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Plastics — Guidelines for the recovery and recycling of plastics waste —

Part 5: Organic/biological recycling

Plastiques — Lignes directrices pour la valorisation et le recyclage des déchets plastiques —

Partie 5: Recyclage organique/biologique

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 14, *Environmental aspects*.

This first edition of ISO 15270-5, together with ISO 15270-1, ISO 15270-2, ISO 15270-3 and ISO 15270-4, cancels and replaces ISO 15270:2008, which has been technically revised.

The main changes are as follows:

— ISO 15270 has been turned into a series of five parts, where ISO 15270-1 is the succession of the essential part of the second edition (2008) and specific methods and technological description of recycling methods are given as ISO 15270-2, ISO 15270-3, ISO 15270-4 and ISO 15270-5.

A list of all parts in the ISO 15270 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Kitchen waste, food scraps, lawn mowing and pruning branches are generally referred to as bio-waste, since it is composed of biodegradable organic materials. Its intrinsic biodegradability makes it possible for this waste to be recovered through biological processes, in which the breakdown and reorganization of the waste into new substances takes place thanks to the action of microorganisms. In ecology, the term recycling refers to the biogeochemical cycle, in particular to that of carbon. In the carbon cycle, organic compounds formed from atmospheric CO_2 through photosynthesis enter the food chain, are metabolised into different compounds, transferred among different environmental compartments, and eventually oxidised back to CO_2, closing the cycle.

The recycling of bio-waste takes place through processes that, regardless of size, lead to the production of soil improvers under controlled conditions. These processes are aerobic composting or anaerobic digestion preferably followed by aerobic composting of digestate.

NOTE The digestate is preferably aerobically composted after anaerobic digestion to maximise benefits to the soil it is applied to afterwards and minimises some potential agro-environmental issues such as release of ammonia and nitrates.

Currently, the predominant output of organic recycling is compost, a soil improver. The various components of the organic waste are mixed in an appropriate way to favour a bio-reaction that transforms the initial waste into a stable, odourless, and sanitized product i.e. compost, that is used in agriculture and horticulture. However, in some countries the slurry-like digestate is applied to agricultural land before maturation. The closure of the cycle (from bio-waste to soil improver back to the soil) is currently considered very important to return the organic substances necessary to maintain fertility back to the soil.

If the waste treatment gives rise to a final output for which there is no advantageous use (for example because the low quality makes it unsuitable for agriculture), then it cannot be defined as recycling. This concept is taken up by some relevant legislations. For example, in Europe, a material produced by the treatment of bio-waste whose quality is so low that it can only be used for backfilling operations cannot be considered the result of recycling.[1] The recycling of bio-waste is hindered by the presence of incompatible materials and objects. Non-biodegradable objects (e.g. conventional plastics waste) represent a contamination for organic recycling. Biodegradable plastics (e.g. that meet the criteria of ISO 17088), on the other hand, are potentially suitable for organic recycling and can be used to make industrially compostable products and compostable packaging made of compostable plastics. These products can be recovered together with the bio-waste contributing to the formation of compost. Generally, the mixing between biodegradable plastic waste and bio-waste is achieved, for example, when industrially compostable plastic waste is collected with bio-waste (for example bags for separate collection of bio-waste, or tableware in collective catering) or tends to be contaminated with bio-waste (some food packaging).

The term industrially compostable is widely used to indicate waste that has characteristics that make it compatible with the separate collection and subsequent treatment of bio-waste. Therefore, in communication with the consumers regarding the end of life of products, the term "industrially compostable" is not used with a technical meaning, i.e. to refer to a specific waste treatment technology (i.e. aerobic treatment carried out at high temperature) but as an indication on how to operate separate collection with it. In this document, the term industrially compostable will be used in this spirit, i.e. as a synonym for "suitable to be collected with bio-waste and recovered by means of organic recycling".

Industrially compostable products and packaging made of compostable plastics (as defined in the relevant standards, e.g. ISO 17088) contribute to the composting process and the production of compost similarly to cellulose-based compounds, a main feedstock of composting. They are a source of carbon and energy. Therefore, composting of biodegradable plastics is a form of recycling even if the result of this process is very different from the original waste. The idea that recycling can give rise to products of a different nature from that of the original waste is well established both at the standardization level (e.g. in the definition of recycling from ISO 472) and at the legislative level. This concept is widely used in different legal and national contexts. For example, the European Waste Framework Directive[1] states that "recycling means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations". As another example, the legislation in force in the Russian Federation states that “waste

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recycling from usage of goods means to use waste resulted from used goods or secondary raw materials, processed from used goods, for manufacturing any products".[2]

Home composting is different from industrial composting. Home composting is a practice used by private individuals to process at home garden and food waste generated at household level and produce compost for personal gardening use. In spite of the common name, industrial and home composting are two very different activities, the former being a controlled waste treatment process and the latter being a gardening activity. Compost produced by a private individual is for his own use and not for provision to others, free of charge or in return for payment. Thus, strictly speaking home composting cannot be classified as a recycling activity for compostable plastic waste, as the concept of recycling implies the conservation of the economic value still present in the waste and the production of materials/substances to be used in the economy either for the original purpose or for other purposes. This is a concept that has been adopted in some relevant legislation. For example, in the European Directive on Packaging and Packaging waste[3], it is stipulated that only industrial composting processes that are realized under controlled conditions are relevant for calculating organic recycling rates of compostable packaging waste, whereas home composting processes are not taken into account.

Small-scale waste treatment systems can enable recycling if, regardless of size, they are based on controlled processes that result in products (e.g. soil improvers).

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Plastics — Guidelines for the recovery and recycling of plastics waste —

Part 5: Organic/biological recycling

1 Scope

This document establishes the terms, definitions, methodologies and calculations that are necessary for the recovery and recycling of waste from plastic products and materials labelled as industrially compostable through organic recycling. It identifies the different types of organic recycling technologies used in the recovery and subsequent recycling of industrially compostable plastics waste arising from pre-consumer and post-consumer sources. It also establishes the requirements and calculations to be considered in evaluating organic recycling inputs and outputs and determining output classifications for the recycling operation and the downstream integration points.

This document also outlines general quality requirements to be applied in all steps of the recovery process, and provides general recommendations for inclusion in material standards, test standards and product specifications. The process stages, requirements, recommendations and terminology presented in this document are intended to be of general applicability.

This document does not establish test methods and criteria for the definition of the organic recyclability (e.g. compostability) of plastic materials and products.

This document refers to plastic waste deriving from products that have been classified as suitable for recovery through organic recycling by the relevant reference standards (e.g. ISO 17088, ISO 18606), and therefore labelled as industrially compostable. These products are generally called “industrially compostable” (e.g. compostable bag, compostable tableware) meaning “suitable for organic recycling”, independently of the treatment technology used for recycling (whether it is composting, or a combination of anaerobic digestion and composting, or only anaerobic digestion).

This document does not address home composting because this gardening practice cannot be classified as recycling.

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.

ISO 472, *Plastics — Vocabulary*

ISO 17088, *Plastics — Organic recycling — Specifications for compostable plastics*

ISO 18606, *Packaging and the environment — Organic recycling*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 472 and the following apply.

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ISO and IEC maintain terminology 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
plastic waste
discarded material which contains as an essential ingredient a high polymer

Note 1 to entry: Plastic waste can be recycled via mechanical recycling, chemical recycling and organic recycling and for energy recovery.

[SOURCE: ISO 24161:2022, 3.1.2.28]

3.2
compostable plastic waste
any plastic material or plastic object which the holder discards, or intends to discard, or is required to discard that can be recovered by organic recycling as shown by relevant international standards

Note 1 to entry: Compostable plastic waste can be generated from post-consumer or pre-consumer activities.

Note 2 to entry: ISO 17088 is an international standard specification with requirements for compostable plastics.

Note 3 to entry: "Compostable" is used as a synonym for "suitable to be recovered by means of organic recycling".

Note 4 to entry: Compostable plastic materials and objects compliant with the relevant international standards are labelled as compostable.

3.3
consumer
individual member of the general public purchasing or using goods, property or services for private purposes

[SOURCE: ISO 14025:2006, 3.16, modified — Reference has been deleted.]

3.4
compost
organic soil improver obtained by biodegradation of a mixture consisting of plant residues with other organic material (e.g. bio-waste)

[SOURCE: ISO 17088:2021, 3.1, modified — "improver" instead of conditioner, "plant" instead of "vegetable", added "(e.g. bio-waste)", deleted "principally", "occasionally", "and having a limited mineral content"]

3.5
composting
aerobic process designed to produce compost starting from biodegradable waste

Note 1 to entry: Composting is classified into industrial composting, home composting and worm composting.

[SOURCE: ISO 17088:2021, 3.3]

3.6
industrial composting
commercial composting
composting process performed under controlled conditions on industrial scale with the aim of producing compost for the market

Note 1 to entry: In some regions industrial composting is referred to as professional composting.

[SOURCE: ISO 17088:2021, 3.13]

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3.7
home composting
composting process performed by a private individual with the aim of producing compost for at home use

[SOURCE: ISO 17088:2021, 3.15, modified — “at home” instead of “his own”]

3.8
organic recycling
biological recycling
aerobic (composting) or anaerobic (digestion) treatment of compostable plastics waste together with bio-waste under controlled conditions to produce stabilized organic soil improver

Note 1 to entry: The term includes industrial processes based on living microorganisms capable of converting bio-waste into valuable products.

3.9
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 anaerobic 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 stabilized by means of a composting (aerobic) process.

Note 2 to entry: In some countries, not stabilized digestate is directly applied to agricultural land.

[SOURCE: ISO 18606:2013, 3.10, modified — added Note 2 to entry; added “anaerobic”]

3.10
organic recyclability
biological recyclability
potential of a material to be recovered by organic recycling

Note 1 to entry: The term compostability is generally used as a synonym.

3.11
bio-waste
biodegradable garden and park waste, food and kitchen waste from households, offices, restaurants, wholesale, canteens, caterers and retail premises and comparable waste from food processing plants

3.12
discards
items that are removed from the main stream of organic/biological recycling because they are not considered to be directly compatible with the process and may contaminate the final product

Note 1 to entry: Discards are generally created by screening.

3.13
screening
any operations aimed at removing non-composted or non-compostable materials

Note 1 to entry: It is carried out using different types of equipment, such as drum or vibrating screens, squeezing machineries, air classifiers and other devices.

4 Waste flows

Plastic waste originated from objects and materials suitable for organic/biological recycling (generally defined and labelled as compostable as per specific standards) can originate at different levels in the supply chain that includes production, marketing and use.

The criterion that helps to classify waste is based on whether the materials or products have been put in use and placed on the market or not. If they have been placed on the market, the waste generated is post-consumer. Otherwise, the waste generated is pre-consumer (also referred to as post-industrial). The term

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