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ISO 18606

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Packaging and the environment — Organic recycling

Emballage et environnement — Recyclage organique

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 18606 was prepared by Technical Committee ISO/TC 122, *Packaging*, Subcommittee SC 4, *Packaging and environment*.

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Introduction

Packaging plays a critical role in almost every industry, every sector, and every supply chain. Appropriate packaging is essential to prevent loss of goods and as a result decrease impact on the environment. Effective packaging makes a positive contribution towards achieving a sustainable society by, e.g.:

a) meeting consumer needs and expectations for the protection of goods, safety, handling, and information;

b) efficiently using resources and limiting environmental impact;

c) saving costs in the distribution and merchandising of goods.

An environmental assessment of packaging should include the manufacturing and distribution system, the wastage of packaging material and goods, the relevant collection systems, as well as recovery or disposal operations. This group of ISO standards and supporting reports provides a set of procedures which aim to:

d) reduce environmental impact;

e) support innovation in product, packaging, and the supply chain;

f) avoid undue restrictions on the use of packaging;

g) prevent barriers and restrictions to trade.

A package should be designed to provide a number of functions for users and producers such as: containment, protection, information, convenience, unitization, handling, delivery, or presentation of goods. A major role of packaging is prevention of damage to or loss of goods. (See ISO 18601 Annex A for a list of the functions of packaging.)

ISO 18601 defines the interrelationships within the family of ISO standards which cover the environmental impact of packaging throughout its life cycle (see Figure 1). These standards will help define whether the selected packaging can be optimized and whether the packaging needs to be modified to ensure it can be reused or recovered after use.

Third-party certification is not required to demonstrate the requirements of these standards are met.

There are different methods to which public claims on the environmental attributes of packaging are discussed. Some of these are technical aspects on reuse or recovery, others relate to access by the population to reuse or recovery systems or the amount of packaging placed on the market for recovery. This series of standards addresses the technical aspects of the packaging. They do not address the requirements of ISO 14021 needed to support a claim or label.

This International Standard does not use the term “and/or” but instead the term “or” is used as an inclusive disjunction, meaning one or the other or both.

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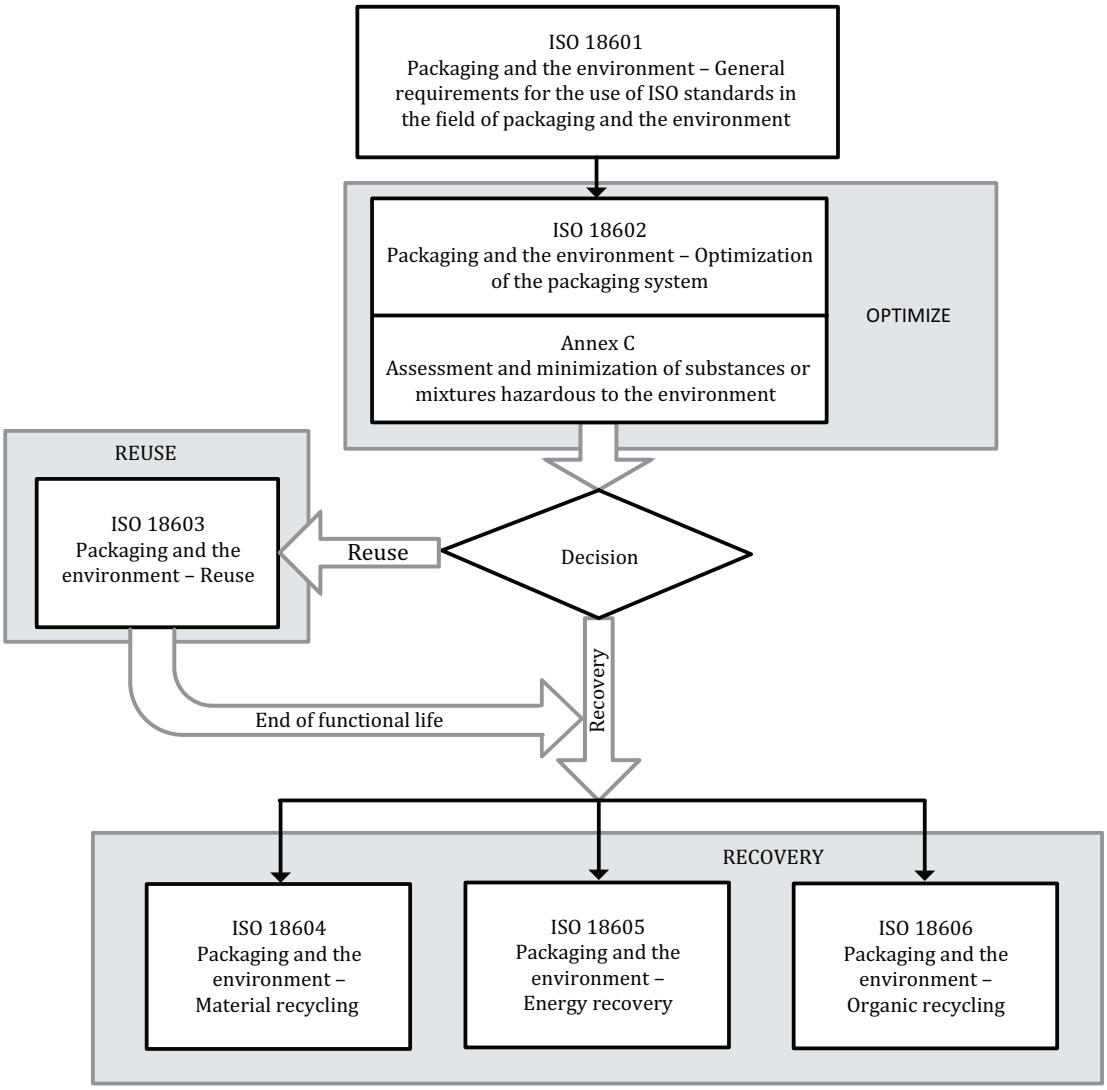

Figure 1 — Relationship of the Packaging and environment standards

The purpose of packaging is the containment, protection, handling, delivery, and presentation of products. In order to save resources and minimize waste, the whole system in which the packaging takes part should be optimized. This includes prevention as well as reuse and recycling of used packaging. Organic recycling by industrial aerobic composting or anaerobic digestion coupled with composting is an option for reducing the need for final disposal of used packaging while increasing the options for its recycling. This International Standard defines the standard specification to be met for packaging to be recovered by organic recycling.

Organic recycling, organic recovery, and biological recycling are interchangeably used to indicate biological waste treatment processes applied to used packaging to produce compost (in industrial composting plants) or compost and biogas (in anaerobic digestors). Examples of packaging suitable for organic recycling are provided in Annex E.

This International Standard presents a framework for self-assessment to determine whether the organic recycling has been met.

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Packaging and the environment — Organic recycling

1 Scope

This International Standard specifies procedures and requirements for packaging that are suitable for organic recycling. Packaging is considered as recoverable by organic recycling only if all the individual components meet the requirements.

Therefore, packaging is not considered recoverable by organic recycling if only some of the components meet the requirements laid down in this International Standard. However, if the components can be easily, physically separated before disposal, then the physically separated components can be individually considered for organic recycling.

This International Standard is applicable to organic recycling of used packaging but does not address regulations that exist regarding the recoverability of any residual packaged goods.

This International Standard does not provide information on requirements for the biodegradability of used packaging which ends up in the soil environment as litter, because littering is not considered as a recovery option. This International Standard is also not applicable to biological treatment undertaken in small installations by householders.

For each of the packaging components the following four aspects are addressed:

a) biodegradation;

b) disintegration during biological waste treatment process (i.e. composting);

c) negative effects on the biological process;

d) negative effects on the quality of the resulting compost, including the presence of high levels of regulated metals and other substances hazardous to the environment.

This International Standard establishes the requirements for packaging suitable for organic recycling.

NOTE "Organically recoverable", "compostable", or "compostable packaging in municipal and industrial composting facilities" or "biodegradable during composting" are expressions considered to be equivalent to organically recyclable for the purposes of this International Standard.

The procedure for applying this International Standard is contained in ISO 18601.

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.

ISO 14851, *Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium — Method by measuring the oxygen demand in a closed respirometer*

ISO 14852, *Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium — Method by analysis of evolved carbon dioxide*

ISO 14855-1, *Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions — Method by analysis of evolved carbon dioxide — Part 1: General method*

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ISO 14855-2, *Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions — Method by analysis of evolved carbon dioxide — Part 2: Gravimetric measurement of carbon dioxide evolved in a laboratory-scale test*

ISO 16929, *Plastics — Determination of the degree of disintegration of plastic materials under defined composting conditions in a pilot-scale test*

ISO 20200, *Plastics — Determination of the degree of disintegration of plastic materials under simulated composting conditions in a laboratory-scale test*

ISO 21067:2007, *Packaging — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21067 and the following apply.

3.1
compost
soil conditioner obtained by biodegradation of a mixture consisting principally of vegetable residues, occasionally with other organic material and having a limited mineral content

3.2
composting
aerobic process designed to produce compost

3.3
disintegration
physical breakdown of a material into fragments

3.4
total dry solids
mass of solids obtained by taking a known mass of test material or compost and drying at about 105 °C to constant mass

3.5
ultimate biodegradability
breakdown of an organic chemical compound by micro-organisms in the presence of oxygen to carbon dioxide, water, and mineral salts of any other elements present (mineralization) and new biomass or in the absence of oxygen to carbon dioxide, methane, mineral salts, and new biomass

3.6
volatile solids
mass of solids obtained by subtracting the residue of a known mass of test material or compost after incineration at about 550 °C from the total dry solids of the same sample

Note 1 to entry: The volatile-solids content is an indication of the amount of organic matter present.

3.7
packaging component
part of packaging that can be separated by hand or by using simple physical means

[SOURCE: ISO 18601:2012, definition 3.11]

3.8
packaging constituent
part from which packaging or their components are made and which cannot be separated by hand or by using simple physical means

[SOURCE: ISO 18601:2012, definition 3.12]

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3.9
organic recycling
through microbial activity, the controlled biological treatment of the biodegradable components of used packaging which produce compost and, in the case of anaerobic digestion, also methane

Note 1 to entry: Landfilling and littering are not considered as organic recycling.

3.10
anaerobic digestion
process of controlled decomposition of biodegradable materials under managed conditions where free oxygen is absent, at temperatures suitable for naturally occurring mesophilic or thermophilic anaerobic and facultative bacteria species, that convert the inputs to a methane rich biogas and digestate

Note 1 to entry: In a second phase, the digestate is typically stabilised by means of a composting (aerobic) process.

4 Principle

The purpose of this International Standard is to establish requirements for packaging that can be recovered by means of organic recycling. Organic recycling is carried out in industrial composting plants or anaerobic digesters.

A packaging is considered as suitable for organic recycling if all the components are suitable for organic recycling. However, individual components of the packaging can be considered recoverable by organic recycling if they meet the requirements of this International Standard. The suitability of packaging components and packaging material is verified by the test scheme described in this International Standard.

5 Basic requirements

5.1 Control of constituents

Constituents known to be, or expected to become, hazardous to the environment during the biological treatment process, besides the substances given in Annex A, shall not be deliberately introduced into packaging or packaging materials intended to be designated as suitable for organic recycling.

5.2 Assessment

5.2.1 General

Except as identified in 5.3, assessment of the biological treatability of packaging and packaging components shall include the following five assessment procedures as a minimum:

— characterization (see 5.2.2);

— biodegradation (see 5.2.3);

— disintegration, including effects on the biological treatment process (see 5.2.4);

— compost quality (see 5.2.5);

— recognizability (see 5.2.6).

5.2.2 Characterization

Each packaging material under investigation shall be identified and characterized prior to testing, including at least:

— information on, and identification of, the constituents of the packaging materials;

— determination of the presence of substances hazardous to the environment, e.g. regulated metals;

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— determination of the organic carbon content, total dry solids, and volatile solids of the packaging material used for biodegradation and disintegration tests.

NOTE In addition to the chemical characteristics for volatile solids, pass levels for regulated metals are also provided as their total absence is not possible.

5.2.3 Biodegradation

To be designated as organically recyclable, each packaging, packaging material, or packaging component shall be inherently and ultimately biodegradable as demonstrated in laboratory tests and to the criteria and pass levels given in 6.3.

5.2.4 Disintegration

To be designated as organically recyclable, each packaging, packaging material, or packaging component shall disintegrate in a biological waste treatment process to the criteria and pass levels given in 6.4, without any observable negative effect on the process.

5.2.5 Compost quality

To be designated as organically recyclable, no packaging or packaging component thereof, submitted to a biological waste treatment process, shall be recorded as having a negative effect on the quality of the resulting compost as specified in 6.5.

5.2.6 Recognizability

The packaging or packaging component which is intended for entering the biological waste stream shall be recognizable as organically recyclable by the end user by appropriate means.

5.3 Exemptions

5.3.1 Equivalent form

A packaging material demonstrated to be organically recyclable in a particular form shall be accepted as being organically recyclable in any other form having the same or a smaller mass-to-surface ratio or wall thickness.

5.3.2 Materials of natural origin

Chemically unmodified packaging materials and constituents of natural origin, such as wood, wood fibre, cotton fibre, starch, paper pulp, bagasse, or jute shall be accepted as being biodegradable without testing (see 6.3) but shall be chemically characterized (see 5.2.2) and fulfil the criteria for disintegration (see 6.4) and compost quality (see 6.5).

6 Detailed requirements

6.1 General

In order to meet the requirements of this International Standard a packaging or a packaging component shall demonstrate all of the characteristics found in 6.2 to 6.5.

NOTE Examples of how to use this International Standard are given in Annex E.

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6.2 Characterization of the packaging

6.2.1 Regulated metals and other substances

The concentrations of regulated metals and other substances hazardous to the environment in the packaging shall not exceed the limits as described in Annex A specific to the country where the final product will be placed on the market or disposed. It is the responsibility of the user to conform to the applicable national or regional regulations dealing with metals, other elements, and substances hazardous to the environment.

6.2.2 Minimum of volatile solids

The packaging or packaging components shall contain a minimum of 50 % of volatile solids.

6.3 Ultimate biodegradation

6.3.1 Aerobic biodegradation

The ultimate level of aerobic biodegradation shall be established by testing under controlled conditions.

A packaging is considered to have demonstrated a satisfactory rate and level of biodegradation if, when tested in accordance with ISO 14855-1 or ISO 14855-2, it achieves the minimum biodegradation percentage specified in 6.3.1.1 within the time period specified in 6.3.1.2.

The ultimate aerobic biodegradability shall be determined for the whole material or for each organic constituent. For organic constituents which are present in the material at a concentration between 1 % and 10 % (by dry mass), the level of biodegradation shall be determined separately.

Constituents which are present at concentrations of less than 1 % do not need to demonstrate biodegradability. However, the sum of such constituents shall not exceed 5 %.

Only biodegradation tests that provide unequivocal information on the inherent and ultimate biodegradability of a packaging material or its significant organic constituents shall be used. The controlled aerobic composting test (ISO 14855-1, ISO 14855-2) shall be used unless inappropriate to the type and properties of the material under test. In the event that alternative methods are necessary, an internationally standardized biodegradability test method shall be used, in particular ISO 14851 and ISO 14852, which are designed for polymeric materials.

6.3.1.1 Conversion to CO_2

90 % of the organic carbon shall have been converted to CO_2 by the end of the test period (absolute biodegradation).

As an alternative, relative biodegradation can be demonstrated in which conversion of carbon to CO_2 from the sample is at least 90 % of the conversion of carbon to CO_2 from the reference.

Both the reference and the test sample shall be composted for the same length of time and the results compared at the same point in time after the activity of both has reached a plateau. The reference used shall be microcrystalline cellulose. The reference shall have met the validation criterion specified in the biodegradation test method used.

NOTE Although the biodegradation test includes the conversion of the polymers into cellular biomass and humic substances in addition to carbon dioxide, no recognized standard test methods or specifications exist for the quantification of these conversion products. When such tests and specifications become available, this International Standard may be revised.

6.3.1.2 Test period

The test period shall be no longer than 180 days.

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6.3.2 Anaerobic biodegradation

The level of anaerobic biodegradation may be established by testing under controlled conditions using ISO 14853:2005 or ISO 15985:2004, in order to estimate the amount of biogas recovered during the first anaerobic phase.

No pass/fail requirement for the percentage of anaerobic biodegradation has been set because most commercial biogasification plants provide for a follow-on second aerobic composting phase. In order to meet the requirements of this International Standard, a packaging or a packaging material has to meet the compostability criteria set forth in 6.2 through 6.5.

6.4 Disintegration

6.4.1 General

The packaging shall disintegrate during the biological waste treatment such that any remaining packaging is not readily distinguishable from the other organic materials in the finished compost. Additionally, the packaging material shall not be found in significant quantities during screening prior to final distribution of the compost.

Packaging is considered to have demonstrated satisfactory disintegration if, after 12 weeks in a controlled composting test, no more than 10 % of its original dry mass remains in the oversize fraction after sieving through a 2,0 mm sieve. The particles or pieces which do not differ from the compost for colour, structure, dimension, moisture feeling, and brightness/gloss are considered to be compost.

The test shall be carried out in accordance with the pilot-scale test in ISO 16929. Alternatively, also the lab-scale test in ISO 20200 can be used. In case of differing results, ISO 16929 results shall prevail.

Also full-scale industrial composting testing can be used as long as it is well defined and uses equivalent test duration, sample concentration, and analytical evaluation of disintegration. However, since no standard method exists for full-scale testing, results obtained should be accompanied by detailed documentation.

NOTE 1 Current composting test procedures are 12 weeks in duration since this is representative of most current industrial composting technologies for typical natural materials.

When testing finished articles and products, testing shall be conducted starting with the articles and products in the same form as they are intended to be used. For products and materials that are made in several different thicknesses or densities, such as films, containers, and foams, only the thickest or most dense products and materials need to be tested as long as the chemical composition and structure remains otherwise the same.

NOTE 2 Special attention should be given to the visual aspects of compost. Visual contamination of compost as evidenced by reduction of aesthetic acceptability should not be significantly increased by any post composting residues of the introduced packaging material.

6.4.2 Test period

The test period shall be 12 weeks (84 days).

6.5 No adverse effect on ability of compost to support plant growth

6.5.1 General

The packaging material tested shall have no adverse effect on the ability of the compost to support plant growth, when compared to blank composts to which no test or control substances has been added at the start of testing. In order to ensure that the composting of packaging does not have any harmful effects on the finished compost or on the environment and complies with appropriate regional and national regulations, all requirements specified in 6.5.2 shall be met.

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6.5.2 Seedling germination rate and plant biomass

The seedling germination rate of the finished compost and the plant biomass in the compost shall be no less than 90 % of that of corresponding blank composts to which no test material was added at the start of testing, determined in accordance with OECD Guideline 208 with the modifications specified in Annex B. Compost to be used for plant toxicity tests shall be prepared according to ISO 16929 using a 10 % sample input concentration.

7 Declaration of results

The results are declared as follows:

— Only packaging meeting all the requirements specified in Clause 6 may be considered as organically recyclable or “compostable”, or “biodegradable during composting”.

— A packaging is considered as suitable for organic recycling if all the components are suitable for organic recycling. However, individual components of the packaging can be considered recoverable by organic recycling if they meet the requirements of this International Standard.

— If the packaged goods remain in part or as whole in the packaging after normal use, the packaged goods shall by themselves be organically recyclable.

8 Test report

The test report shall provide all pertinent information, including:

a) all information necessary to identify and describe the product or material tested,

b) references to all standards, guidelines, and regulations that are relevant to 6.2.1 regarding the content of regulated metals and other substances hazardous to the environment (a Table of regulated metals and other substances hazardous to the environment shall be presented, specifying each such reference and stating the prescribed limit for each metal and other substance hazardous to the environment, the concentration determined in the test, and the percentage of the prescribed limit),

c) a description of other relevant requirements in the referenced documents and a statement, for each such requirement, as to whether the test result was in agreement with the requirement or not, and

d) recording of assessment outcome.

An example format for an assessment checklist is given in Annex D.

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Annex A
(normative)

Maximum concentrations of regulated metals and other substances hazardous to the environment

Table A.1 — Maximum concentrations of regulated metals and other substances hazardous to the environment in mg/kg of dry material

Element	US [a]	Canada [b]	EU + EFTA countries [c]	Japan [d]
Zn	1 400	463	150	180
Cu	750	189	50	60
Ni	210	45	25	30
Cd	17	5	0,5	0,5
Pb	150	125	50	10
Hg	8,5	1	0,5	0,2
Cr	—	265	50	50
Mo	—	5	1	—
Se	50	4	0,75	—
As	20,5	19	5	5
F	—	—	100	—
Co	—	38	—	—

[a] As per ASTM D 6400 requirements the maximum metal concentrations given here for the US are 50 % of those prescribed by 40 CFR 503.13, Table 3.

[b] The maximum metal concentrations for Canada are those prescribed in 6.1 of BNQ 9011-911-I/2007.

[c] As per EN 13432 requirements the maximum metal concentrations for the EC are 50 % of those prescribed in ecological criteria for the award of the Community eco-label to soil improvers (EC OJ L 219, 7.8.1998, p. 39).

[d] The maximum metal concentrations for Japan are 10 % of those prescribed in the *Fertilizer Control Law* (Ministry of Agriculture, Forestry and Fisheries) and *Guidelines for Quality of Composts* (Central Union of Agricultural Co-operatives).

This International Standard prescribes no detailed testing methods for the determination of regulated metals. However, the testing methods used should be validated by the testing laboratory in accordance with ISO/IEC 17025 or other appropriate recognized standard. Where no applicable international standard test methods are available, reference should be made to relevant published national standards. The analytical laboratory is responsible for ensuring that the results of metal analyses represent the whole content using best available practice for both extraction procedure and analysis.

Substances hazardous to the environment should be identified and assessed according to Annex C (informative) of ISO 18602. Identification and assessment should be in compliance with legislative requirements. Countries not listed in the table shall follow their own regulations, failing which one of the above shall be used.

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Annex B
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Determination of ecotoxic effects to higher plants

B.1 General

The basis for the determination is the OECD Guideline for testing of chemicals 208 "Terrestrial Plant Test: Seedling Emergence and Seedling Growth Test". The principles of the standard test method have to be followed and modifications given in this annex which are required to meet the special needs for testing compost samples.

B.2 Properties of the reference substrate

Any reference substrate is suitable if it allows a normal seed germination and plant growth. It should preferably have a composition and structure similar to the compost samples. Fertilisers shall not have been added. Suitable reference substrates are all those which are defined by European national standards for analysis of compost quality, for example: standard soil EE0 (Bundesgütegemeinschaft Kompost e. V., Germany), mixtures of culture substrate with backed clay granules (ÖNORM S2023), or mixtures of peat and siliceous sand.

B.3 Preparation of samples

Prepare mixtures of the reference substrate with 25 % and 50 % (m/m or v/v, documented in the report) of compost. Use the compost obtained after disintegration of the test material (sample compost) and the blank compost, obtained from the parallel process without addition of test material.

B.4 Selection of plant species

Use at least two plant species from each family:

Monocotyledonae (e.g. summer barley: *Hordeum vulgare*; wheat: *Triticum aestivum*; perennial ryegrass*: Lolium perenne)*;

Dicotyledonae (e.g. white mustard: *Sinapis alba*; garden cress: *Lepidium sativum*; radish: *Raphanus sativus*; mung bean: *Phaseolus aureus*).

B.5 Performing the tests

Fill each tray with a minimum of 200 g of the samples (see B.2) and add as a minimum 100 seeds (see B.3) on the top. Cover the seeds with a thin layer of inert material, such as siliceous sand or perlite. Perform the tests in three parallels for each mixture. Add water until 70 % to 100 % of the water holding capacity is reached. Supply evaporated water periodically during the whole test duration as needed.

NOTE It is of advantage to keep the trays at a dark place or to cover them during the germination period.

B.6 Evaluation of the results

The germination numbers (number of grown plants) and the plant biomass of the sample compost and the blank compost are compared in all mixing rates. Germination rate and biomass are both calculated as per cent of the corresponding values obtained with the blank compost.

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Annex C
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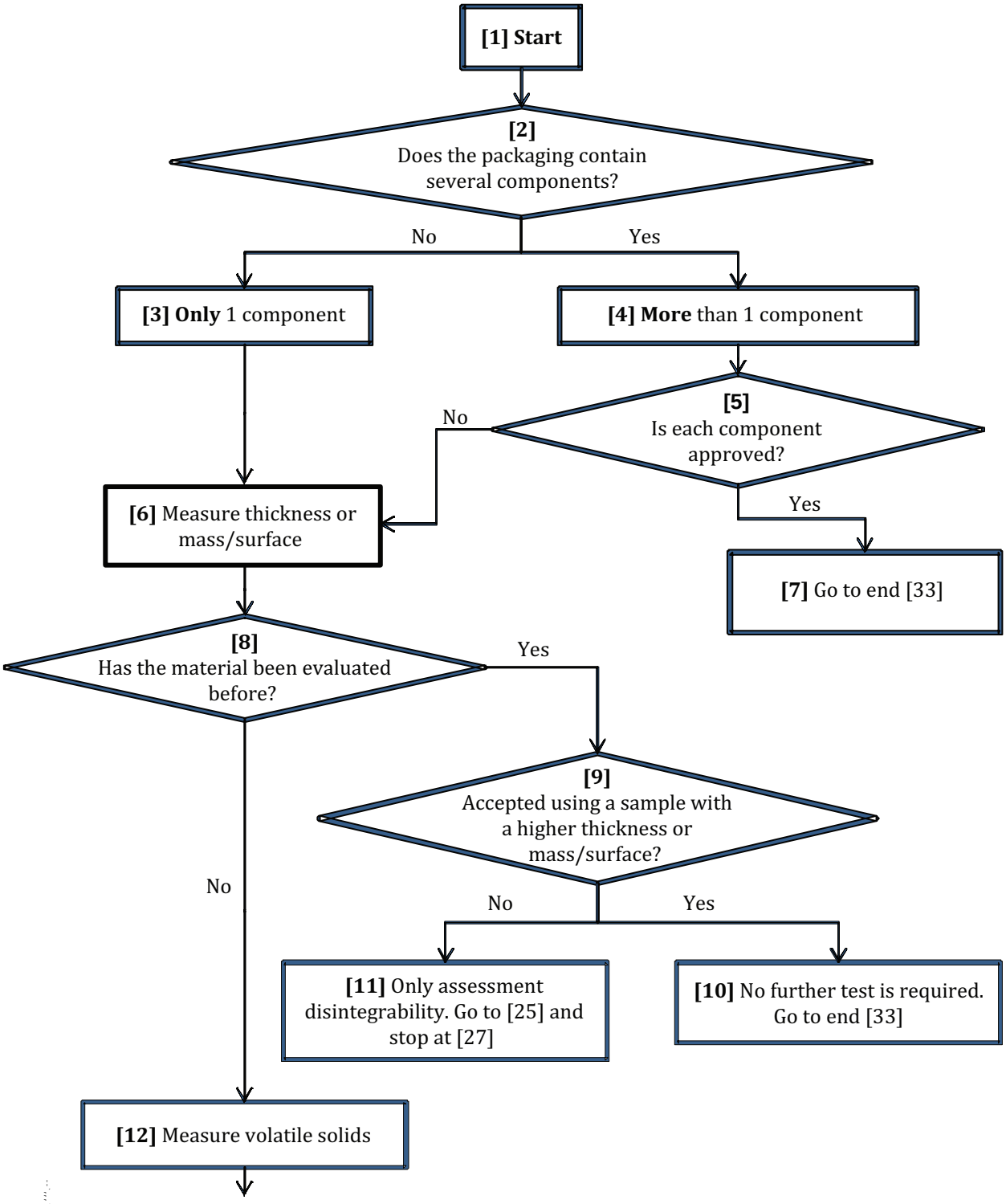
Flow Chart



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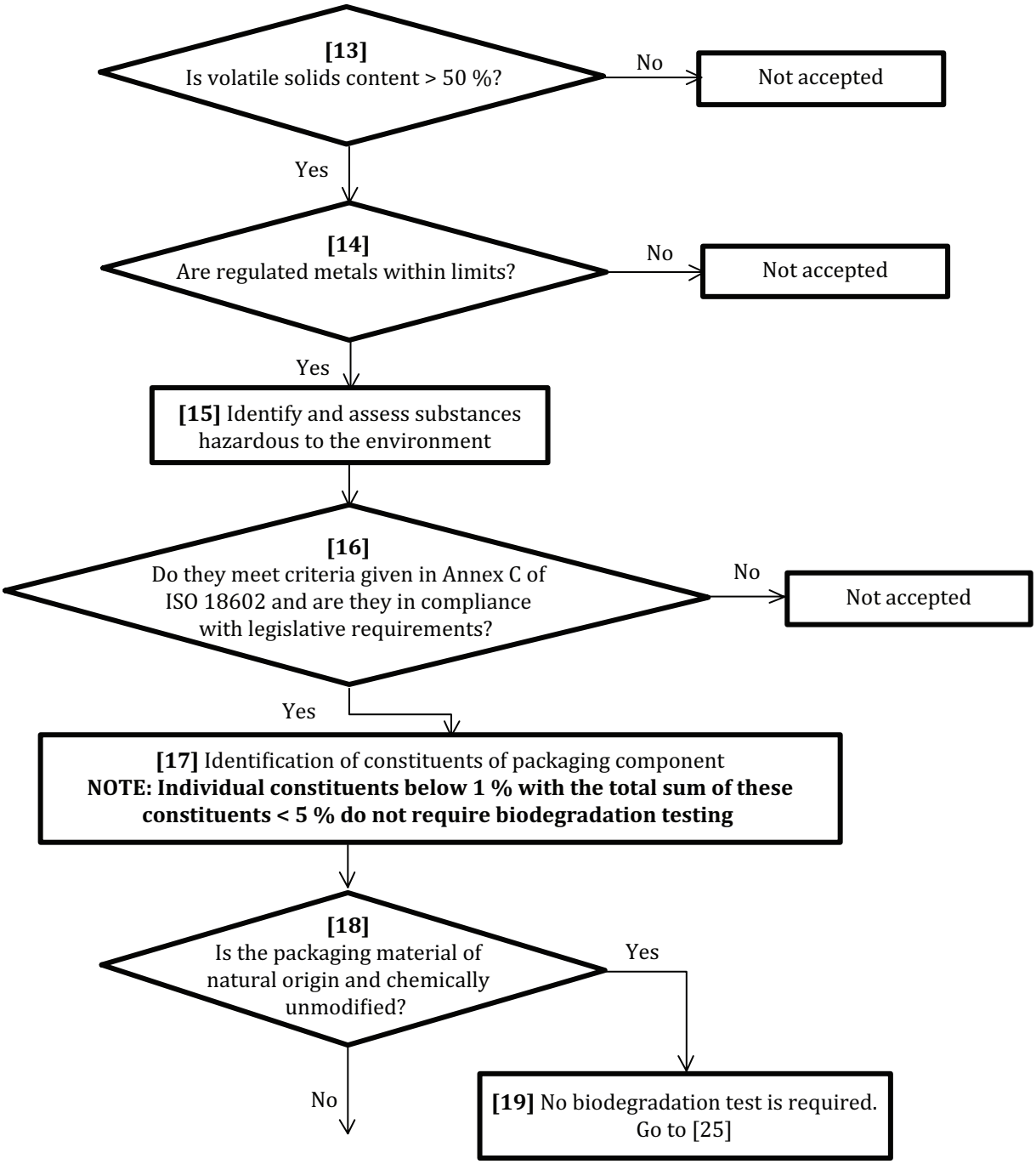

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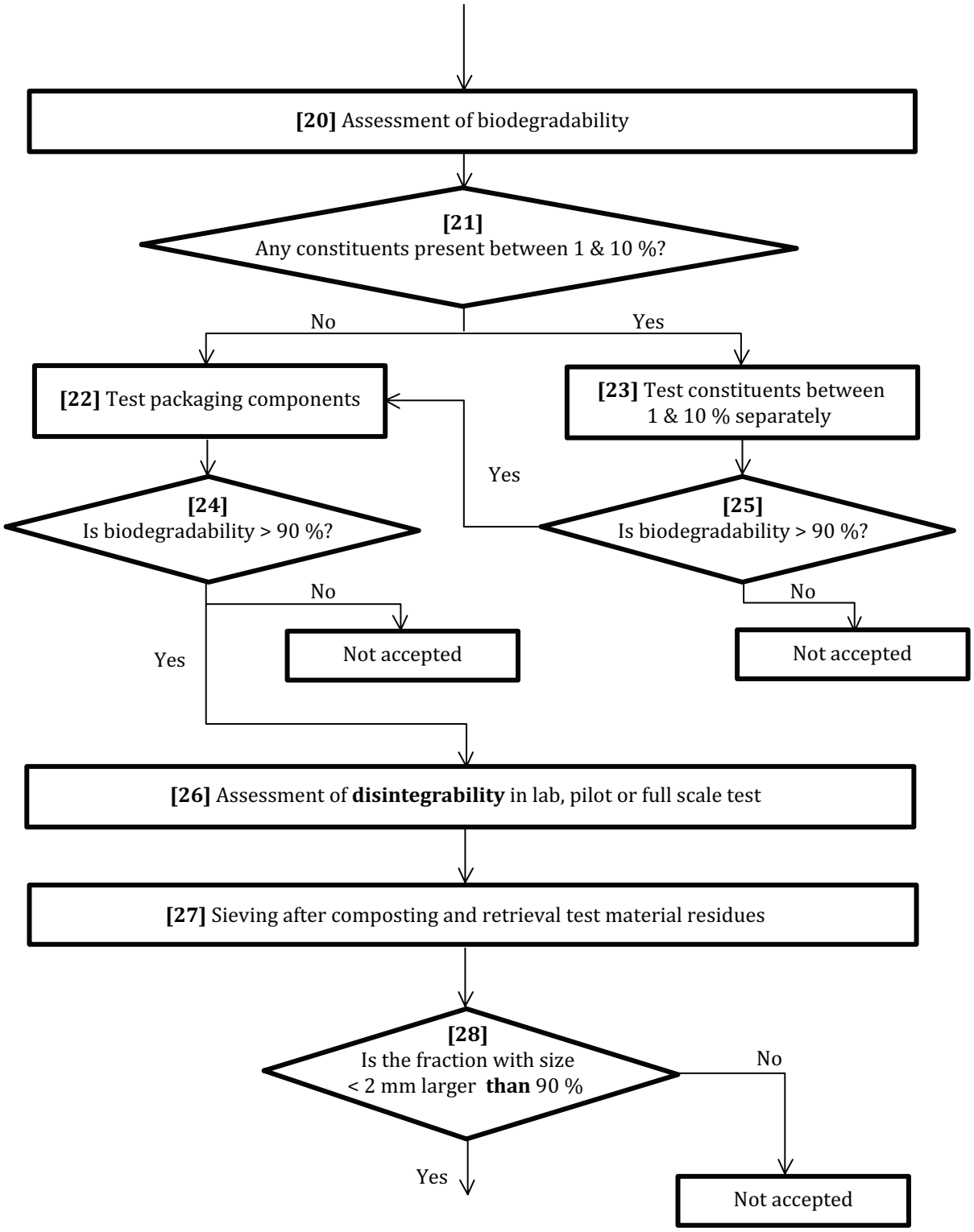

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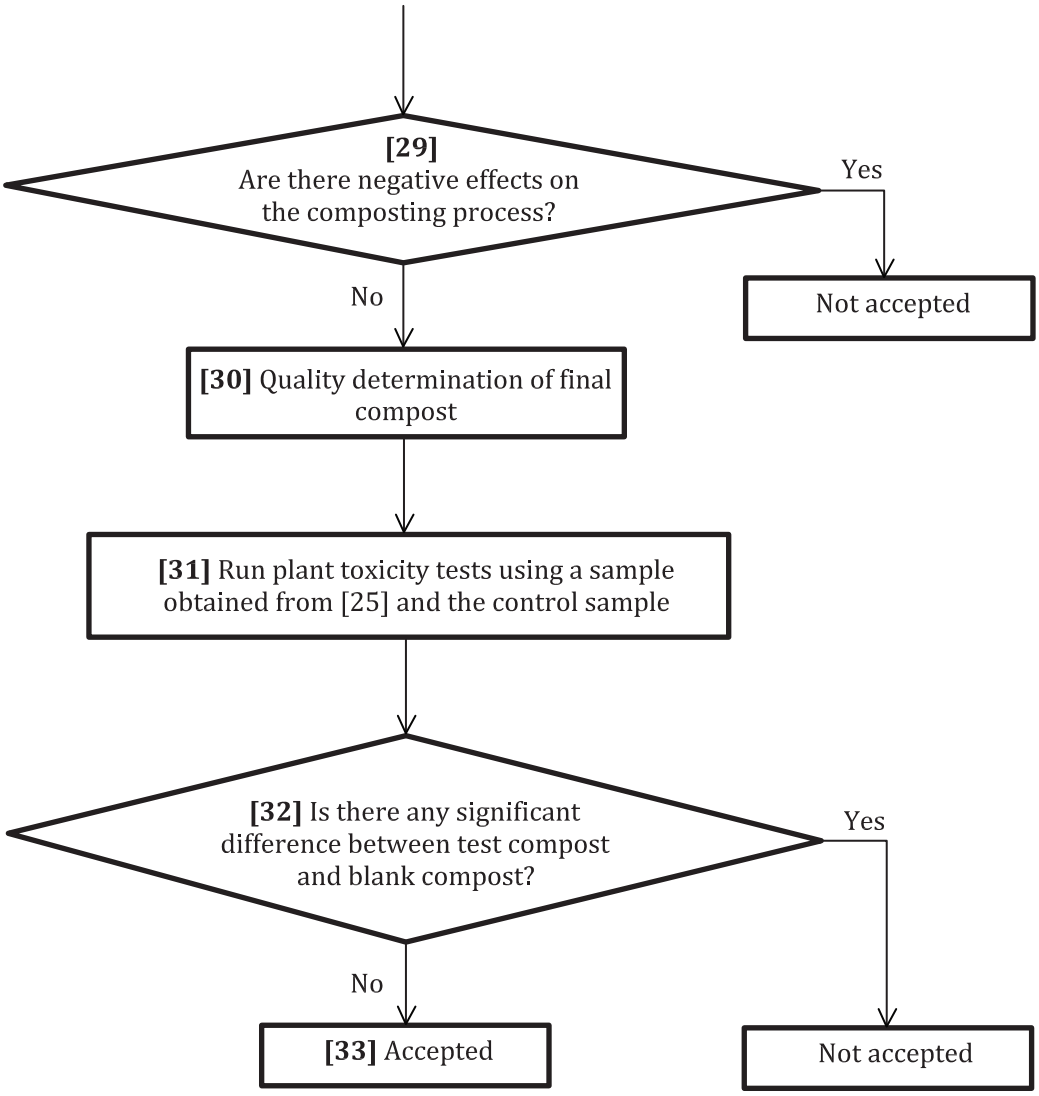

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Annex D
(informative)

Recommended assessment checklist for meeting the requirements of this International Standard

Identification of supplier:			Date:
Identification of packaging material / packaging:			
Overall result of assessment for organic recycling	Assessment file reference	Accept	Reject

Component/ Constituent	Characterization	Biodegradation ≥ 90 %	Disintegration ≥ 90 % < 2 mm	Plant growth Species A > 90 %	Plant growth Species B > 90 %	Regulated metals & substances hazardous to the environment	Biogas production (anaerobic biodegradation) %

NOTE References to supporting documents should be made for each applicable test. Where no biodegradation test is required (e.g. natural materials) comment should be made in this regard.

- Disintegration is not applicable for packaging constituents, only for packaging components.

The packaging / packaging material has previously been tested with high mass-to-surface ratio — see assessment file reference ……	
Minor changes have been made which do not influence meeting the requirements of this International Standard	
Nature of changes	
Comment (if any)	
Signature and status of person responsible for this assessment Signature …… Status ……	

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Annex E
(informative)

Examples of packaging suitable for organic recycling

E.1 General

The organic fraction of municipal, commercial, and industrial solid wastes is composed of biowaste. Biowaste can be defined as animal and vegetal waste arising from households, commerce, and the food manufacturing industry. This fraction contains large amounts of water and is therefore more suited to recycling using industrial biological treatments such as composting or anaerobic digestion coupled with composting.

Compost is a soil conditioner that promotes fertility, prevents erosion of the soil, reduces the chemical inputs, and suppresses some plants pathogens. Biogas can be used as a fuel to produce renewable energy.

Organic recycling is applicable only to biodegradable material.

Used packaging can be recycled together with organic waste streams provided the packaging meets the requirements of this International Standard.

Organic recyclability is a term which indicates an additional property of packaging which attests the overall compatibility of a material with the biological systems for treatment of biowaste. According to this International Standard, packaging is organically recyclable if it is formed of components which have been each individually qualified as organically recyclable. In this way the analysis of packaging is simplified and traced back to the analysis of the single components. Some relevant examples are given below.

E.2 Example for plastic producer

A producer of a plastic material wishes to verify whether his own material is suitable for organic recycling by meeting the requirements of this International Standard. He must follow the procedure described in this International Standard. In a preliminary phase (5.1 control of constituents), information on the material is gathered. The constituents are identified and the presence of hazardous substances, regulated metals in particular, verified. Biodegradability is measured under specific laboratory conditions. The biodegradability is assessed by a laboratory scale test method (ISO 14855 all parts). The method simulates the environmental and microbiological conditions of a composting process. From the measurement of the CO_2 produced under these conditions, the degree of conversion (mineralization) of the organic carbon of the plastic material is determined. In parallel, the biodegradation of the reference material, microcrystalline cellulose, is measured. According to this International Standard, the biodegradation of the test material, measured with the controlled composting test, shall be at least 90 % (conversion percentage of the organic carbon into CO_2) or 90 % of the level reached by the cellulose in the same time (relative biodegradation), in a maximum time of six months.

As an alternative to the method in ISO 14855 (all parts), it is possible to use two other test methods for measuring biodegradability in aqueous environment: ISO 14851 and ISO 14852. This is applicable for those cases in which the composting method is not appropriate (ink, additives, colorants, etc.).

The disintegration of the test material in its final physical form needs to be verified during the composting process (visual pollution is not acceptable in commercial compost). The basic material is converted into a suitable specimen e.g. a semi-manufactured product such as film, sheet, or foam. Samples of the test material are mixed together with fresh organic waste and co-composted in accordance with ISO 16929 or ISO 20200 or in a full-scale composting system. After 12 weeks, a screening is performed on the final compost using a 2 mm sieve. The degree of disintegration is determined as described in this International Standard and should meet the requirements specified in 6.4.

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The thickness of the specimens used in the disintegration test is important because this fixes the maximum thickness at which the packaging material under study can be applied in the market. The disintegration rate generally decreases with the increase of the thickness. Therefore, a positive result obtained in the disintegration test allows the use of the material at the tested thickness or at lower thickness but it does not guarantee disintegration of the material if used at higher thickness.

The compost resulting from the ISO 16929 test is also used to verify possible negative effects of the test material on the composting process and for conducting quality analysis and ecotoxicity testing. Samples of compost are mixed with the test material and organic waste which are compared with samples of reference compost, produced only with organic waste, without the test material. The germination rate and plant biomass yield of the test compost shall be at least 90 % of that of the reference compost. The effect of the compost samples on the plant growth are assessed, using the method described in this International Standard, to show that the test material, during degradation, does not release into the compost substances toxic for the plants and the environment.

E.3 Example for paper producer

A paper producer wishes to verify whether his own material is suitable for recyclability following this International Standard. In a preliminary phase (5.1 Control of constituents), information on the material is gathered. The constituents, i.e. the ingredients used for the production of the material, are identified and the presence of substances hazardous to the environment, including regulated metals, verified.

Paper pulp is a material of natural origin and as such accepted as biodegradable without testing (5.3.2 Materials of natural origin).

In order to verify that the test material, in its final physical form, is disintegrated during a composting cycle, the test material is subjected to composting. The paper test sample is mixed together with fresh organic waste and co-composted at pilot-scale level in a 200 litre bin at a concentration of 1 %. At the end of the process, a screening is performed on the final compost using a 2 mm sieve. The particles or pieces which do not differ from the compost for colour, structure, dimension, moisture feeling, and brightness/gloss are considered to be compost (6.4 Disintegration). The non-compost particles > 2 mm are assumed to be the non-disintegrated fraction and used to determine the degree of disintegration. The method is described in ISO 16929. A positive result obtained in the disintegration test allows the use of the material at the tested thickness or at lower thickness but does not guarantee the compostability of the material if used at higher thickness.

The pilot-scale composting is also used to verify possible negative effects of the test material on the composting process and to produce the compost needed for conducting quality analysis and ecotoxicity testing. Samples of compost obtained by mixing the test material with organic waste are compared with samples of reference compost, produced only with organic waste without the test material. The effect of the compost samples on the plant growth are assessed, using the method described in this International Standard, to show that the test material, during degradation, does not release into the compost substances toxic for the plants and the environment.

E.4 Example for plastic converter

A converter (manufacturer of blown films) produces rolls of film using a plastic raw material (plastic pellets) supplied by plastic producer. The raw material has been already tested according to this International Standard and found to be suitable for organic recycling on condition that it is converted to specimens with a maximum thickness of 80 µm. Film rolls with a thickness ≤ 80 µm do not need to be retested as long as they are uniquely made with the tested plastic material.

E.5 Example for paper converter

A paper converter buys virgin paper and produces a bag. Since the raw material is natural, there is no need for the bag to undergo the biodegradation testing. However, there is still the requirement to undergo

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the disintegration test (either ISO 16929, ISO 20200, or under full industrial composting conditions) and meet the general requirements for chemical characterization and compost quality.

E.6 Example for plastic packaging producer

A converter (packaging producer) buys rolls of film from manufacturer of blown films and makes carrier bags. The converter does not need to repeat testing for the carrier bags to show organic recyclability as long as the original material is converted into the carrier bag with no addition of extra constituents or printing and the thickness is less than 80 µm. Where additional constituents are added or the article is printed, then additional assessment is required.

E.7 Example for a paper packaging producer

The packaging producer buys paper from the normal paper-making process and makes paperboard containers. Since paper is known to be biodegradable, there is no need for the container to undergo biodegradation testing if no organic constituents are added above 1,0 % on dry weight. However, there is still the requirement to undergo the disintegration test (either ISO 16929, ISO 20200, or under full industrial composting conditions) and meet the general requirements for chemical characterization and compost quality.

E.8 Example for food packaging

A food packaging is made with a tray and a lid. Both components have been individually tested and found to be in compliance with this International Standard. The tray is made using a sheet at 50 µm and the lid is a 15 µm film. Both packaging components (tray and the lid) are organically recyclable. However, the tray is made with a material that was tested and accepted only at 40 µm. Therefore, the packaging is not recyclable. To make it organically recyclable, the producer has to reduce the thickness of the tray below 40 µm or use a different material that is recyclable at 50 µm.

E.9 Example for multilayer packaging

A packaging producer makes a plastic/paper laminate. Both materials have been already tested and found to comply with this International Standard and used at the proper thickness. However, the packaging producer adds an additional additive at a final concentration of 0,9 % which has not been tested before. The final packaging is considered to be recyclable on condition that the disintegrability of the new multilayer packaging is shown and the additive is not ecotoxic. Biodegradability of the additive is not requested to be proven because the additive is used at a concentration lower than 1 % and no other additive is used (total additives used are lower than 5 %).

E.10 Example for partly organically recyclable packaging

A food packaging is made by a tray and a lid. The tray has been tested and found to meet the requirements of this International Standard. However, the lid is not organically recyclable. Therefore, the packaging is not recyclable. However, the consumer can be informed that the tray can be organically recycled on condition that the lid is removed and disposed of in a different way.

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