > 99$ %.

Dissolve 25 g EDTA in 1 000 ml of water.

6.2.9 Ethanol, C_2H_5OH, $\varphi(C_2H_5OH) = 96$ %.

6.2.10 Acidic Lugol's solution, 100 g potassium iodide (6.1.5), 50 g iodine (6.1.6) and 100 ml glacial acetic acid (6.2.16) in 1 000 ml water to pH 2.

6.2.11 Alkaline Lugol's solution, 100 g potassium iodide (6.1.5), 50 g iodine (6.1.6) and 250 g sodium acetate (6.1.7) in 1 000 ml water to pH 10.

6.2.12 Neutralized formaldehyde solution, formaldehyde solution (6.2.7) neutralized with sodium tetraborate (6.1.3) or hexamethylenetetramine (6.1.4). Formalin solution at 100 g/l gives a final solution of $\varphi(CH_2O) = 3{,}7$ %.

WARNING — Beware of formaldehyde vapours. Do not store large numbers of samples in small working areas.

6.2.13 Ethanol preservative solution.

Ethanol (6.2.9), formaldehyde solution (6.2.7) and glycerol (6.2.17) (100 + 2 + 1 parts by volume, respectively).

6.2.14 Sodium hypochlorite, NaOCl, w(NaOCl) = 10 %.

Dissolve 100 g sodium hypochlorite (NaOCl) in 1 000 ml of water.

6.2.15 Potassium iodate, KIO_3, $w(KIO_3)$ = 10 %.

Dissolve 100 g potassium iodate (KIO_3) in 1 000 ml of water.

6.2.16 Glacial acetic acid, $C_2H_4O_2$, $w(C_2H_4O_2)$ > 99 %.

6.2.17 Glycerol (glycerin, glycerine), $C_3H_5(OH)_3$.

6.2.18 Sodium hydrogen sulfate, $NaHSO_4$.

6.2.19 Sodium thiosulfate pentahydrate solution, $\rho(Na_2S_2O_3{\cdot}5H_2O)$ = 18 mg/ml.

6.3 Materials

6.3.1 Container and cap.

The types of containers and caps are specified in Tables A.1 to A.5.

6.3.2 Membrane filter, with pore size 0,40 µm to 0,45 µm.

7 Containers

7.1 Container selection and preparation

The choice of sample container (6.3.1) is of major importance and ISO 5667-1 provides some guidance on this subject.

Details of the type of container used for the collection and storage of samples are given in Tables A.1 to A.5. The same considerations given to this selection of suitable container material shall also be given to the selection of cap liner materials.

For microbiological analyses, clean sterile bottles shall be used. If the water contains an oxidant, stop the action of the oxidant as soon as the sample is taken by adding a reducing agent. Add a reducing agent such as sodium thiosulfate to the sample bottles. The theoretical mass of sodium thiosulfate (pentahydrate) necessary to inactivate 1 mg of chlorine is 7,1 mg. Thus, 0,1 ml of sodium thiosulfate pentahydrate solution (6.2.19) is added for each 100 ml of bottle capacity. This will inactivate at least 2 mg/l and up to 5 mg/l of free chlorine residual, depending on inactivation dynamics, which is sufficient for the majority of samples.

In certain circumstances, such as foot baths in swimming pools, disinfection measures (e.g. *Legionella* eradication in drinking water distribution systems), higher chlorine concentrations can be found and a proportionately higher dosage of sodium thiosulfate will be necessary. Sodium thiosulfate is not destroyed by autoclaving or dry heat.

For other disinfectants, corresponding inactivation measures need to be taken. If inactivation is not possible or feasible, it has to be reported. Chelating agents have been recommended to protect bacteria from the toxic action of heavy metals such as copper or zinc. Ethylene dinitrilotetraacetic acid (EDTA) or sodium nitrilotriacetate (NTA) ($Na_3C_6H_6NO_6$) can be used as a filter-sterilized solution at a final concentration of about 50 mg/l but should only be added when necessary (e.g. water treated with silver or copper). More information is specified in ISO 19458.

Containers used for microbiological samples shall be tested to ensure sterility. Either by a certificate from the supplier or in-house control. If disinfection agents have been added, the concentration shall also be monitored. Guidance on this subject is provided in ISO 19458.

Sample containers shall be made of a material appropriate for preserving the natural properties of both the sample and the expected range of contaminants. Suitable types of containers for each analyte to be measured are given in Tables A.1 to A.5.

NOTE For very low concentrations of metals, containers prescribed can be different from those used for higher concentrations. Details can be found in Table A.1 or in the analytical International Standards.

If the samples are to be frozen, suitable containers, such as polyethylene (PE) or polytetrafluoroethylene (PTFE), shall be used to prevent breakage.

The use of disposables is preferred due to lower risks of contamination. Some manufacturers supply containers with a certificate of cleanliness. If such a certificate of cleanliness is supplied, it is not necessary to clean or rinse the containers before use.

More information on container preparation can be found in Annex B.

7.2 On-site filtration

On-site filtration using a membrane filter (6.3.2) is required in some cases such as:

— if the dissolved metals need to be analysed, then acidify to pH < 2 after filtration;

— if required according to Tables A.1 to A.5, e.g. ammonium, nitrate, nitrite, phosphate, sulfate and silicates.

If experience has shown that no significant amount of particles occur (e.g. in drinking water), the filtration may be omitted. Those samples shall be colourless and shall have a turbidity <1,5 FNU (formazine nephelometric unit).

If immediate filtration on site is impossible when required (for instance under freezing weather conditions), then the reason and the time between sampling and filtration shall be added to the test report.

7.3 Filling the container

Containers (6.3.1) should be filled as prescribed in Tables A.1 to A.5 or in the analytical International Standard. If there are no instructions regarding the filling of the containers, they should be filled completely, unless the samples are to be frozen as part of their preservation. In this case, the sample containers shall not be filled completely in order to prevent breakage which can arise from the expansion of the water sample during the freezing and thawing process.

For microbiological samples, the filling procedure described in ISO 19458 shall be followed.

If no preservatives are present in the bottle, prerinsing the bottle is advisable. Guidance on prerinsing can be found in ISO 5667-14.

8 Sample handling and preservation

8.1 General

Waters, particularly surface waters, waste waters and groundwaters, are susceptible to changes as a result of physical, chemical or hydrobiological reactions which can take place between the time of sampling and the commencement of analysis. The nature and rate of these reactions are often such that, if precautions are not taken during sampling, transport and storage (for specific analytes), the concentrations determined are different to those existing at the time of sampling.

The extent of these changes is dependent on the chemical and biological nature of the sample, its temperature, its exposure to light, the type of container in which it is placed, the time between sampling and analysis, and the conditions to which it is subjected, e.g. agitation during transport.

8.2 Sample handling and preservation for physical and chemical analysis

Changes to particular constituents vary both in degree and rate, not only as a function of the type of water, but also, for the same water type, as a function of seasonal conditions.

These changes are often sufficiently rapid to modify the sample considerably in a short time. In all cases, it is essential to take precautions to minimize these reactions and, in the case of many analytes, to analyse the sample with a minimum of delay.

Further specific causes of variation are listed in a) to f).

a) The presence of bacteria, algae and other organisms can consume certain constituents of the samples. These organisms can also modify the nature of the constituents to produce new constituents. This hydrobiological activity affects, for example, the concentrations of dissolved oxygen, carbon dioxide, compounds of nitrogen, phosphorus and, sometimes, silicon.

b) Certain compounds can be oxidized either by dissolved oxygen present in the samples, or by atmospheric oxygen [e.g. organic compounds, Fe(II) and sulfides].

c) Certain substances can precipitate out of solution [e.g. calcium carbonate, metals and metallic compounds such as $Al(OH)_3$] or can be lost to the vapour phase (e.g. oxygen, cyanides and mercury).

d) Absorption of carbon dioxide from the air can modify the pH, conductivity and the concentration of dissolved carbon dioxide. The passage of compounds like ammonia and silicon fluoride through some types of plastics (see Table A.1) can also affect pH or conductivity.

e) Dissolved metals or metals in a colloidal state, as well as certain organic compounds, can be irreversibly adsorbed on to the surface of the containers or solid materials in the samples.

f) Polymerized products can depolymerize and, conversely, simple compounds can polymerize.

On-site filtration can be required as a precaution (7.2).

Samples for element analysis that are preserved with acid, can be transported under room temperature.

Details of the sample preservation are given in Tables A.1 and A.2.

8.3 Sample handling and preservation for hydrobiological analysis

The handling of samples for hydrobiological analysis is different from that for samples requiring chemical analysis. The addition of chemicals to the sample for hydrobiological analysis can be used for fixation or preservation of the sample. The term “fixation” is defined as the protection of morphological structures, while the term “preservation” is defined as the protection of organic matter from biochemical or chemical degradation. Preservatives, by definition, are toxic, and the addition of preservatives can lead to the death of living organisms. Prior to death, irritation can cause the most delicate organisms, which do not have strong cell walls, to collapse before fixation is complete. To minimize this effect, it is important that the fixation agent enters the cell quickly.

IMPORTANT — Acidic Lugol's solutions (6.2.10) can lead to the loss of structures in organisms or to the loss of small organisms, e.g. some flagellates. An alkaline Lugol's solution (6.2.11) should be used when silico-flagellates are frequently observed, e.g. during the summer.

The fixing and/or preservation of samples for hydrobiological analysis shall meet the following criteria:

a) the effect of the fixative and/or preservative on the loss of the organism shall be known beforehand;

b) the fixative or preservative shall effectively prevent the biological degradation of organic matter at least during the storage period of the samples;

c) the fixative, and/or preservative, shall enable the hydrobiological analyte (e.g. organisms or taxonomical groups) to be assessed during the storage period of the samples.

Details of the sample preservation are given in Table A.3.

8.4 Sample handling and preservation for radiochemical analysis

WARNING — Radioprotection, such as shielding, can be necessary, depending on the activity of the sample.

There is little difference between the handling of samples for radiochemical analysis and the handling of samples for physicochemical analysis.

The delay between sampling and measurement has to be consistent with the radioactive half-life of the radionuclides of interest. The conditions for adequate storage are independent of the radioactive half-life, but identical to those required for the corresponding stable isotope.

Cooling radiological samples is primarily used to prevent algal growth and biological spoilage. It is not a necessary preservation step for radiochemical analyses.

Details of the sample preservation are given in Table A.5.

9 Sample transport

Cooling or freezing procedures shall be applied to samples to increase the time period available for transport and storage (and if required, by Tables A.1 to A.5). When transport takes place, the sampling plan (e.g. ISO 5667-1) shall consider:

— the time between sampling (end of filling the sample container intended for the laboratory) and start of transport;

— the transport time;

— the time before further treatment in the laboratory.

The sum of these three periods is limited to the maximum storage times according to Tables A.1 to A.5.

If the maximum storage time cannot be met, then the sampling plan shall be reformulated to allow these requirements to be accommodated. In case the requirements cannot be met, instructions are given in ISO/TS 5667-25 to validate the preservation time of specific water samples or sample types.

Containers holding samples shall be protected and sealed during transport in such a way that the samples do not deteriorate or lose any part of their content. Container packaging shall protect the containers from possible external contamination, particularly near the opening, and should not itself be a source of contamination.

Glass containers shall be protected from potential breakage during transport by appropriate packaging. Samples shall be transported as soon as possible after sampling and with cooling (if necessary, according to Tables A.1 to A.5).

Laboratory samples for dispatch or transport by third parties and preserved laboratory samples should be sealed in such manner that the integrity of the sample can be maintained.

During transportation to the laboratory, samples shall be stored in a cooling device capable of maintaining a temperature of 5 °C ± 3 °C, apart from samples for element analysis that are preserved with acid. The samples intended for radiochemical analysis can be placed under room temperature. For proper evaluation of the conditions during transport, a device capable of recording the (maximum) temperature of the air surrounding the sample can be used. The temperature sensor should then be placed in a small container (e.g. 50 ml to 100 ml) filled with a fluid in order to avoid short time fluctuations in temperature.

Cooling and freezing procedures applied shall be in line with instructions from the analytical laboratory. Freezing especially requires detailed control of the freezing and thawing process in order to return the sample to its initial equilibrium after thawing.

Samples should not be in direct contact with the ice packs.

NOTE 1 Devices capable of logging the temperature during the transportation are available.