Determination of the ultimate biodegradation of plastics materials in an aqueous system under anoxic (denitrifying) conditions - Method by measurement of pressure increase

EESTI STANDARDIKESKUS
ESTONIAN CENTRE FOR STANDARDISATION

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 17417:2020 sisaldab Euroopa standardi EN 17417:2020 ingliskeelset teksti.	This Estonian standard EVS-EN 17417:2020 consists of the English text of the European standard EN 17417:2020.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 04.11.2020.	Date of Availability of the European standard is 04.11.2020.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 13.030.99, 83.080.01

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 17417

November 2020

ICS 13.030.99; 83.080.01

English Version

Determination of the ultimate biodegradation of plastics materials in an aqueous system under anoxic (denitrifying) conditions - Method by measurement of pressure increase

Détermination de la biodégradation ultime des matériaux plastiques dans un système aqueux dans des conditions anoxiques (dénitrifiantes) - Méthode par mesure de l'augmentation de pression

Bestimmung der vollständigen Bioabbaubarkeit von Kunststoff-Materialien in wässriger Phase unter anoxischen (denitrifizierenden) Bedingungen - Verfahren mittels Messung der Druckzunahme

This European Standard was approved by CEN on 21 September 2020.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. EN 17417:2020 E

Contents

Page

European foreword

This document (EN 17417:2020) has been prepared by Technical Committee CEN/TC 249 “Plastics”, the secretariat of which is held by NBN.

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of an identical text or by endorsement, at the latest by May 2021, and conflicting national standards shall be withdrawn at the latest by May 2021.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Biodegradation of a chemical substance strongly depends on environmental conditions. The presence or the absence of oxygen is significant for the metabolic pathway on which the degradation by bacteria can take place. At present, several test methods for the investigation of biodegradability of polymers under aerobic conditions, but only a few test methods for the investigation of biodegradability under anaerobic conditions exist. However, degradation under anoxic (denitrifying) conditions has barely been considered yet. The concept "anoxic" has been created by engineers and designates conditions under which denitrification can take place. This means that either a little amount of oxygen or no oxygen at all (< 0,1 mg/l) but nitrate (> 0,1 mg/l NO_3^--N) is present. During heterotrophic denitrification, e.g. inside the denitrification tank of a wastewater treatment plant, nitrate is reduced to nitrogen and at the same time organic substrate is oxidized to CO_2. In nature, anoxic conditions can be present within the hypolimnion of eutrophic lakes or within the sediment at the transition zone between the aerobic and the anaerobic zone.

A way to use biodegradable polymers after intended service life would be their addition as additional carbon source to the denitrification unit of a wastewater treatment plant. In order to check if this way of disposing a polymer is possible, the biodegradability under anoxic (denitrifying) conditions shall be determined. Even if a substance shows good aerobic degradability, this does not necessarily apply under anoxic conditions.

Furthermore, a distinction shall be made between biodegradable polymers that are soluble in water and those not soluble in water.

Those biodegradable polymers that are soluble in water could be added systematically and continuously to the denitrification unit as a solid substrate, which is quickly converted and which can therefore replace the addition of an external liquid carbon source such as ethanol or acetic acid. Testing their aerobic degradability, their water solubility and, if necessary, their water dispersibility can be carried out in accordance with EN 14987 [1]. In addition to this, special testing regarding their use as a carbon source for denitrification is done according to this document. As long as these biodegradable polymers are present as a solid substance, it shall be ensured that they remain in the denitrification tank in order to prevent operational failure during other phases of the wastewater treatment plant.

Those biodegradable polymers that are not soluble in water are discontinuously introduced as a solid substance into a specially designed denitrification reactor, where they substantially remain because of an appropriate process control. Induced by bacterial activity, they continuously release carbon for the purpose of denitrification during a process of anoxic degradation, the duration of which depends on their dimensions (surface/volume ratio). Special testing regarding their use as a water insoluble carbon source for denitrification is described in this document.

1 Scope

This document specifies a method for the determination of the ultimate anoxic biodegradation of plastics made of organic compounds, where the amount of the produced nitrogen and carbon dioxide at the end of the test is measured.

The test substance is exposed to an inoculum stemming from the denitrification tank of a wastewater treatment plant. Testing is performed under defined laboratory conditions.

Claims of performance are limited to the numerical result obtained in the test and not used for making unqualified claims such as “disposable in waste water treatment plants” and similar.

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.

EN 872:2005, *Water quality — Determination of suspended solids — Method by filtration through glass fibre filters*

3 Terms and definitions

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

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

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

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

3.1
ultimate anoxic biodegradation
degradation of an organic compound into carbon dioxide, water and mineral salts of any of the present elements (mineralization) as well as new biomass by means of microorganisms in the presence of oxidized nitrogen compounds (nitrate, nitrite) and in the absence of oxygen

3.2
suspended solids
solids obtained by filtration under specified conditions

[SOURCE: EN 872:2005, 3.1]

3.3
dissolved inorganic carbon
DIC
part of the inorganic carbon in water which cannot be removed by specified phase separation

Note 1 to entry: Phase separation can be achieved for example by centrifugation at 40 000 m s^{-2} for 15 min or by membrane filtration using membranes with pores of 0,2 µm to 0,45 µm in diameter

[SOURCE: EN ISO 14852:2018, 3.4]