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Influence of materials on water for human consumption - Enhancement of microbial growth (EMG)

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

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English Version

Influence of materials on water for human consumption - Enhancement of microbial growth (EMG)

Influence des matériaux sur l'eau destinée à la consommation humaine - Stimulation de la croissance microbienne (SCM)

Einfluss von Materialien auf Wasser für den menschlichen Gebrauch - Förderung des mikrobiellen Wachstums

This European Standard was approved by CEN on 25 October 2014.

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COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 16421:2014) has been prepared by Technical Committee CEN/TC 164 “Water supply”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by June 2015, and conflicting national standards shall be withdrawn at the latest by June 2015.

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Introduction

Water intended for human consumption comes into contact with construction products during storage, transportation and distribution, including water systems inside buildings. The materials used in these products are selected on the basis of technical requirements and criteria regarding their influence on the water quality, e.g. release of substances and effects on odour, flavour or colour of the water. However, water quality problems may also arise when such materials enhance the multiplication of micro-organisms.

A test method to determine the enhancement of microbial growth is required as organic substances present in non-metallic materials (either as ingredients, contaminants or process by-products) are capable of being utilized by micro-organisms and can give rise to a noticeable deterioration in the organoleptic, physical or microbiological quality of the water with which they are in contact. Microbial growth may occur in the water itself or at the material/water interface.

Materials with the potential of supporting microbial growth do not necessarily lead to a deterioration in water quality in every situation due to the influence of various environmental factors, e.g. microbial quality of the water, temperature, presence of residual disinfectant or other growth limiting factors.

The purpose of this standard is to describe three European test methods that can be applied to determine the ability of non-metallic materials to enhance microbial growth in drinking water.

a) Method 1 determines the Biomass Production Potential (BPP) by using changes in ATP concentrations as a surrogate measure for active biomass. This method, developed by the Dutch, has been further enhanced as part of the CPDW project 2003 and 2006.

b) Method 2 uses a volumetric measurement of the biofilm. This, German method, was first published as DVGW W 270 in 1984 and is used for certification purposes with limit values established for many years.

c) Method 3 uses dissolved oxygen depletion in water as a surrogate measure of microbial activity (Mean Dissolved Oxygen Difference – MDOD). This British method, first issued as BS DD82 in 1982 and published as BS 6920 Section 2.4 (1988 and 2000), is used for materials approval with limit values.

Each method thus uses different performance characteristics, which allows its use for specific materials or product types but also has limitations. For example, multi-layer pipes cannot currently be tested with the BPP (Method 1) and the MDOD-method (Method 3), and greases or lubricants cannot currently be tested with the BPP (Method 1) and Volumetric-method (Method 2). Harmonised product standards will provide the specific methodology to be followed; this will take into account material of construction and type of components.

All three methods use natural mixtures of aquatic organisms to assess the enhancement of growth by the sample of material. The natural flora comprises many strains that are adapted to living in a relatively hostile environment like drinking water and the results of tests using natural floras have been shown to correlate well with growth on materials in practice. The numbers, types and growth requirements of harmless micro-organisms present in drinking water vary considerably and no single cultural technique exists to enumerate all the aquatic micro-organisms that may be present in a sample of water. Therefore, overall numbers of micro-organisms are generally assessed by using simple indirect measurements of their activity.

The technique for assessing enhanced microbial growth is different in each of the test methods described in this European Standard. In the BPP method described in Method 1 surface and planktonic microbial growth is determined using adenosine triphosphate (ATP) as a surrogate method for active biomass determination. In the Volumetric method (DVGW) described in Method 2, the sum of both active and non-active biofilm on the surface of the test material (living and dead micro-organisms as well as extracellular polymeric substances) is determined volumetrically. In the MDOD method described in Method 3 the measurement of dissolved oxygen uptake is used as a surrogate measure of the growth of both biofilm and planktonic aquatic micro-organisms (most of the organisms which give rise to appreciable microbial growth respire aerobically and exert an influence on the concentration of oxygen dissolved in the water in the test systems).

A variety of factors may influence the capacity of living organisms to respond in a predictable manner and thus validation procedures are an essential part of any biological assay. In all three methods validation is achieved through the use of reference materials.

It is important to note that none of the three methods allows conclusions to be made on the physical (including surface roughness), chemical or toxicological behaviour of materials nor on their resistance to detergents or disinfectants. Additionally, none of the methods provides information on the pathogenicity of any micro-organisms whose numbers may be increased by nutrients leaching from the test material.

WARNING – The tests described in this document should only be carried out in laboratories with suitable facilities and by suitably qualified persons with an appropriate level of chemical and microbiological expertise. Standard microbiological procedures should be followed throughout.

1 Scope

This European Standard specifies three methods for determining the ability of non-metallic materials to enhance the growth of micro-organisms.

This European Standard is applicable to those materials destined to be used under various conditions for the transport and storage of water intended for human consumption.

The standard allows for the testing of a single type of material, or a product in which only one material is in contact with water. It is unsuitable for use with assembled products where more than one material is exposed to water.

NOTE The results given by each method are not directly comparable.

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.

EN 901, *Chemicals used for treatment of water intended for human consumption — Sodium hypochlorite*

prEN 1254-1:2007, *Copper and copper alloys — Plumbing fittings — Part 1: Fittings with ends for capillary soldering or capillary brazing to copper tubes*

EN 1484, *Water analysis — Guidelines for the determination of total organic carbon (TOC) and dissolved organic carbon (DOC)*

EN 10088-1, *Stainless steels — Part 1: List of stainless steels*

EN 14944-1, *Influence of cementitious products on water intended for human consumption — Test methods — Part 1: Influence of factory made cementitious products on organoleptic parameters*

EN ISO 3696:1995, *Water for analytical laboratory use — Specification and test methods (ISO 3696:1987)*

EN ISO 5814, *Water quality — Determination of dissolved oxygen — Electrochemical probe method (ISO 5814)*

EN ISO 7393-2, *Water quality — Determination of free chlorine and total chlorine — Part 2: Colorimetric method using N, N-diethyl-1, 4-phenylenediamine, for routine control purposes (ISO 7393-2)*

EN ISO 9308-1, *Water quality — Enumeration of Escherichia coli and coliform bacteria — Part 1: Membrane filtration method for waters with low bacterial background flora (ISO 9308-1)*

EN ISO 10012, *Measurement management systems — Requirements for measurement processes and measuring equipment (ISO 10012)*

EN ISO 10523, *Water quality — Determination of pH (ISO 10523)*

EN ISO 13385-1, *Geometrical product specifications (GPS) — Dimensional measuring equipment — Part 1: Callipers; Design and metrological characteristics (ISO 13385-1)*

EN ISO 13385-2, *Geometrical product specifications (GPS) — Dimensional measuring equipment — Part 2: Calliper depth gauges; Design and metrological characteristics (ISO 13385-2)*

EN ISO 16266, *Water quality — Detection and enumeration of Pseudomonas aeruginosa — Method by membrane filtration (ISO 16266)*

ISO 2016, *Capillary solder fittings for copper tubes — Assembly dimensions and tests*