

**Vee kvaliteet. Biokeemilise
hapnikutarbe (BHTn) määramine n
päeva pärast. Osa 2: Meetod
lahjendamata proovide jaoks**

Water quality - Determination of biochemical
oxygen demand after n days (BOD_n) -
Part 2: Method for undiluted samples
(ISO 5815:1989, modified)

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-EN 1899-2:1999 sisaldab Euroopa standardi EN 1899-2:1998 ingliskeelset teksti.</p> <p>Käesolev dokument on jõustatud 12.12.1999 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes.</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p>	<p>This Estonian standard EVS-EN 1899-2:1999 consists of the English text of the European standard EN 1899-2:1998.</p> <p>This document is endorsed on 12.12.1999 with the notification being published in the official publication of the Estonian national standardisation organisation.</p> <p>The standard is available from Estonian standardisation organisation.</p>
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<p>Käsitlusala: Standard esitab meetodi vee biokeemilise hapnikutarbe määramiseks lahjendamata proovides. See standard on kohaldatav kõikidele vetele, mille biokeemiline hapnikutarve on suurem kui määramise piirkontsentratsioon, 0,5 mg hapnikku/l, või on sellega võrdne ning ei ületa 6 mg hapnikku/l. Saadud tulemused on biokeemiliste ja keemiliste reaktsioonide kombinatsiooni saadus. Seetõttu ei ole need tulemused täpse ja ühetähendusliku iseloomuga, nagu on üksiku, täpselt määratletud keemilise protsessi tulemused. Sellest hoolimata võivad nad anda näidu, mille alusel saab vee kvaliteeti hinnata. Testi võib mõjutada mitmesuguste ainete juuresolek. Nendeks on mikroorganismid, näiteks bakteritsiidid, toksilised metallid või vaba kloor, mis pidurdavad biokeemilist oksüdatsiooni. Vetikate või nitrifitseerivate bakterite juuresolek võib põhjustada kõrgeid tulemusi.</p>	<p>Scope:</p>
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ICS 13.060.50

Võtmesõnad: hapnikutarve, keemiline analüüs, proovid, sisalduse määramine, veetestid, vesi

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Descriptors: Water quality, biochemical oxygen demand, testing.

English version

Water quality

Determination of biochemical oxygen demand after n days (BOD_n)
Part 2: Method for undiluted samples
(ISO 5815 : 1989, modified)

Qualité de l'eau – Détermination de la demande biochimique en oxygène après n jours (DOB_n) – Partie 2: Méthode pour les échantillons non dilués (ISO 5815 : 1989, modifiée)

Wasserbeschaffenheit – Bestimmung des Biochemischen Sauerstoffbedarfs nach n Tagen (BSB_n) – Teil 2: Verfahren für unverdünnte Proben (ISO 5815 : 1989, modifiziert)

This European Standard was approved by CEN on 1998-02-22.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

The European Standards exist in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 230 "Water analysis", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 1998, and conflicting national standards shall be withdrawn at the latest by September 1998.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This draft European Standard consists of the following Parts:

- EN 1899-1 Water quality – Determination of biochemical oxygen demand after n days (BOD_n) – Part 1: Dilution and seeding method with allylthiourea addition
- EN 1899-2 Water quality – Determination of biochemical oxygen demand after n days (BOD_n) – Part 2: Method for undiluted samples

Annex A, which is normative, concerns alternative incubation periods.

Annex B, which is normative, concerns modifications for specific evaluations of the quality of waters.

Annex C, which is informative, contains bibliography.

Endorsement notice

The text of the International Standard ISO 5815:1989 was approved by CEN as a European Standard with agreed common modifications as given below:

- Change in setup (splitting into two parts)
- Additions of annexes.

Introduction

This European Standard EN 1899-2 is intended for analysis of BOD in waters with a BOD in the range (0,5 to 6) mg/l of oxygen.

The times of incubation specified in the proposal are 5 days - as in ISO 5815:1989, "Water Quality - Determination of biochemical oxygen demand after 5 days (BOD₅) - Dilution and seeding method". Incubation for 5 days - as has been applied in many European countries - or 7 days as has been applied in several Nordic countries through the past many years. The 7 day incubation will typically give higher BOD results than 5 days incubation time.

With an incubation time of 5 days weekend work can only be avoided, if samples are collected Wednesdays, Thursdays to Fridays. With an incubation time of 7 days, samples collected on the first five weekdays can be analysed without implying weekend work. For this reason a 7 day incubation can be considered more convenient than the conventional 5 day incubation.

A modified 7 day incubation is described in a normative annex. The first investigations indicate that BOD results obtained by this modified method are identical to results obtained by the 5 day method described in the proposed standard. It is hoped that more comparative data on these two incubation methods will be obtained during the coming years, so that the modified 7 day incubation method can be included fully at the time of review and revision of this standard.

1 Scope

This European Standard specifies determination of the biochemical oxygen demand of waters of undiluted samples.

This standard is applicable to all waters having biochemical oxygen demands greater than or equal to the limit of determination 0,5 mg/l of oxygen and not exceeding 6 mg/l of oxygen. In this standard, the limit of determination, D_L , is defined as

$$D_L = t_{0,95(f)} \cdot 2 \cdot s_B \cdot \sqrt{1 + \frac{1}{n}} \quad (1)$$

where s_B is the within series standard deviation, $t_{0,95(f)}$ is the Student t-value, with f is the degrees of freedom for the determination of s_B and n is the number of analysis for determination of the blank in an analytical series. s_B is calculated from determinations of real samples with a BOD concentration near the estimated D_L .

In cases where the analytical method does not require any blank correction, the term

$$\sqrt{1 + \frac{1}{n}} \quad (2)$$

is omitted.

The results obtained are the product of a combination of biochemical and chemical reactions. They do not have the rigorous and unambiguous character of those resulting from, for example, a single, well-defined, chemical process. Nevertheless, they provide an indication from which the quality of waters can be estimated.

The test can be influenced by the presence of various substances. Those which are toxic to microorganisms, for example bactericides, toxic metals or free chlorine, will inhibit biochemical oxidation. The presence of algae or nitrifying microorganisms can produce high results. In these situations a modification of the method (see annex B or as described in EN 1899-1).

It is absolutely essential that test conducted according to this standard are carried out by suitably qualified staff.

Annex A describes alternative incubation periods.

Annex B describes procedures for modification of the method by addition of seeding material, salts, inhibition of nitrification by allylthiourea (ATU) addition, neutralisation, homogenisation and/or filtration. These modifications may be found necessary for specific evaluations of the water quality of receiving waters.

2 Normative references

This European Standard incorporates by dated or undated reference provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- EN ISO 3696 Water for analytical laboratory use – Specification and test methods (ISO 3696:1987)
EN 25813 Water quality – Determination of dissolved oxygen – Iodometric method (ISO 5813:1983)
EN 25814 Water quality – Determination of dissolved oxygen – Electrochemical probe method (ISO 5814:1990)
ISO 6107-2:1997 Water quality – Vocabulary – Part 2

3 Definition

For the purposes of this European Standard, the following definition applies:

biochemical oxygen demand after n days (BOD_n): The mass concentration of dissolved oxygen consumed under specified conditions by the biochemical oxidation of organic and/or inorganic matter in water. n is the incubation time; it is equal to 5 or 7.

NOTE: For the purpose of this European Standard, "biochemical oxidation" is taken to mean "biological oxidation". This definition is similar to the definition of ISO 6107-2.

4 Principle

Equilibration of the sample of water to be analyzed to 20 °C followed by, if necessary, aeration. Incubation at 20 °C for a defined period, 5 or 7 days, in the dark, in a completely filled and stoppered bottle. Determination of the dissolved oxygen concentration before and after incubation. Calculation of the mass of oxygen consumed per litre of sample.

5 Apparatus

5.1 Incubation bottles, BOD bottles, with glass stoppers,

For example, preferably 250 ml to 300 ml or 100 ml to 125 ml, with stoppers and preferably with straight shoulders, or any equivalent bottles.

It is important that the bottles are thoroughly cleaned before use. If the iodometric method (in accordance with EN 25813) for determining dissolved oxygen is used, it is, for example, normally sufficient to rinse the bottle several times with tap water then deionised water. However, if the electrode method (in accordance with EN 25814) is used, a more stringent cleaning procedure, for example, as follows, is required. Add to the empty bottle 5 ml to 10 ml of a wash solution (for example 2,5 g of iodine plus 12,5 g of potassium iodide per litre of 1% (V/V) sulfuric acid) shaking well to coat the bottle walls. Let stand for 15 min, pour off the solution and rinse thoroughly with tap water and finally deionised water.

5.2 Incubator, capable of being maintained at (20 ± 1) °C.

5.3 Equipment for determining dissolved oxygen concentration

In accordance with EN 25813 and EN 25814.

5.4 Means of refrigeration, (0 to 4) °C, for transport and storage of the sample.

5.5 Aeration equipment

A bottle of compressed air or a compressor: The air quality shall be such that the aeration does not lead to any contaminations, especially by the addition of organic matter, oxidizing or reducing materials, or metals. If a contamination is suspected, the air shall be filtered or washed.