SLOVENSKI STANDARD
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Alge in izdelki iz alg - Metode za določanje produktivnosti rastišč alg

Algae and algae products - Methods for the determination of productivity of algae growth sites

Algen und Algenprodukte - Methoden zur Bestimmung der Produktivität von Algenwachstumsstandorten

Algues et produits à base d'algues - Méthodes de détermination de la productivité des sites de croissance d'algues

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Algae and algae products - Methods for the determination of productivity of algae growth sites

Algues et produits à base d'algues - Méthodes de détermination de la productivité des sites de croissance d'algues

Algen und Algenprodukte - Methoden für die Bestimmung der Produktivität von Algenwachstumsstellen

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European foreword

This document (EN 17480:2021) has been prepared by Technical Committee CEN/TC 454 “Algae and algae products”, the secretariat of which is held by NEN.

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of an identical text or by endorsement, at the latest by February 2022, and conflicting national standards shall be withdrawn at the latest by February 2022.

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Introduction

This document has been prepared by the experts of CEN/TC 454 “Algae and algae products”.

The European Committee for Standardization (CEN) was requested by the European Commission (EC) to draft European standards or European standardization deliverables to support the implementation of Article 3 of Directive 2009/28/EC for algae and algae-based products or intermediates.

This request, presented as Mandate M/547, also contributes to the Communication on “Innovating for Sustainable Growth: A Bio economy for Europe”.

The former working group CEN Technical Board Working Group 218 “Algae”, was created in 2016 to develop a work programme as part of this Mandate. The technical committee CEN/TC 454 “Algae and algae products” was established to carry out the work programme that will prepare a series of standards.

The interest in algae and algae-based products or intermediates has increased significantly in Europe as a valuable source, including but not limited to carbohydrates, proteins, lipids, and several pigments. These materials are suitable for use in a wide range of applications from food and feed purposes to other sectors, such as textile, cosmetics, biopolymers, biofuel and fertilizer/biostimulants. Standardization was identified as having an important role in promoting the use of algae and algae products.

The work of CEN/TC 454 should improve the reliability of the supply chain, thereby improving the confidence of industry and consumers in algae, which include macroalgae, microalgae, cyanobacteria, Labyrinthulomycetes, algae-based products or intermediates and will promote and support commercialisation of the European algae industry.

In industry and science many different measures for productivity can be found. This makes comparison unrealistic.

The goal of this document is to allow for a comparison between productivity of different algae growth sites.

The reasons to compare algae growth sites can be different. For example, there might be the interest to invest in a cultivation unit or to invest in a company which produces algae. Or there might be sustainability issues and life-cycle-analysis (LCA) which need to rely on a common way to calculate the productivity and thereby the area.

With EN ISO 14040 and EN ISO 14044 complete standards on LCA and sustainability for algae already exist. The parameter which is not clearly defined in these standards is the accounting of the productivity area (or volume) of algae growth sites. The way the area is calculated can have a huge impact on the productivity per area. Because of this, a great part of this document is on the definition of area. The challenge of defining the area lies in the diversity of cultivation units and the impact of their configuration on the ground area. As the goal of the area definition is to be applicable for all kinds of algae production techniques and cultivation units (e.g. ropes and ponds), the production under sunlight in cultivation units forms the basis (see Figure 1) to calculate productivity. The service and utility areas are not integrated in the area calculation, but will be accounted for in the cultivation unit area.

With regard to non-horizontal cultivation units (e.g. bubble columns, tubular photobioreactors and green-wall panels) every system has a different total direct solar area in a different ratio to the ground area of the cultivation unit, therefore the volumetric productivity formula should apply (see Figure 1).

A flowchart is provided to estimate if it is possible to utilize the general area definition of this document.

In comparison to land-based agriculture, the productivity of algae growth sites can be defined over several time periods. This allows to calculate productivity of algae growth sites also over periods which are less than one year.

Whenever possible, for comparability reasons, it is advisable to use the achieved production data to calculate the productivity for every time period that is defined in this document.

The specification of the area in a wild growth site where macroalgae are growing in nature without human interference, except when harvesting, is misleading for the calculation of productivity as many factors influence the growth (e.g. currents, mixture of species, natural regeneration cycles, etc.). For an investigation on the productivity and its sustainability of an aquatic ecosystem an area estimation is possible, but this exceeds the scope of this document.

1 Scope

This document specifies the methods to be used for the determination of productivity of algae growth sites.

This document excludes methods for sampling, harvesting and pre-/postprocessing. Excluded as well is "wild growth", which is defined as algae growing in nature without human interference except when harvesting the algae.

2 Normative references

The following document is 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 17399, *Algae and algae products — Terms and definitions*

3 Terms and definitions

For the purposes of this document, the terms and definitions in EN 17399 and the following apply.

ISO and IEC maintain terminological 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
cultivation
process of maintaining, growing and harvesting algae

3.2
controlled growth
algae growing in (partly) controlled conditions

3.3
wild growth
algae growing in nature without human interference except when harvesting the algae

3.4
cultivation unit
equipment for cultivating algae, e.g. photobioreactors, open ponds or longlines

3.5
natural basin
enclosed or sheltered area of water in nature in which algae are cultivated

3.6
natural site
area of open water in nature where algae are cultivated

3.7
insolate
expose to sunlight

3.8
algae growth site
area of a single or multiple algae cultivation unit(s) or natural sites

3.9
production area
insolated horizontal surface of the culture medium

Note 1 to entry: The production area of non-horizontal systems could result in multi-interpretable outcomes, therefore non-horizontal systems use the volume productivity formula to calculate productivity.

Note 2 to entry: Wild growth areas are excluded.

3.10
cultivation unit area
area occupied by the cultivation unit, including equipment needed to operate the unit and service area

Note 1 to entry: The equipment is considered to be tubing and connections necessary for the specific cultivation unit to function, e.g. the area occupied by the pumps and recirculating reservoir/ degasser in a tubular photobioreactor or to fixate a macroalgae cultivation unit in the sea.

Note 2 to entry: Cultivation unit area does not include equipment upstream and downstream of the cultivation unit, e.g. the reservoirs for water preparation and/or harvesting.

Note 3 to entry: Service area is considered to be the area necessary for the operation of the cultivation unit, including paths needed for inspection, cleaning and maintenance.

3.11
productivity
quantity of algae produced or harvested during a specified period of time and over a specified area or volume

3.12
peak productivity
indicates the maximum productivity obtained in a certain period of time

3.13
yearly productivity
indicates the average productivity obtained during one year

3.14
net productivity
indicates the average productivity obtained during the operative time

3.15
operative time
period that the algae production is in progress

4 Productivity

4.1 Parameters specific to algae productivity

4.1.1 Area aspect

The type of algae, and therefore the production methods, covered by this standard are very diverse. The types of algae are specified in EN 17399. Not all production alternatives have the same prerequisites and are therefore not comparable. To help to decide whether a production method is applicable for an area calculation, and thereby an area productivity calculation, a flowchart was developed.

By going through the characteristics of the production method the indication is given, if an area definition is possible and therefore an area productivity can be calculated.

The flowchart (Figure 1) can be utilized for all algae defined (microalgae, cyanobacteria, Labyrinthulomycetes and macroalgae). Additionally explanatory notes are added.