SLOVENSKI STANDARD
SIST-TP CEN/TR 16957:2016

01-november-2016

Bioizdelki - Smernice za popis življenjskega cikla (LCI) za fazo po izteku življenjske dobe

Bio-based products - Guidelines for Life Cycle Inventory (LCI) for the End-of-life phase

Produits biosourcés - Lignes directrices relatives à l'inventaire du cycle de vie (ICV) pour la phase de fin de vie

Ta slovenski standard je istoveten z: CEN/TR 16957:2016

ICS:

13.020.55	Biološki izdelki	Biobased products
13.020.60	Življenjski ciklusi izdelkov	Product life-cycles

SIST-TP CEN/TR 16957:2016 **en,fr,de**

TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

CEN/TR 16957

September 2016

ICS 13.020.60

English Version

Bio-based products - Guidelines for Life Cycle Inventory (LCI) for the End-of-life phase

Produits biosourcés - Lignes directrices relatives à l'inventaire du cycle de vie (ICV) pour la phase de fin de vie

Biobasierte Produkte - Leitlinien für die Sachbilanzierung von Produkten in der Nachnutzungsphase

This Technical Report was approved by CEN on 22 May 2016. It has been drawn up by the Technical Committee CEN/TC 411.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Ref. No. CEN/TR 16957:2016 E

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European foreword

This document (CEN/TR 16957:2016) has been prepared by Technical Committee CEN/TC 411 “Bio-based products”, the secretariat of which is held by NEN.

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Introduction

Bio-based products from forestry and agriculture have a long history of application, such as paper, board and various chemicals and materials. The last decades have seen the emergence of new bio-based products in the market. Some of the reasons for the increased interest lie in the bio-based products' benefits in relation to the depletion of fossil resources and climate change. Bio-based products may also provide additional product functionalities. This has triggered a wave of innovation with the development of knowledge and technologies allowing new transformation processes and product development.

Acknowledging the need for common standards for bio-based products, the European Commission issued mandate M/492, resulting in a series of standards developed by CEN/TC 411, with a focus on bio-based products other than food, feed and biomass for energy applications.

The standards of CEN/TC 411 "Bio-based products" provide a common basis on the following aspects:

— Common terminology;

— Bio-based content determination;

— Life Cycle Assessment (LCA);

— Sustainability aspects;

— Declaration tools.

It is important to understand what the term bio-based product covers and how it is being used. The term 'bio-based' means 'derived from biomass'. Bio-based products (bottles, insulation materials, wood and wood products, paper, solvents, chemical intermediates, composite materials, etc.) are products which are wholly or partly derived from biomass. It is essential to characterize the amount of biomass contained in the product by for instance its bio-based content or bio-based carbon content.

The bio-based content of a product does not provide information on its environmental impact or sustainability, which may be assessed through LCA and sustainability criteria. In addition, transparent and unambiguous communication within bio-based value chains is facilitated by a harmonized framework for certification and declaration.

1 Scope

This Technical Report provides guidance on how to compile an inventory for the end-of-life phase in LCA of bio-based products. All the end-of-life treatments here addressed are shown in Figure 1.

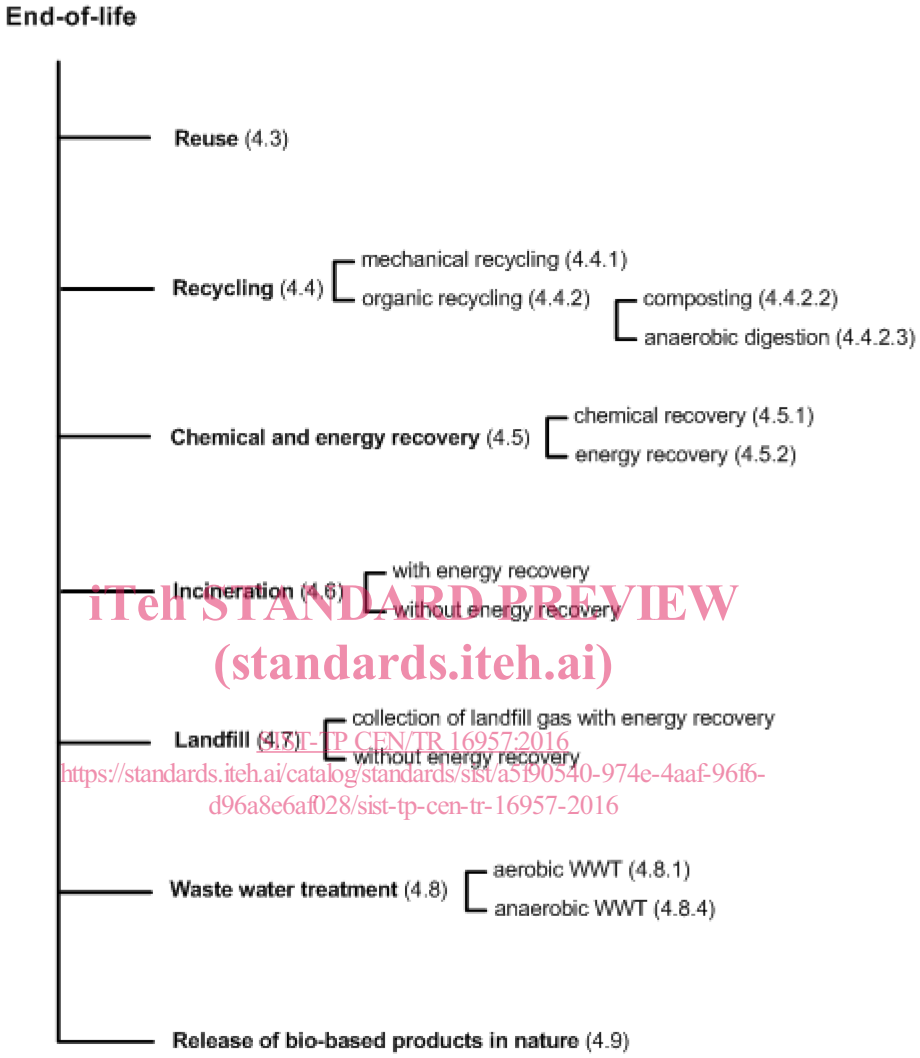

Figure 1 — End-of-life treatments addressed in this TR and related clauses

NOTE The order of the end-of-life options indicated in Figure 1 respect the Directive 2008/98/EC on waste. This list is not exhaustive, but illustrates the content of this Technical Report.

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 16575, *Bio-based products - Vocabulary*

EN 16760, *Bio-based products - Life Cycle Assessment*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 16575, EN 16760 and the following apply.

3.1
chemical recovery
process to recover valuable chemical substances by chemical treatment of used materials by hydrolysis, glycolysis, methanolysis, catalytic reaction, thermal reaction, and other chemical processes

[SOURCE: ISO 18601:2013, definition 3.1, modified - “packaging” replaced by “materials”, “process to substitute used packaging for natural resources” deleted.]

4 Modelling end-of-life options for bio-based products

4.1 General

The end-of-life options for bio-based products are in general the same as the options available for non bio-based products. Each end-of-life option has different environmental impacts to be evaluated as part of the LCA.

Life cycle inventory data (e.g. emissions to air, water and soil) related to the bio-based product end-of-life option depends on the type of treatment technology, processing conditions, the local infrastructure for collection (e.g. separate collection of biodegradable waste for composting), sorting and processing, the location (i.e. the contribution of for example the electricity used) and the physical-chemical characteristics of the disposed material such as the chemical composition and the biodegradation behaviour.

The end of life options recycling (mechanical or organic) and chemical recovery can lead to secondary materials, and consequently saving primary materials, keeping the bio-based carbon fixed in the material or preserving nutrients.

NOTE 1 Collection, transportation and sorting of the waste from bio-based products are considered under the LCA but are not detailed in this Technical Report. Regardless of the origin of the process module applied in the LCA study (generic modules from LCA databases, other public data, or modules developed by the practitioner of the LCA study), the parameters shown in Table 1 need to be defined in order to reflect the material properties of the studied bio-based waste.

Table 1 — Properties of waste from bio-based products

Parameters	**Unit**
Combustion characteristics	
Lower Heating Value (LHV)	MJ/kg
Share of biodegradable carbon actually decomposed into inorganic components within a defined time period	
In composting	%
In landfill Time period covered	% years
In incineration	%
In anaerobic digestion	%
Water content	% (weight)
Chemical composition (in dry mass)	
Carbon (fossil) (C)	g/kg
Carbon (biogenic) (C)	g/kg
Hydrogen (H)	g/kg
Oxygen (O)	g/kg
Sulphur (S)	g/kg
Nitrogen (N)	g/kg
Fluorine (F)	g/kg
Chlorine (Cl)	g/kg
Magnesium (Mn)	g/kg
Potassium (K)	g/kg
Calcium (Ca)	g/kg
Arsenic (As)	g/kg
Cadmium (Cd)	g/kg
Nickel (Ni)	g/kg
Cobalt (Co)	g/kg
Chromium (Cr)	g/kg
Copper (Cu)	g/kg
Mercury (Hg)	g/kg
Manganese (Mg)	g/kg
Lead (Pb)	g/kg
Zinc (Zn)	g/kg
Other elements (e.g. Se and Mo)	g/kg

NOTE 2 Very low concentrations (ppm) of some of these elements may have a high impact and therefore need to be included in the LCI.

The quantity of energy contained in a material is generally expressed through the Lower Heating Value (LHV). This parameter points out the maximum energy obtainable from the complete combustion of the material, without considering the heat of the water vapour generated by the combustion. The lower heating value of bio-based product waste can be measured according to EN 15359.

LHV can be estimated using the following formula, based on the chemical composition of the bio-based material.

$$LHV\left[MJ/kg\right] = HHV - H_2O \times 2,2 - H \times 2,2 \times 9$$

where

$$HHV = O \times 9,83 + H \times 124,27 + C \times 34,02 + S \times 19,07 + N \times 6,28$$

where

HHV is Higher Heating Value (MJ/kg material);

O is oxygen (without O from H_2O) (kg/kg of material);

H is hydrogen (without H from H_2O) (kg/kg of material);

C is carbon (kg/kg of material);

N is nitrogen (kg/kg of material);

S is sulphur (kg/kg of material).

NOTE 3 Source: Ecoinvent [15].

The share of biodegradable carbon actually decomposed into inorganic components, along with, chemical composition of the bio-based material guarantee, for example, a closed biogenic carbon balance in the LCA system model of the bio-based product.

4.2 Documentation requirements

The properties of the waste from bio-based products (Table 1) need to be documented along with their data sources to ensure transparency and enable comparability. This is especially relevant in case of cradle-to-grave studies, where those properties are of key importance to correctly model the end-of-life process along the value chain.

Biogenic carbon content in any LCA study of bio-based products/materials should be documented.

Biogenic carbon emissions (carbon dioxide, methane), originating from decomposition or combustion, of bio-based material need to be documented separately from non-bio-based carbon emissions in order to allow a consistent biogenic carbon balance over the full lifecycle of a bio-based product.

4.3 Reuse and/or preparation for reuse

Reuse means any operation by which products or components that are not waste are used again for the same purpose for which they were conceived. Preparing for reuse means checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be reused without any other pre-processing.

Important aspects to consider in the LCA study are the energy use from transportation to collection and logistic points and the use of resources for the preparation for reuse (e.g. water use, cleaning agents, energy, etc.).

NOTE See also Annex C of ILCD Handbook [17].

4.4 Recycling

4.4.1 Mechanical recycling

4.4.1.1 General

In mechanical recycling, waste material is reclaimed in order to enable use of the material in manufacture of a new product. During mechanical recycling, waste for example is ground, cleaned and eventually recycled (e.g. for plastics recycled into flakes or pellets). The quality of the recycled materials differs depending on original material properties and recycling processes applied.

This waste treatment pathway is open to bio-based materials. Prerequisite for a valuable mechanical recycling of bio-based material is (a source-separated) waste collection and subsequent sorting.

Recycled bio-based material maintains the CO_2 fixed from the atmosphere during plant growth within the technical material cycle. This might be accountable as a type of carbon sequestration. In such case bio-based carbon may therefore be considered as sequestered in the recycled bio-based material until the recycled material (after one or more recycling "loops") ends up in a final treatment (incineration, composting or anaerobic digestion process).

4.4.1.2 Parameters specific for bio-based waste

The key parameters for modelling bio-based waste recycling are listed in Table 2.

Table 2 — Parameters required for recycling model

Energy demand – electrical	kWh/t waste input
Energy demand – thermal	kWh/t waste input
Energy demand – mechanical	kWh/t waste input
Operating supplies (e.g. water, detergents)	
Recycling efficiency (dry weight of waste) (%)	kg output materials/ kg input materials x 100
Amount of non-recycled fraction (kg) and its end-of-life	

Depending on the LCA modelling approach to be used, information on what is substituted, the end use market or the quality of the recycled material may be needed.

4.4.1.3 Documentation requirements

Bio-based carbon content that is fixed in recycled material needs to be documented in order to guarantee a consistent biogenic carbon balance over the lifecycle.

Inventory and impact assessment results need to be presented transparently, separately indicating contributions of recycling processes and any associated credits (e.g. credits for replacement of virgin materials).