Nederlandse norm

NEN-ISO 10704

(en)

Water - Meting van totale alfa- en totale beta-activiteit in niet-zout water - Dunne-laag afzettingsmethode (ISO 10704:2009,IDT)

Water quality - Measurement of gross alpha and gross beta activity in non-saline water - Thin source deposit method (ISO 10704:2009,IDT)

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- ISO 10704:2009,IDT

Normcommissie 390010 "Radioactiviteitsmetingen"

NEN

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Postbus 5059, 2600 GB Delft
Telefoon (015) 2 690 390, Fax (015) 2 690 190

NEN-ISO 10704:2012

INTERNATIONAL STANDARD

ISO 10704

First edition
2009-11-15

Water quality — Measurement of gross alpha and gross beta activity in non-saline water — Thin source deposit method

Qualité de l'eau — Mesurage des activités alpha globale et bêta globale des eaux non salines — Méthode par dépôt d'une source fine

Reference number
ISO 10704:2009(E)

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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 10704 was prepared by Technical Committee ISO/TC 147, *Water quality*.

Water quality — Measurement of gross alpha and gross beta activity in non-saline water — Thin source deposit method

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

IMPORTANT — It is absolutely essential that tests conducted according to this International Standard be carried out by suitably trained staff.

1 Scope

This International Standard specifies a method for the determination of gross alpha and gross beta activity in non-saline waters for alpha- and beta-emitting radionuclides.

The method is applicable to raw and potable waters containing a small quantity of dissolved matter. It can, after adaptation, apply to other kind of waters.

The range of application depends upon the amount of dissolved material in the water and on the performance characteristics of the measurement equipment (background count rate and counting efficiency).

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

ISO 5667-1, *Water quality — Sampling — Part 1: Guidance on the design of sampling programmes and sampling techniques*

ISO 5667-3, *Water quality — Sampling — Part 3: Guidance on the preservation and handling of water samples*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

ISO 80000-10, *Quantities and units — Part 10: Atomic and nuclear physics*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement* (*GUM:1995*)

3 Symbols, definitions and units

For the purposes of this document, the symbols, definitions, and abbreviations given in ISO 80000-10, and the following, apply.

A	activity of the calibration source	Bq
A_a	activity spiked in sample a, prepared for self-absorption estimation purposes	Bq
c_A	activity concentration	Bq l^{-1}
c_A^*	decision threshold	Bq l^{-1}
$c_A^\#$	detection limit	Bq l^{-1}
$c_A^\triangleleft$, $c_A^\triangleright$	lower and upper limits of the confidence interval	Bq l^{-1}
$f_{\text{a}\alpha}$, $f_{\text{a}\beta}$	self-absorption factor of sample a for α and β, respectively	—
m_d	mass of the deposit	mg
m_p	mass of the planchet	mg
m_pd	mass of the planchet and the deposit	mg
m_pf	mass of the planchet and the filter	mg
m_pfd	mass of the planchet, the filter and the deposit	mg
$r_{0\alpha}$, $r_{0\beta}$	background count rate from the α and β windows, respectively	s^{-1}
$r_{\text{a}\alpha}$, $r_{\text{a}\beta}$	self-absorption sample a count rate from the α and β windows, respectively	s^{-1}
$r_{\text{g}\alpha}$, $r_{\text{g}\beta}$	sample gross count rate from the α and β windows, respectively	s^{-1}
$r_{\text{s}\alpha}$, $r_{\text{s}\beta}$	calibration count rate from the α and β windows, respectively	s^{-1}
t_0	background counting time	s
t_g	sample counting time	s
t_s	calibration counting time	s
U	expanded uncertainty calculated by $U = k \cdot u(c_A)$ with k = 1, 2,...	Bq l^{-1}
$u(c_A)$	standard uncertainty associated with the measurement result	Bq l^{-1}
V	volume of test sample	l
ε_α, ε_β	counting efficiency for α and β, respectively	—
$\varepsilon_{\text{a}\alpha}$, $\varepsilon_{\text{a}\beta}$	counting efficiency of sample a for α and β, respectively	—
χ	alpha-beta crosstalk	—

4 Principle

IMPORTANT — Gross alpha and gross beta determinations are not absolute determinations of the sample alpha and beta radioactive contents, but relative determinations referred to specific alpha and beta emitters that constitute the standard calibration sources.

In order to obtain a thin deposit directly on a planchet, the sample can be progressively evaporated to dryness at a temperature below about 85 °C. Alternatively, for alpha determination, it can be concentrated via a coprecipitation, the filtered coprecipitate being measured on to the planchet (Reference [3]). The gross alpha and gross beta activity of the deposit is measured by counting in an alpha- and beta-particle detector or counting system previously calibrated against alpha- and beta-emitting standards.

When suspended matter is present in a significant quantity, a filtration step is required and the gross alpha and gross beta activity can also be determined for the material retained on the filter.

IMPORTANT — Due to the ingrowth of radon daughters over time, the results are dependent on the time elapsed between sample preparation and measurement. For comparison purposes, it is recommended that the measurement be performed at the same time after the preparation of the sample.

5 Chemical reagents and equipment

5.1 Reagents

All reagents shall be of recognised analytical grade and shall not contain any detectable alpha and beta activity, except for radioactive standards solutions.

5.1.1 Standard solutions

5.1.1.1 Alpha standard

The choice of alpha standard depends on the knowledge of the type of radioactive contaminant likely to be present in the waters being tested. In general, this leads to a choice between naturally occurring and man-made alpha emitters.

Commonly used standards of artificial alpha-emitting radionuclides employed for this purpose are ^{241}Am solutions and ^{239}Pu solutions. When ^{239}Pu is used, the presence of ^{241}Pu as an impurity shall be taken into account as it leads to growth of ^{241}Am in prepared standard solutions of sources. When ^{241}Am is used, take into account the potential interferences of its gamma emission.

NOTE An uranium compound of certified natural or known isotopic composition has one arguable advantage, in that its specific activity can be calculated from established physical constants and isotopic abundance date which are independent of the calibration procedures of a particular organisation. However, an uranium compound of known isotopic composition is difficult to obtain. Furthermore, since the energies of the alpha emissions from uranium isotopes are less than those from the artificial transuranic nuclides, the use of a uranium standard tends to give a high result for transuranic elements.

5.1.1.2 Beta standard

The choice of beta standard depends on knowledge of the type of radioactive contaminant likely to be present in the waters being tested.

As a natural material, ^{40}K as potassium chloride, dried to constant mass at 105 °C, can be used. Standard solutions of artificial beta-emitting radionuclides ^{90}Sr^{90}Y are commonly used.

5.1.2 Wetting or surfactant agents

5.1.2.1 Vinyl acetate

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