Compostable by Design Guidelines

Design recommendations for compostable packaging and products

COMPOSTABLE BY DESIGN PLATFORM

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TERMINOLOGY

These Guidelines make reference to both packaging and non-packaging products. In order to improve the readability of the text, both types of products are collectively referred to as 'compostable items'.
Where the distinction between packaging and non-packaging items is important, this is stated.
Furthermore, for the sake of readability, the terms 'product' and 'item' may be used interchangeably; any difference between the two is explained.

DISCLAIMER

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INNOVATIONS

These Guidelines have been designed to advocate for the adoption of designated compostable items made of compostable materials to enhance environmental sustainability. Its primary objective is to ensure that current compostable solutions meet established standards. Testing is essential to verify their compatibility with composting processes. The Compostable by Design Platform will regularly zonitor and evaluate relevant emerging trends and innovations for future updates and improvements.

Vision of the Compostable by Design Platform

The Compostable by Design Platform (CbDP) is a cross-value chain initiative promoting collaboration and innovation in compostable packaging and products, as well as associated technologies and manufacturing processes. Formed in 2023, its aim is to support the circular economy by building a robust evidence base to strengthen the introduction of compostable items for relevant applications, and to find pathways for them to be recycled by the appropriate bio-waste treatment facilities and infrastructure.

The Platform was founded on the belief that certain compostable packaging and products can positively contribute to the biological loop of a circular economy by enhancing bio-waste recycling through increasing the collection rate and reducing associated contamination. **Its vision is a future where appropriate compostable packaging and products are widely accepted and effectively recycled at scale across Europe, supporting sustainable bio-waste management and the circular economy.**

Recognising that effective solutions require a collective effort, the Platform unites stakeholders across the compostable products value chain, to share experience and collaborate in a pre-competitive working environment. It brings together leaders from resin producers to film and paper manufacturers, packaging converters, brands, retailers, logistics providers, bio-waste management experts, certification bodies, testing laboratories, academic institutions, and beyond.

THE CbDP VISION

A future where appropriate compostable packaging and products are widely accepted and effectively recycled at scale across Europe, supporting sustainable bio-waste management and the circular economy.

The Platform has identified the following essential deliverables as its primary focus:

1. A framework and best practice guide for field-testing the disintegration of compostable products and packaging in industrial composting facilities
2. Design recommendations for compostable packaging and products
3. Framework for Extended Producer Responsibility (EPR) for compostable packaging and products
4. Bio-waste recycling infrastructure map for Europe

Further information about the Compostable by Design Platform, including our sponsors, can be found at www.compostablebydesign.com

Introduction

The circular economy[1] is a system where materials are kept in use for as long as possible, extracting the maximum value from them during use phase, and recovering and regenerating materials at the end of their service life. The aim is to eliminate waste and pollution by design, keeping resources in continuous circulation, and regenerating natural systems. It offers a sustainable alternative to traditional linear economic models, addressing key environmental challenges – such as climate change, biodiversity loss and pollution – while promoting economic growth and social well-being.

The concept has been championed by the Ellen MacArthur Foundation, which depicts flows of materials through two main cycles: a biological cycle and a technical cycle, depending on whether a material is intended for biological or technical retrieval.[2] The biological cycle is centred around regeneration, with the objective of returning nutrients and microbiological biomass back to the ecosystem. In Europe, biodegradable waste materials are referred to as bio-waste, which is typically made up of food waste from household kitchens, canteens, offices, restaurants, and retail premises, as well as waste from gardens and parks. A circular economy for bio-waste involves the recycling of such materials through processes like composting or anaerobic digestion (AD). This bio-waste recycling helps to mitigate several specific issues associated with the traditional disposal of bio-waste, such as landfill or incineration, while simultaneously returning nutrients, organic matter and microbes to the soil through compost or digestate.[3]

Currently, only about half of bio-waste in the EU is collected separately from other types of waste and recycled into compost and/or digestate,[4] thus representing a significant loss of valuable resources. The European Union's Framework Directive on Waste (EU 2018/851)[5] seeks to reduce the unnecessary disposal of waste by setting a minimum recycling rate of 60% of municipal waste by 2030. To reach this target, it will be necessary for most EU member states to increase the separate collection of different types of waste; with glass, metals, paper/cardboard and plastics being recycled through technical cycles, and food/garden waste recycled at bio-waste recycling facilities, such as composting and/or anaerobic digestion facilities. As bio-waste constitutes the largest fraction of municipal waste, effective capture and recycling of bio-waste can significantly contribute to meeting the municipal waste recycling targets outlined in the Waste Framework Directive.

1 Technical definitions to all terms highlighted in blue are provided in the 'Glossary'
2 Circular economy diagram, Ellen MacArthur Foundation
3 Benefits of Compost and Anaerobic Digestate; J. Gilbert, M. Ricci
4 Bio-waste generation in the EU: Current capture levels and future potential – Second Edition
5 Directive – 2018/851 – EN – EUR-Lex (europa.eu)

Unfortunately, separately collected bio-waste may contain non-biodegradable waste, such as glass and conventional facilities. These so-called contaminants are challenging and costly to remove at bio-waste recycling plants.[6] Removal techniques result in some loss of bio-waste, and, as they are never 100% effective, some contaminants may remain in the final compost or digestate. As both compost and digestate are applied to agricultural soils,[7] contamination may risk harming soil ecosystems and the quality of the food we eat. The most effective and economic approach is to reduce contamination in the input bio-waste stream in the first place.

Designing products made from biodegradable materials is one such way to reduce the level of contamination in compost and digestate. However, these products necessarily need to be sufficiently biodegradable during a bio-waste recycling process, meaning their rate of decomposition and the substances they contain need to meet strict criteria set out in relevant European and international standards. Products designed and certified specifically for end-of-life treatment in bio-waste recycling processes (composting, in particular) are referred to as compostable.

Substituting conventional (non-compostable) products with compostable counterparts may seem, at face value, to be a solution to many of society's waste problems. However, most of the products in use in our homes and places of work would not be suitable contenders, due in part to the nature and functionality of the products, the different types of materials they contain, and the waste streams they enter at the end of their functional lives. Only certain types of products should be manufactured out of compostable materials: those that are prone to enter separate bio-waste collection schemes.

By integrating compostability into the design of certain products, the diversion and quality of bio-waste can be improved, thereby reducing burdens on landfill and incineration (waste-to-energy) operations. This approach helps to reduce environmental footprints and support a sustainable circular economy, enhancing resource efficiency and resilience in modern supply chains. However, for compostable items to achieve their intended impact, they must also be utilised in areas having appropriate infrastructure to collect bio-waste separately and recycle it into compost or digestate.

6 ISWA-Contaminants-Report-2023
7 Incorporating compost into soil enhances its structure, improves water retention capacity and sequesters carbon, while applying digestate to agricultural land reduces the need for organic fertilisers. These benefits are especially important given the continuing deterioration of soil quality across Europe, which is starting to adversely affect land productivity and the growth of food crops.

These Compostable by Design Guidelines has been developed to help readers understand when and where the use of compostable items is appropriate, as well as the materials suitable for their design.

It provides design recommendations, highlights potential applications for compostable items, and outlines what to do with them after use. Although this Guideline is specifically tailored for application within Europe, taking into account the region's legal requirements and bio-waste recycling technologies, it could also be relevant to other parts of the world.

It contains chapters on:

1. **Today's landscape** – this provides an overview of the current legislative status in Europe, most common bio-waste recycling infrastructure and existing standards for compostable items.
2. **When designing compostable items makes sense** – this provides guidance on key decision-making criteria and proposes a number of appropriate applications for compostable items.
3. **Choosing compostable materials** – this describes the different types of compostable raw materials, as well as other constituents that may be used in the final product.
4. **Further information and best practice examples** – this offers guidance on designing and promoting compostable products, including good practice examples.

The Guideline is aimed at products intended for recycling at industrial composting (IC) facilities, or via anaerobic digestion followed by a composting phase. Standalone AD and home composting systems have not been specifically included in this version of these Guidelines on the basis that most specification and test method standards to date have been developed for industrial composting; however, they may well be included in future revisions of the Guidelines.

Abbreviations

µm	Micrometre or micron
AC	Aerobic composting
AD	Anaerobic digestion
CbDP	Compostable by Design Platform
CO_2	Carbon dioxide
EN	European norm
EoL	End-of-life
EU	European Union
EPR	Extended Producer Responsibility
GHG	Greenhouse gas
HC	Home composting
IC	Industrial composting
IVC	In-vessel composting
PA	Polyamide
PBAT	Polybutylene adipate terephthalate
PBS	Polybutylene succinate
PCL	Polycaprolactone
PE	Polyethylene
PET	Polyethylene terephthalate
PHA	Polyhydroxyalkanoate
PLA	Polylactic acid
PPC	Poly (propylene carbonate)
PP	Polypropylene
PPWD	Packaging and Packaging Waste Directive
PPWR	Packaging and Packaging Waste Regulation
SSSU	System single serve units
SUP	Single-use plastic
TPS	Thermoplastic starch

Chapter 1 Today's landscape

Designated compostable items could hold significant potential for promoting sustainability, but to realise these benefits several essential prerequisites must first be established. First and foremost, supportive legislation is essential to allow the collection and processing of compostable items together with bio-waste, ensuring that they are not discarded alongside residual waste. Additionally, robust infrastructure is necessary for the effective collection and recycling of these items, allowing them to be processed in bio-waste treatment facilities equipped to handle compostables. Alongside these practical elements, appropriate standards and certification schemes must be in place to prevent counterfeit or misleading products from entering the market. Finally, strict enforcement of certification claims is essential to maintain compliance and trust among consumers and producers alike.

This chapter provides a short overview of the current landscape surrounding compostable items and the prerequisites needed to achieve their intended environmental benefits.

1.1 LEGISLATIVE SITUATION

At the European level, numerous legislative instruments[8] aim to encourage the design of functional and resource-efficient products as part of a broader commitment to sustainability and the circular economy. The 2018 Circular Economy Package led to significant legislative updates, notably the Landfill Directive,[9] and the Waste Framework Directive.[10] Article 22 of the Waste Framework Directive mandates that municipalities across the European Union (EU) must establish separate collection systems for bio-waste as of December 2023.

A recent report by Zero Waste Europe[11] indicated that while some member states have implemented separate bio-waste collections and enacted laws regarding compostable items, others still need to fully implement these requirements.

This situation implies that infrastructure for bio-waste recycling is not yet sufficiently widespread across the EU; significant changes are therefore needed soon, as compliance with this legal requirement is essential in order for member states to achieve a minimum recycling rate of 60% of municipal waste by 2030.

Furthermore, with the publication of the EU policy framework on bio-based, biodegradable, and compostable plastics,[12] and the recent entry into force of the Packaging and Packaging Waste Regulation (PPWR),[13] the role of compostable items has been acknowledged as part of the 100% re-usable, recyclable and compostable objectives.

8 These include binding legislative instruments such as regulations, directives, decisions and delegated acts, as well as non-binding instruments such as opinions and guidelines.
9 Directive (EU) 2018/850
10 Directive – 2018/851 – EN – EUR-Lex (europa.eu)
11 Bio-waste generation in the EU: Current capture levels and future potentional - Second Edition
12 COM/2022/682 – EU policy framework on bio-based, biodegradable and compostable plastics, European Commission

Article 9 of the PPWR stipulates that the following applications must meet European standards for industrial composting throughout the EU by February 2028, with the additional possibility for member states to require that these products be home compostable:[14,*]

> Sticky labels attached to fruit and vegetables;
> Permeable tea, coffee, or other beverage bags; and
> Soft after-use system single-serve units that contain tea, coffee, or other beverages and are intended to be used and disposed of together with the product.

In addition, where member states have a bio-waste collection system and appropriate recycling infrastructure in place, they may also require that other items be compostable in industrial composting (IC) facilities. These include, for example, non-permeable tea, coffee, or other beverage system single-serve units (SSSUs), excluding those made out of metal, as well as lightweight and very lightweight plastic carrier bags.

The PPWR sets out provision for the European Commission to expand the list of applications that may be industrially compostable and to propose new legislation in the future. Annex III of the Regulation outlines the conditions that must be considered when mandating or introducing the use of new compostable packaging formats:

a) It could not have been designed as reusable packaging or the products could not be placed on the market without packaging;
b) It is designed to enter the bio-waste stream at the end of its life;
c) It is of such a biodegradable nature that it allows the packaging to undergo physical or biological decomposition, including anaerobic digestion, resulting ultimately in conversion into carbon dioxide and water, new microbial biomass, mineral salts, and, in the absence of oxygen, methane;
d) Its use significantly increases the collection of bio-waste compared to the use of non-compostable packaging materials;
e) Its use significantly reduces the contamination of compost by non-compostable packaging and does not cause any problems in bio-waste processing; and
f) Its use does not increase the contamination of non-compostable packaging waste streams.

13 Regulation (EU) 2025/40 of the European Parliament and of the Council of 19 December 2024 on packaging and packaging waste, amending Regulation (EU) 2019/1020 and Directive (EU) 2019/904, and repealing Directive 94/62/EC. The text is available here.

* During 2025, the Commission is expected to request the European Standardisation Organisation to update harmonised standards for industrial composting and to prepare harmonised standards for home compostability.

14 Home composting is usually carried out at lower temperatures and over longer timeframes than industrial composting systems. This is explained further in Section 1.3.

1.2 INFRASTRUCTURE

Achieving a circular economy and transforming waste into resources requires the establishment of efficient systems and effective infrastructure for the collection, sorting and recycling of materials. Key facilities, including collection centres and transportation networks, play a vital role in the recovery of bio-waste. According to the European Compost Network,[15] countries such as Austria, Belgium, Germany, Italy, and the Netherlands have developed industrial composting systems that significantly enhance their waste recovery infrastructure. Across the rest of the EU there are large differences in the extent to which bio-waste is collected, sorted and recycled; however, the mandatory separate collection of bio-waste, as outlined in Article 22 of the EU Waste Framework Directive (2018/851)[6], is anticipated to harmonise these processes in the future.

In addition to having access to infrastructure for recycling bio-waste, the acceptance and collection of specific compostable items as part of the bio-waste stream is an essential factor. A prime example is Italy, where compostable items are widely used by citizens and accepted in separate bio-waste collection schemes and at composting facilities. The existence of appropriate collection and treatment infrastructure enables certified compostable items, such as carrier bags, beverage capsules, tea bags, fruit and vegetable stickers, fruit and vegetable packaging, and small format packaging for condiments and sauces to be recycled as an integral part of the bio-waste stream.

Furthermore, Italy is the first country to establish a separate Extended Producer Responsibility (EPR) scheme specifically for compostable plastic packaging, aiming to collect and treat it with bio-waste. An *ad hoc* consortium called BioRepack was created to engage with composters, educate consumers, and coordinate the collection and bio-waste recycling of compostable packaging alongside bio-waste. According to BioRepack, Italy achieved a recycling rate for bioplastic (compostable) packaging processed together with organic waste of 57%, seven percentage points higher than the target for 2025 and two points higher than the 2030 target.[16]

While Italy leads the way by implementing best practices and progressing toward increased use of compostable items, other EU member states are at various stages in their journey toward the acceptance and processing of these items.[17]

15 ECN Data Report – European Compost Network
16 BioRepack initiative press release https://eng.biorepack.org/communication/press-releases/recycling-of-compostable-bioplastics-reaches-61-of-italian-population.kl
17 At the time of writing, the CbDP is in the process of developing a guideline on collection and bio-waste recycling, which will provide detailed information on the current situation in various member states.

1.3 BIO-WASTE RECYCLING PROCESSES

BIO-WASTE RECYCLING AT BIO-WASTE TREATMENT FACILITIES – A NOTE ON TERMINOLOGY

The term 'bio-waste recycling' is ill-defined, both in European Union legislation, and European and international harmonised standards. It is generally assumed that it encompasses both composting and/or anaerobic digestion processes; however, it may also include a wide range of novel and emerging biorefinery processes that seek to convert and extract usable chemicals from bio-waste.

Bio-waste recycling is often referred to as 'organic recycling' or 'biological treatment'; however, these terms lack formal definition at the EU level. While the EU Waste Framework Directive makes reference to the 'reprocessing of organic material' in its definition of 'recycling', the list of recovery operations (R3) makes specific reference to the 'recycling/reclamation of organic substances'. The Packaging and Packaging Waste Regulation makes specific reference to 'bio-waste treatment facilities', in particular Article 9 on compostable packaging.

In order to prevent confusion, and as the PPWR is binding across the EU member states, 'bio-waste recycling' and 'bio-waste treatment facilities' are the preferred terms used in these Guidelines. For the sake of clarity, reference to 'organic' relates solely to organic chemicals, i.e. those containing carbon-hydrogen bonds or carbon-carbon bonds. It does not refer to organic produce, i.e. agricultural products grown without the use of inorganic fertilisers.

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This section describes the two principal bio-waste recycling methods, namely, composting and anaerobic digestion; the main differences are as follows:

> **Aerobic composting (AC)**, or simply composting, is a process where naturally occurring aerobic micro-organisms (bacteria and fungi) decompose organic material in the presence of oxygen, converting it into a stable organic residue (compost), carbon dioxide and water. There are two main scales of composting:
>
> - **Industrial composting (IC)** which is carried out on a large scale, treating thousands of tonnes of bio-waste every year, and
> - **Home composting (HC)** which, as the name suggests, is generally carried out by householders in gardens or community areas. It involves relatively small volumes of bio-waste, and is carried out at lower temperatures than industrial composting so it therefore takes much longer to produce compost.

> **Anaerobic digestion (AD)** is a process where naturally occurring anaerobic micro-organisms (bacteria) decompose organic material in the absence of oxygen, converting it into digestate and biogas. The anaerobic digestion processes are typically shorter than composting ones, and anaerobic digestion is now starting to be used in some countries as a first step in combined systems where it is followed by a post composting (aerobic) phase.

At industrial composting facilities, the process typically begins once the bio-waste is delivered to the site. Depending on the collection system operated by the local municipality and the environmental authorisation held by the facility's operators, the bio-waste may arrive as separately collected:

> Food waste
> Garden/park waste
> Co-mingled food and garden/park waste
> Other types of bio-waste, manures and agricultural residues

Compostable packaging and products (collectively referred to in these Guidelines as 'compostable items') may be included in these waste streams, or they may be delivered separately where a closed loop scheme is in operation (see Section 2.1).

The bio-waste may then be pre-treated via a shredding process (to reduce its particle size and increase its surface area) and screening to remove over-sized materials and physical contaminants. Shredded bio-waste is then placed in large piles, called windrows (Windrow Composting), in large Aerated Static Piles with forced aeration (ASP composting), or inside vessels (In-Vessel Composting) which vary in design depending on the composting method employed.

These methods are described in further detail in the following report: 'A Framework and Best Practice Guide for Field-Testing the Disintegration of Compostable Products and Packaging in Industrial Composting Plants'[18] and are shown schematically in Figure 1.

The active composting phase is then allowed to occur. It is characterised by rapid microbial activity resulting in the composting mass reaching high temperatures (typically between 60-70 °C) for a few weeks. This is called sanitisation and is important to ensure that disease-causing micro-organisms and weed seeds are destroyed.

Following active composting, the material is then screened to remove physical contaminants and to separate fine compost from larger particles. The final stage, known as the curing or maturation phase, allows the compost to mature, stabilising its nutrient content and further reducing any compounds that may harm sensitive plants. The outcome is a compost rich in organic matter, that also contains a range of nutrients and is suitable for use in various markets, e.g. agriculture, horticulture and soft landscaping. 'A Framework and Best Practice Guide for Field-Testing the Disintegration of Compostable Products and Packaging in Industrial Composting Plants' provides further information on industrial composting methods.

[18] A deliverable from Compostable by Design Platform.

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Bio-waste received on site → Shredding and screening → Active composting stage → Screening → Maturation → Grading into final product

Figure 1: Stages in a typical industrial composting process

1.4 STANDARDS AND CERTIFICATION

There are different types of standards, with each serving a distinct purpose. Test method and specification standards are prescriptive, defining an agreed approach to measuring, classifying, testing, or establishing consistent and repeatable outcomes. Vocabulary standards provide standardised terms and definitions, while guides offer non-mandatory recommendations.

European and international standards relevant to compostable packaging fall in the specification and test method categories. The European Standard (**EN 13432:2000**)[19] specifies: *'Requirements for packaging recoverable through composting and biodegradation. Test scheme and evaluation criteria for the final acceptance of packaging.'*

It addresses four characteristics, namely:

> Biodegradability,
> Disintegration during biological treatment,
> Effect on the biological treatment process, and
> Effect on the quality of the resulting compost.

The focus of EN 13432:2000 is **industrial (not home) composting**, and where it addresses anaerobic digestion, it assumes the AD process would be followed by a composting phase. Furthermore, as EN 13432:2000 is specific to compostable packaging items, its **mirror standard EN 14995:2006**,[20] specifies identical criteria for compostable plastic items.

Claims of conformance with EN 13432:2000 should not be made by manufacturers of compostable items themselves, as this can lead to misleading claims being made and potentially inappropriate products being placed on the market.

Conformity assessments should be carried out by independent, third-party certification bodies, which verify whether a product complies with the stringent requirements of a given standard. Items are tested under realistic conditions in a composting facility or under defined conditions in an accredited laboratory.

To maintain their impartiality, certification bodies need to be accredited by a national body who assesses them against internationally recognised standards to ensure they operate independently and competently.

19 At the time of writing, the European standards setting body, CEN, is in the process of updating EN 13432:2000, although the timescale for publication has yet to be finalised.
20 Plastics – evaluation of compostability – test scheme and specifications.

Within Europe, there are a number of established such bodies experienced in certifying compostable items to EN 13432:2000.

These include:

> Compost and Biogas Association (Italy) (CIC has developed a certification program, called "Compostabile CIC", to certify items, already certified according to EN13432, which correctly disintegrate and biodegrade in industrial composting facilities, i.e. real life conditions)
> DIN CERTCO (Germany)
> Renewable Energy Assurance Ltd (United Kingdom)
> TÜV AUSTRIA (Belgium/Austria)
> Cré Ireland (Ireland)

Manufacturers of certified items are permitted to use the certification scheme's logo on their products accompanied by a registration number which is unique to each product and its owner.

These logos show consumers and businesses that the packaging or other item meets the requirements of EN 13432 and that it has been independently verified. Figure 2 shows examples of certification logos[21] for industrially compostable packaging/items:

Figure 2: Industrial composting certification logos: Renewable Energy Assurance Ltd, TÜV Austria, Seedling, DIN Geprüft and Compostabile CIC , & Cré Compostable Certification Scheme.

[21] These are sometimes also called certification 'labels' or 'marks'.

Chapter 2
When designing compostable items makes sense

When designing an item, it is essential to balance technical specifications and business objectives with the item's most appropriate End-of-Life (EoL) management strategy.[22] The design should incorporate the principles of the waste hierarchy,[23] prioritising source reduction and reuse, while also ensuring that they lead to a genuinely lower environmental impact. It is also important not to compromise a product's shelf-life and safety (especially with regard to food products) during this design process. Only after thoroughly evaluating these considerations should the most appropriate EoL options be explored. Identifying the best EoL option is a key step in product design, as it requires an evaluation of the product's function, context, and the conditions under which it will be used and disposed of. Moreover, understanding how the product will be managed after use is vital to minimise its environmental impact. This reinforces the importance of a thoughtful approach that considers sustainability from the very beginning of the design process.

Compostable items can provide an effective solution in various scenarios, particularly when they address specific EoL challenges. Their value becomes evident when considering the following key questions:

- **Is the item likely to be soiled with food or other bio-waste at its EoL?**
- **Does the item support the diversion of bio-waste to bio-waste recycling?**
- **Is the item a common contaminant in the bio-waste stream?**
- **Will the item be used in a closed-loop system?**
- **Is the item currently recyclable in another material recycling stream?**

Designing an item for compostability is highly beneficial when the first four questions yield affirmative responses. These questions underscore the **key criteria**, which are fundamental for understanding when a compostable item is appropriate. By analysing these interconnected criteria in conjunction with other considerations, such as the geographic and regulatory context, as well as the type and intended use of the item, it becomes possible to identify the most suitable EoL pathway. This approach allows for the effective leveraging of the added value of compostable items in various circumstances, ensuring they contribute meaningfully to sustainability and circularity goals.

This chapter explores some key design criteria and considerations that need to be taken into account when identifying whether composting is a suitable End-of-Life strategy for a specific item.

22 This will vary across Europe, depending on infrastructure and the extent to which bio-waste recycling systems are in place.
23 Waste hierarchy

The first version of this Design Guidelines gives guidance for industrial composting (or AD plus industrial composting) as an intended EoL. Following the key criteria (Section 2.1), a decision tree has been developed in Figure 3 to show the decision-making process, along with a non-exhaustive table of potential compostable applications (see Section 2.4) to provide effective examples for a better understanding.

2.1 KEY CRITERIA

Colour coding that will appear in every criterion below are linked to the decision tree (Figure 3) and the table of compostable applications (Figure 4).

CRITERION 1: CONTACT WITH FOOD OR OTHER BIO-WASTE AND CONSEQUENT SOILING

To maintain the integrity and quality of compost as well as the operational efficiency of composting facilities, the primary guiding principle is that only items that contain residual food and other bio-waste should be considered as suitable for inclusion in a composting facility. Items that are likely to be tainted with hazardous substances, non-compostable contaminants, or any physical residues that could impede the effective functioning of bio-waste recycling facilities must not be designed for compostability. This approach is essential to ensure that the composting process remains effective and that the resulting compost is safe and beneficial for use.[24]

Is the item likely to be soiled with food or other bio-waste at its EoL?

In many cases, items that are food-soiled or contain bio-waste after their effective use phase end up in landfills, where they contribute to methane emissions; a greenhouse gas that has a global warming potential over 25 times greater than carbon dioxide. This disposal method also results in the formation of liquid leachates, which, unless properly contained and managed, can also pollute.[25] Conversely, incinerating food-soiled items or those containing bio-waste generate less energy than clean items due to their high moisture content.

24 C. Scopetani, D. Chelazzi, A. Cincinelli, T. Martellini, V. Leiniö, J. Pellinen, Hazardous contaminants in plastics contained in compost and agricultural soil. Chemosphere. Vol 293, 2022, 133645, ISSN 0045-6535

25 Greenhouse Gas Protocol, IPCC Global Warming Potential Values, Version 2.0, 7 August 2024

If these items are designed to be compostable, they can be recycled with bio-waste at their EoL, allowing the nutrients in the residual food or bio-waste to remain within the bio-waste recycling loop.

The inclusion of compostable items in the bio-waste recycling stream is likely to increase diversion of bio-waste from the residual waste stream. When evaluating the additional amount of bio-waste diverted toward bio-waste recycling and assessing whether certain applications are particularly conducive to composting, a co-benefit ratio model can be applied. For instance, in 2020, the Wageningen Food & Biobased Research Institute[26] proposed a model to facilitate the calculation of a score based on the ratio of bio-waste to packaging. According to this model, certain items like coffee pods/capsules are better suited for composting than material recycling, as the ratio of bio-waste to the dry material used for packaging or the item scores highly.

In the next version of this Guideline, we will focus on exploring this topic in greater detail, examining various methodologies and best practices.

[26] The fate of (compostable) plastic products in a full-scale industrial organic waste treatment facility.

Does the item support the diversion of bio-waste to bio-waste recycling?

Some items in everyday use could be a vehicle for easier collection of bio-waste and therefore enhance the diversion of bio-waste from landfilling or incineration to the recycling stream. These items should be made from certified compostable material to make sure they do not contaminate the compost. The main examples are:

- Plastic liners for kitchen caddies and food waste bins
- Paper bags for bio-waste collection
- Lightweight plastic carrier bags that can be repurposed to collect bio-waste from households

Does food or other bio-waste create problems in the material recycling streams?

Certain items are currently manufactured using materials that could be effectively processed in material recycling streams if they did not contain bio-waste. Unfortunately, the presence of bio-waste, which is challenging to eliminate, often leads to these items being discarded as residual waste, ultimately destined for landfills or incineration. It is important to note that certain products within these categories, such as food containers from the ready meal and dairy sectors, are made from materials that could be effectively collected, sorted, and recycled in conventional material recycling streams if they were not soiled by food or other organic residues. Moreover, the acceptable level of food contamination in traditional recycling streams, particularly regarding plastics and paper, remains a subject of ongoing discussion.* Key questions include:

- What are the maximum levels of bio-waste tolerated in the material recycling that would compromise the quality of the recycled material?
- What additional efforts are required to reduce bio-waste residue in packaging or items to be accepted in traditional material recycling?
- At what level does food or bio-waste contamination begin to negatively impact the recycling process?

* The issue of bio-waste residues is a critical factor that significantly impacts recycling chains. Therefore, the Compostable by Design Platform will conduct thorough research on the criteria for assessing the level of food or other bio-waste contamination that makes items suitable for composting. This topic will be discussed and explored along with other interested parties, and the findings will be incorporated into the next version of the Design Guidelines.

CRITERION 2: Bio-waste CONTAMINATION RISK

Is the item a common contaminant in the bio-waste stream?

Bio-waste contamination is a significant challenge for both municipalities and recyclers. Depending on where (households, businesses, schools, events) and how (door-to-door or street bins) bio-waste is collected, the contamination will vary. Common contaminants tend to be physical materials, such as pieces of non-compostable plastic or glass, although they may also be chemical (e.g. pesticides), or biological (e.g. pathogens).

Non-compostable items attached to food (bio-waste) are difficult for householders to separate (e.g. fruit and vegetable stickers) and non-compostable items frequently disposed of with garden waste (e.g. plastic wires used to support plants) contribute to end-product contamination of digestate and compost. On average, bio-waste

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contamination rates range between 5% and 8% by mass, and vary significantly depending on the country and type of collection system in place.[27]

Overall, there are **two main sources** of physical contamination:

- Items that accompany bio-waste and are difficult to separate, e.g. fruit and vegetable stickers or clips, twine, and wires used in agriculture.
- Non-compostable items incorrectly thrown into bio-waste bins (partly) because of the absence of a specific recycling label; there is no clear recycling label and/ or accompanying recycling instructions. This is significant where both compostable and non-compostable versions of the same product are placed on the market at the same time (e.g. lightweight bags, filter paper for coffee or tea).

Bio-waste contamination results in significant costs as it increases the complexity of sorting and managing bio-waste recycling facilities. It also means many composters and institutions are reluctant to accept certified compostable items as the perceived risk is too high.

[27] ISWA Contaminants Report 2023 by J. Gilbert, M. Ricci

Can the item be effectively removed during the bio-waste recycling process?

Despite most bio-waste recycling facilities having equipment in place to remove physical contaminants, in practice it is never 100% effective. To prevent the final products (compost and digestate) from being contaminated with visible and non-visible pieces, fragments and/or residues of physical contaminants, the choice can be made to certify the item as compostable.

CRITERION 3: PROBLEMATIC ITEMS IN OTHER WASTE STREAMS

Could the item be recycled in any material recycling stream?

In practice, the question posed above may not result in a simple 'yes' or 'no' answer as many items may not fulfil all the criteria for composting and could be better suited for recycling. However, material recycling might also be impractical due to various factors that negatively affect the ease with which it can be sorted and separated from other material fractions. This can cause the item to be rejected and ultimately end up in landfill or an incineration facility – outcomes that clearly run counter to better waste management practices and circular economy principles.

Contamination with bio-waste is a significant issue in material recycling streams, as it can hinder the sorting or recycling processes. This presents an opportunity to properly segregate, collect, and process items containing bio-waste in order to create valuable compost/digestate. This would have the double benefit of minimising greenhouse gas emissions associated with landfill or incineration and avoiding contamination in dry waste streams.

Another example relates to the use of multilayer packaging, especially when used in conjunction with food and drink products. Complex packaging like this is designed to protect and optimise the shelf-life of the products they contain, and for certain applications, multilayer packaging is also required to meet the desired mechanical, technical and physical performance requirements while in use. However, these items present an EoL challenge when it comes to separating the individual materials and generating high-quality recyclates. A significant portion of the material recycling stream consists of a mix of various materials, including multilayer plastic films and paper-based 'flexibles',[28] complicating recycling processes. Moreover, due to their shapes, sizes, and lightweight nature, certain items are more likely to leak into the environment unless properly separated from the material recycling stream.

Examples of other items that can negatively impact different waste streams and are potential candidates to be manufactured out of compostable materials include small items with high bio-waste content, such as packaging used for condiments, sauces, jam, coffee creamers, and sweets or confectionary wrappers. Lightweight items, such as improperly disposed carrier bags, can contribute to littering in the environment. Furthermore, multilayer packaging and items that cannot be recycled are seen as contaminants in common waste streams due to the challenges of mechanical recycling, with alternatives often involving high energy consumption and low efficiency. In such cases, compostability could be the most viable option to create valuable compost and reduce waste.

For items that are currently not recyclable by design or at scale, improvements in specifications or recycling infrastructure are necessary. If these improvements are unfeasible, an alternative consideration might be to make the item compostable, as long as it meets at least some of the previously mentioned criteria and the appropriate local infrastructure is in place enabling its recycling in the bio-waste stream.

CRITERION 4: CLOSED-LOOP SYSTEMS

Will the item be used in a closed-loop system?

A closed-loop system refers to controlled environments where waste management is optimised to collect and process materials, within a confined context. Closed-loop systems are designed to enhance recovery efficiency, minimise contamination and ensure proper disposal. Examples of premises that can be, and are, part of closed-loop systems are events, festivals, sport venues, fast food premises, canteens and institutional settings like schools or corporate offices.

[28] Multi-country study setting new benchmark for detail and understanding of plastic packaging in European waste streams – CEFLEX)

Closed-loop systems tend to have the following characteristics:

> **Controlled waste flow** – materials are generated and collected within a confined system, reducing the risk of contamination from external sources.
> **Volume of waste** – typically, these situations generate large quantities of bio-waste.
> **Material segregation** – clear labelling and designated collection points ensure proper separation of compostable, recyclable, and residual waste.
> **Processing integration** – closed-loop systems often have dedicated partnerships with specialised processors.
> **Educational components** – stakeholders (e.g. employees or attendees at events) are educated on segregation practices to enhance system efficiency.

Closed-loop systems provide the following advantages:

> **Reduced contamination** – proper segregation of different types of waste minimises contamination in bio-waste and material recycling streams.
> **Enhanced recovery rates** – controlled systems ensure higher rates of material recovery and waste diversion from disposal.
> **Localised impact** – closed-loop systems often operate at the community or institutional level, reducing transportation emissions and fostering local environmental benefits.
> **Regulatory alignment** – they reduce the risk of non-compliance with relevant regulations.
> **Public engagement** – they provide a tangible example of circular economy principles, promoting awareness and behavioural change.
> **Clear labelling and identification** – closed-loop systems provide the opportunity to set up clear and unambiguous product labelling supported by informative signs on bins/collection points.
> **Monitoring and evaluation** – they allow organisations to implement tracking systems and clear metrics to measure the success of waste diversion, material recovery rates, and contamination (data can then be used to improve and develop the system).

Examples of compostable items that can be integrated seamlessly into closed-loop systems include food service ware such as containers designed for take-out meals, cutlery, straws, plates, and both hot and cold drinking cups. Additionally, compostable coffee packaging and compostable sachets for sauces (such as ketchup, mayonnaise, or mustard), as well as packaging for small snacks, provide sustainable disposable options at events. This approach allows for a single bin to be used for the collection of bio-waste and compostable items, thus increasing collection efficiency and reducing contamination levels.

2.2 RELEVANT CONSIDERATIONS

When designing a compostable item, a number of additional relevant considerations also need to be taken into account, as these can significantly influence their effectiveness and the successful integration of compostable products in real-world applications. These key considerations encompass a range of aspects including material selection, environmental impact, EoL scenarios, consumer education, and regulatory compliance. Understanding these elements is essential for creating products that not only meet compostability standards but also contribute positively to sustainability efforts.

CONSIDERATION 1: GEOGRAPHICAL AREA(S) AND INFRASTRUCTURES/ACCEPTANCE

The successful introduction of compostable items is directly related to the geographical area and can only be realised when there is an appropriate separate bio-waste collection and bio-waste recycling infrastructure in place locally. In many parts of Europe, bio-waste recycling is still developing, while in other places with well-established bio-waste recycling schemes, the use of compostable items is discouraged or prevented by local regulations or industry trade bodies.

In some cases, bio-waste recycling infrastructure may not be available or may not accept compostable items due to restrictions imposed by local regulations. In such cases, designing a product that can be reclaimed in a material recycling system would present the best option. Moreover, wherever possible, products that are intrinsically recyclable in both bio-waste and material recycling systems could maximise resource recovery potential. Paper-based items manufactured from compostable materials present such opportunities.

To ensure the reduction of waste and its proper waste management, different strategies are needed. When the collection and composting infrastructure is in place (criteria to be developed by CbDP), EoL compostablility becomes more relevant (please refer to Chapter 1). The CbDP is also developing a document to map the composting capabilities in the EU.

CONSIDERATION 2: LOCAL AND REGIONAL LEGISLATION

Local legislation and policies play a critical role in determining whether certified compostable items are accepted in the market. Regulations regarding waste management, composting facilities, and environmental protection can either facilitate or hinder the introduction of certified compostable products. For instance, areas with supportive composting infrastructure and favourable policies may encourage businesses to adopt compostable items, while regions lacking such frameworks may see limited market potential.

It is therefore essential that before placing a compostable item on the market, businesses conduct thorough background research to understand local regulations, and to identify potential barriers to market entry. By doing so, companies can better position their products for success and contribute to sustainable practices in their communities. For more details on this topic, refer to Chapter 1.

CONSIDERATION 3: CONSUMER BEHAVIOUR

Consumer behaviour is important to prevent contamination of materials in recycling streams and the environment. Several factors influence appropriate consumer behaviour when disposing of an item:

> **Awareness and education –** consumers who understand the environmental consequences of improper disposal are more inclined to recycle or dispose of waste correctly than those who are unaware. Likewise, households familiar with separate bio-waste collection schemes should have received information explaining why non-compostable materials should not be placed in bio-waste bins. Clear labelling and claims can help ensure proper behaviour (refer to Chapter 4).

> **Convenience –** easy access to recycling bins or the provision of compostable bags for bio-waste collection encourages appropriate waste recycling and disposal. The collection system is also important; for instance, in closed-loop systems the correct disposal can be managed more easily (refer to Criterion 4).

2.3 DECISION TREE

To better understand how to apply the key criteria described in Section 2.1, the decision tree below has been developed. It is intended to be used as a practical tool to guide readers through the design of items, especially in identifying the most appropriate End-of-Life option. Navigating through the decision tree reveals when the use of compostable items is meaningful and essential is based on the above-explained key criteria.

Click on Yes/No

Reset

See the full tree

Interactive decision tree

Is the item likely to be **soiled with food or other bio-waste**?

Yes No

COLOUR KEY/ Each colour represents a key consideration in the design process.

- Criterion 1. Contact with food or other bio-waste and consequent soiling
- Criterion 2. Bio-waste contamination risk
- Criterion 3. Problematic items in other waste streams
- Criterion 4. Closed-loop systems
- Relevant considerations

Yes ——— No - - - - - -

Figure 3: CbDP Decision Tree

Go to the interactive tree

Decision tree

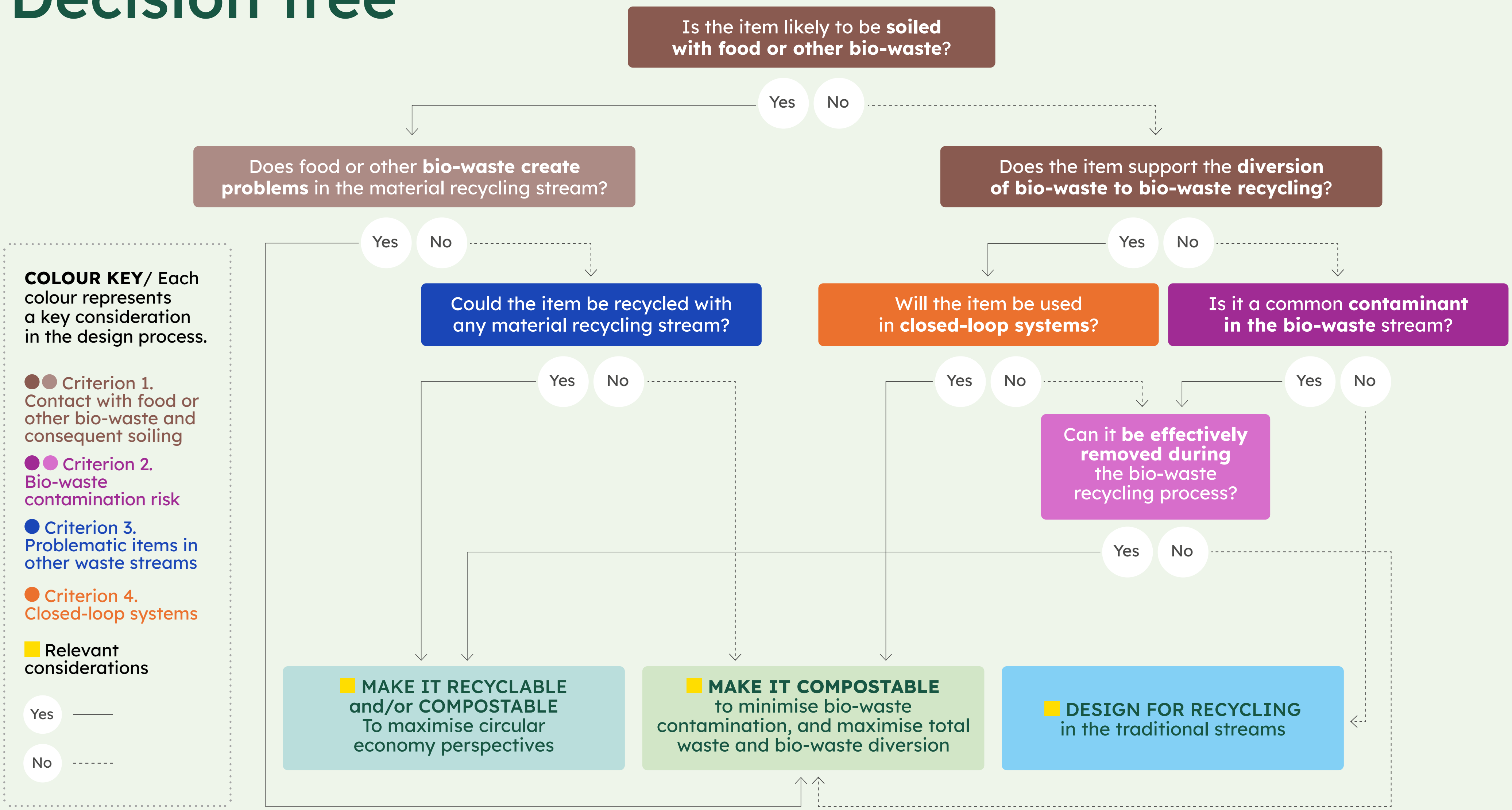


Figure 3: CbDP Decision Tree

The Decision Tree is a tool to explore possible pathways by answering YES/NO questions based on the key criteria for design (see Section 2.1). Coloured dots and squares attached to each corresponding-coloured block, serve as a reference, helping to locate the corresponding chapter section that details the corresponding question/criterion and related considerations.

When using the decision tree the following should be considered:

> The decision tree should be used in the context of local legislation (see Consideration 2). For example, it should be applied in relation to the requirements set by the Packaging and Packaging Waste Regulation in the EU.
> The current and future available infrastructure for collection and processing of both bio-waste and material recycling on the country level must be taken into consideration (see Consideration 1).
> The best EoL definition is not always a simple black-or-white decision, especially for important criteria, such as the bio-waste contamination after use, where the level is not yet regulated in many European countries. In some cases, it will make sense to make packaging both compostable and recyclable (see key criteria and considerations).
> After going through the decision tree and reaching the 'make it compostable' result, please refer to Chapter 3 which gives technical recommendations for designing compostable items in terms of materials and product characteristics.
> While the current range of items compostable at scale is limited, CbDP trusts that the definition of applications that bring value for composting together with increased separate collection of bio-waste will provide the right conditions to increase the actual composting rates for target items.

2.4 SUGGESTED COMPOSTABLE APPLICATIONS

Although there is currently only a relatively small number of compostable items placed on the market, and current bio-waste recycling options are limited in a number of countries, the CbDP envisages the application of selected products will bring value to bio-waste recycling systems by increasing capture rates and decreasing contamination.

Table 1: The coloured dots ●●●● and yellow square ■ serve as a reference, helping to locate the corresponding chapter section that details the corresponding question/ criterion and related considerations.

* System single-serve unit for coffee, tea used in a machine

** Not relevant when other criteria are completely satisfied and/or regulations are/will be in place (e.g. PPWR)

*** Plastic pots for plants sold to consumers that are designed for relatively short in-use lifespans.

Table 1: The decision tree in action.

ITEM	CRITERIA			COLLECTION SYSTEM
	FOOD SOILED / BIO-WASTE DIVERSION	COMMON CONTAMINANT IN BIO-WASTE	MATERIAL RECYCLING	
Tea/coffee/ other beverage bags and soft after-use SSSU* for tea/ coffee/other beverages	●● Containing bio-waste	●● Yes	NOT RELEVANT**	Household bio-waste bin
Sticky labels for fruit and vegetables	●● Accompanying bio-waste			
The above items are mandated compostable under the PPWR. The items below are suggested for when compostability makes sense.				
Lightweight (<50 μ) and very lightweight carrier bags (<15 μ)	●● Supporting the collection of bio-waste, if given a second life as a bio-waste bag	●● Yes	NOT RELEVANT**	Household bio-waste bin
Rigid SSSU* for tea/coffee/ other beverages	●● Containing bio-waste		●■ CAN BE RELEVANT	
Plant pots***				Household bio-waste or gadern waste bin
Twine and clips	●● Accompanying bio-waste			Bio-waste bin for plant waste

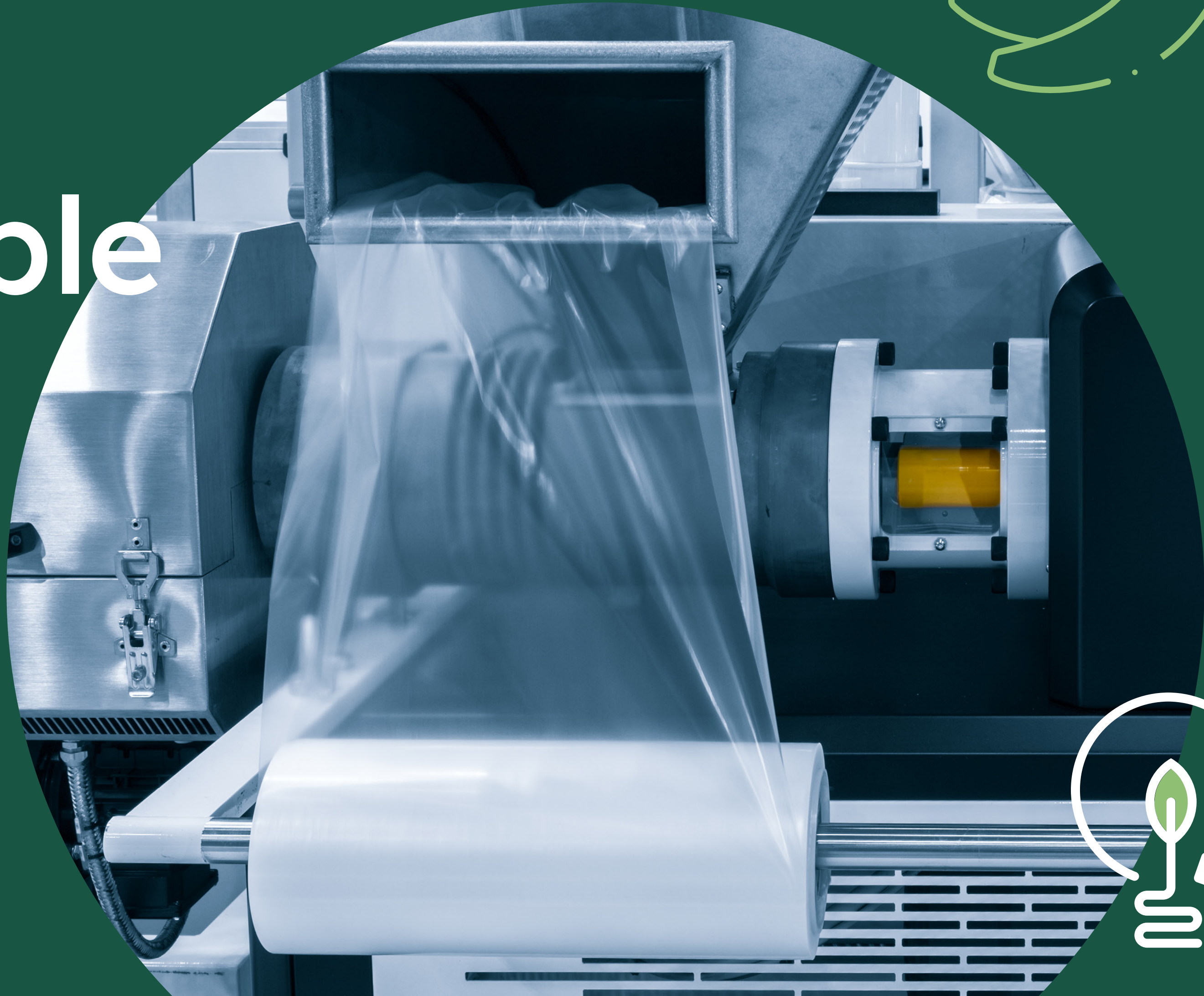
Table 1 provides a non-exhaustive list of potential compostable applications. It offers practical examples to illustrate how the decision tree and related **key criteria and considerations** can be adopted (excluding the consideration of geographical area(s) and infrastructure for simplicity). Colour coding that appears in the table refers to the corresponding criteria detailed in Section 2.1. Additionally, refer to Chapter 4 for best practice examples of compostable items to gain a practical understanding.

<table>
<tr><th rowspan="2">ITEM</th><th colspan="3">CRITERIA</th><th rowspan="2">COLLECTION SYSTEM</th></tr>
<tr><th>FOOD SOILED / BIO-WASTE DIVERSION</th><th>COMMON CONTAMINANT IN BIO-WASTE</th><th>MATERIAL RECYCLING</th></tr>
<tr><td>Food service ware (cutlery, paper, bowls and cups)</td><td>Soiled with food residues; relevant for closed-loop collection</td><td rowspan="5">Occasionally</td><td rowspan="3">CAN BE RELEVANT</td><td>Closed-loop bio-waste bin</td></tr>
<tr><td>Short shelf-life fruit and vegetable packaging (e.g berries, tomatoes, herbs)</td><td>Containing bio-waste; often disposed with residual spoiled content</td><td rowspan="2">Retailer or household bio-waste bin</td></tr>
<tr><td>Ready-to-eat food paperboard trays/ boxes</td><td rowspan="3">Soiled with food residues</td></tr>
<tr><td>Small sachets for sauces (small format flexible)</td><td rowspan="2">NOT RELEVANT**</td><td>Household or closed-loop bio-waste bin</td></tr>
<tr><td>Absorbent pads for meat, fish, fruit, etc.</td><td>Household bio-waste bin</td></tr>
</table>

COLOUR KEY/ Each colour represents a key consideration in the design process.

- Criterion 1. Contact with food or other bio-waste and consequent soiling
- Criterion 2. Bio-waste contamination risk
- Criterion 3. Problematic items in other waste streams
- Criterion 4. Closed-loop systems
- Relevant considerations

Chapter 3
Choosing compostable materials



This chapter provides guidance on the use of different compostable materials and other constituents such as additives, coatings, inks, colourants and adhesives. It also makes recommendations for ensuring the compostability of the final product, e.g. consideration of its thickness and any components. The aim is to offer best practice recommendations to help designers create items that can be certified to the compostability standard.

While regulations and standards provide clear guidelines and strict requirements for compostable applications, this chapter should be viewed as a recommendation, offering best practices for designing items made from compostable materials.

3.1 RECOMMENDED MATERIALS

Compostable materials are those that satisfy established requirements concerning disintegration, biodegradation, ecotoxicity, and limitations on harmful substances (see Section 1.4). It is essential to review certification claims and/or scientific documentation of the material before specifying its use.

Additional note on per-and polyfluoroalkyl substances (PFAS) and fluorine containing compounds
PFAS are fluorinated substances that contain at least one fully fluorinated methyl or methylene carbon atom (without any H/Cl/Br/I atom attached to it), i.e. with a few noted exceptions, any chemical with at least a perfluorinated methyl group (–CF3) or a perfluorinated methylene group (–CF2–). Most PFAS are known to be persistent and suspected to have bio-accumulative properties and adverse effects for the environment and on human health. Compostability certification requires total fluorine testing to ensure that any levels are below the permissible limits, and the applicant's declaration that the compostable material/item does not contain any deliberately added PFAS.

Materials that are intended to be used as the main constituent of items should be certified as compostable in their own right, irrespective of their specific type. Certification bodies will need to see evidence of this before certifying the final product itself. Most certification bodies offer databases of compostable materials, intermediates, and products that have valid (current) certification, including:

> Australasian Bioplastics Association ABA
> Biodegradable Products Institute BPI
> Compostabile CIC
> Cré Compostable Certification Scheme
> DIN-CERTCO
> Renewable Energy Assurance Ltd
> TÜV Austria

3.1.1 COMPOSTABLE MATERIALS

The following is a non-exhaustive list of compostable materials recommended for use:

- Polyhydroxyalkanoates (PHA)
- Polylactic Acid (PLA)
- Polybutylene Adipate Terephthalate (PBAT)
- Polybutylene Succinate (PBS)
- Polybutylene Succinate Adipate (PBSA)
- Polycaprolactone (PCL)
- Cellulose:
  - Cellulose Acetate and other derivates (Cellulose esters)
  - Cellulose (lignin content <5%)
  - Virgin fibre pulp
  - Regenerated cellulose
- Starch:
  - Thermoplastic starch (TPS)
  - Starch

Resin blends and multilayer structures include:

- **Resin blends** where two or more polymers are physically mixed together during manufacture to achieve certain desired properties, and
- **Multilayer structure** where item is composed of multiple distinct layers, each of which can consist of either a single polymer or a blend of polymers, allowing for tailored characteristics (e.g. improved barrier properties, strength, flexibility, or thermal stability).

Although items may be produced out of individually certified compostable resins, the way in which the final item is manufactured could affect its compostability. This needs to be taken into account during design of the item.

Fibre-based materials

Fibre-based materials are generally plant-based and are derived from the structural components of the leaves, stems, and trunks. Lignin, cellulose and hemi-cellulose are the main polymers, which are present in different ratios depending on the source plants and the way they have been processed.

Paper and cardboard are the two most commonly recognised fibrous materials, both of which can be used to make industrially compostable items. However, it is important to understand that not all paper and cardboard materials meet the standard for industrially compostable items, as processing treatments (e.g. bleaching), coatings, laminates, inks and adhesives may be non-compostable or possess ecotoxic properties. Furthermore, even though chemically unmodified materials and constituents of natural origin (e.g. unmodified natural fibres) are exempt from the biodegradation test in EN 13432:2000, they do still need to meet the other compostability requirements specified in the standard. It is therefore recommended that compostable items made out of paper/card should only be manufactured out of paper or cardboard pre-certified to EN 13432:2000.

It is also important to note that pulps used to make paper/cardboard material can contain different amounts of lignin depending on the pulping process used, which can subsequently affect the rate of disintegration and biodegradation of the manufactured item.

Additional note on materials containing lignin and challenges

The presence of lignin, a natural biopolymer found in wood and other plants, can slow down disintegration due to its branched structure and resistance to microbes. Materials such as paperboard and composites containing wood chips and sawdust as fillers may have higher lignin content. High lignin content can hinder disintegration, which may cause the material to fail the compostability test.

3.2 RECOMMENDATIONS FOR OTHER CONSTITUENTS

As most compostable items need to meet technical specifications in order to confer precise functional properties, this means that the final item is often made up of a number of different constituents. **All the constituents described below must comply with the industrial composting standard for the region or country where it is intended to be used.** In addition, assessment for compliance on maximum allowable concentrations for various heavy metals and total fluorine is needed.

3.2.1 ADDITIVES

Additives are typically incorporated into the main constituent material with the intention of modifying the inherent mechanical and/or optical properties of the material. These properties can include, but are not limited to, its rate of crystallisation, toughness, and processability. These additives are also known as processing aids, fillers, toughening agents, nucleating agents, antioxidants, plasticisers, etc.

3.2.2 COATINGS

A coating may be applied to a product to improve the look or feel of a product, or to improve its functionality. The coatings should allow the finished item or packaging to biodegrade within the specified timeframe without any harmful residues or inhibition of the composting process.

3.2.3 INKS

Ink is commonly used for branding and informational purposes; however, the amount used should be minimised wherever possible. Heavy ink coverage can have an impact on the ecotoxicity or it may slow down or hinder the item's disintegration or biodegradation during composting. Some of the key considerations are the maximum allowable concentration of ink by colour (as a percentage of dry weight), although these may vary by colour, as different pigments may have different impacts on composting.

Inks shall be included in the certifier's assessment of the final product. Alternatively, if compostable compliant or certified inks are used, this means that they have already been assessed individually as additives. In this case, the manufacturer must inform the certifier about the specific inks used and their quantities.

Ink suppliers often provide tools, such as 'ink calculators', to help determine the maximum combination of different colours and concentrations to ensure and item complies with compostability requirements.

3.2.4 COLOURANTS

Colourants are added to polymer mixes to change their overall colour, and can be inorganic pigments, organic pigments, and dyes. If the colourants used are in masterbatch form, the maximum dosage or amount used in the final item must comply with compostability requirements. Using colourants that are approved for direct contact with food means that they will not contain potentially hazardous substances that may contaminate the final compost.

3.2.5 ADHESIVES

Adhesives are used to bind two or more materials together. Adhesives may be water-based, solvent-based or solventless. While solventless and water-based adhesives may be less likely to have challenges related to toxic residues, solvent-based adhesives must be formulated using non-toxic solvents.

It is important to control the amount (by weight) of adhesive applied during the converting process, to make sure the amount used is compliant with EN 13432:2000. This standard limits the use of non-biodegradable organic constituents, such as adhesive/glue usage, for structural purposes.

3.3 NON-COMPOSTABLE MATERIALS

Non-biodegradable materials should not be used in the manufacture of a compostable item, as EN 13432:2000 specifies that each packaging item, packaging material or packaging component shall 'be inherently and ultimately biodegradable as demonstrated in laboratory tests'. Conventional polymers such as polystyrene, polyamides, polycarbonates, polyacrylates and polyolefins (polyethylene, polypropylene and others), must not be used as they are non-biodegradable. Additionally, conventional non-biodegradable polymers that contain additives to promote disintegration, such as oxo-degradable plastics, are banned in the EU and must not be used.[29]

3.4 PRODUCT CHARACTERISTICS

In addition to choosing inherently compostable materials and constituents, the overall configuration and structure of the product can also affect its compostability.

3.4.1 THICKNESS

The thickness of an item is an important factor that will affect its rate of biodegradation, and hence the item's capacity to compost during a typical composting process. The thicker the item, the harder it will be to absorb water and the smaller the available surface area for the composting microbes to colonise. When designing a product that will use certified material, check the material's certified maximum thickness. If the new product is thicker than the certified material's thickness, additional testing will be required. In scenarios, where the product is made up of several layers, although each individual layer may pass the maximum threshold for thickness, their combination may not and will require additional testing.

3.4.2 FINAL ITEM COMPONENTS

Some final items have components; these are parts of a final item that are 'easily separatable by hand or by using simple physical means' before disposal. While this is permissible under EN 13432:2000, the rules of individual certification schemes vary on whether all components in a final item must be compostable.

[29] Single-use plastics, European Commission web-page

For example, the Australasian Bioplastics Association and BPI's certification schemes mandate that all components in the final product are certified 'compostable' because consumers typically tend not to separate them, and instead dispose of them together. In contrast, TÜV AUSTRIA provides guidance on a range of scenarios, covering items with easily separatable components and items with components that are difficult to separate; for each scenario it says whether the components must be evaluated/tested together (as a whole).[30]

The CbDP **strongly recommends** that all components of a final item be certified as compostable.

Note: This guide's design recommendations are not intended to be an exhaustive list of materials or resins. The list aims to provide an overview of different materials known to be used during packaging/item design for different EoL. A more comprehensive list of materials may be found on the public databases (see Section 3.1). The maximum thicknesses for the homopolymers listed may vary depending on the resin type and/or the resin supplier. Disintegration testing of the final package/item is critical to prove its suitability for treatment under industrial (commercial) composting conditions.

30 TÜV Austria – Component vs Product

Chapter 4
Further information and best practice examples

Compostable items need to be clearly differentiated from their non-compostable counterparts so that they can be recycled in the correct bio-waste stream at the end-of-life. This means that all compostable products need to be accompanied by relevant information to inform consumers and bio-waste managers. Due to potential for misleading claims (so-called 'greenwashing') it is important that products carry accurate and up-to-date information.

4.1 CERTIFICATION STATUS

Firstly, only products that have been independently certified by an accredited certification body (see Chapter 1.4) should be marketed as compostable. Products should therefore carry the following information: **name of the certification body**, and the **item's unique certification number** provided by the certification body. Certification numbers associated with a raw or intermediate material should not be used.

These requirements can be easily met by using the logo and embedded or accompanying certification number provided by a certification body following successful conformance assessment. Examples are shown in Figure 2.

4.2 RECYCLING INSTRUCTION AND INFOGRAPHICS

It is recommended that the term '**industrially compostable**' be used as this communicates, in a simple way, the relevant end-of-life strategy. This may also be accompanied by reference to the most appropriate waste stream: for example, 'recycle in bio-waste'. Additionally, customers may also need to be informed about possible limitations of local waste collection infrastructure.

In some instances, products may be composted or recycled in a scheme for dry recyclable scheme. In such cases, dual labelling may offer the best approach, such as the USA's How2Recycle/How2Compost[31] label which provides guidance to consumers. Successful labels use standardised infographics to inform consumers about end-of-life recycling routes.

Across the European Union, the Packaging and Packaging Waste Regulation will require use of harmonised pictograms on some items, thus providing a tool to communicate to consumers about how to recycle the product after use. This is scheduled for 2028.

If only one component of an item is compostable, it will need to be disassembled before recycling, and appropriate labelling will be required. Manufacturers will need to consider the likelihood that a consumer will effectively separate and sort the different components for recycling. This must be reviewed on a case-by-case basis.

[31] How2Recycle/How2Compost

4.3 TERMS TO AVOID

The unqualified term 'biodegradable' should not be used. This is because it does not provide any indication of the timescale over which the item will decompose, or appropriate environmental conditions. Furthermore, terms such as 'degradable' or 'oxo-degradable' should be avoided, as these are typically used on oxo-degradable plastics which are non-compostable (see Section 3.3).

In order to avoid misleading claims, compostable items should always be supported by specific and valid certification that the item conforms to a published specification standard.

4.4 LABELLING TECHNIQUES

Depending on the compostable item – including its size, intended end use and whether it is packaged – different labelling options are available. These include:

> **Printing:** this is a reliable method of delivering specific information on a product or package, whether through visual elements like a stripe or grid, or with words and symbols or codes (e.g. a QR code). Printing, however, may not be possible on all products.

> **Embossing:** this is a good alternative to avoid printing or the use of an additional label. This technique is efficient when the term or logo is prominent on the product. However, compared with print or colour coding on a compostable item, embossed products are harder to identify visually, especially at bio-waste recycling facilities when carrying out quality control checks on waste loads recieved.

> **Colouring:** this is a useful complementary technique to differentiate a compostable product or packaging from others that are not compostable, use of colour it does not, by itself, deliver all the desirable information and is not suitable for all products (e.g. tea and coffee bags). There is no internationally or nationally agreed colour scheme, but it can be helpful on compostable items when it is colour-matched with signage/labels on bio-waste collection bins.

Until harmonised infographics have been introduced across the EU, product designers can select the most appropriate labelling technique for each compostable item.

4.5 BEST PRACTICE EXAMPLES

Best practice example 1

Fruit and vegetable stickers

Product characteristics, end-of-life options and benefits

> Compostable fruit and vegetable stickers designed to adhere securely to the skin of fruit and vegetables.

> Stickers can be disposed of together with fruit and vegetable peelings, eliminating the need for separating or peeling off.

Best practice example 2

Coffee pads, pods, bags and capsules

Product characteristics, end-of-life options and benefits

> Compostable coffee pads, pods and capsules designed to brew single servings of coffee.

> Compatible with common coffee brewing equipment.

> Coffee grounds can be disposed of along with the pad, pod etc., minimising the need for separation.

> Increased capture of food waste in the bio-waste stream for composting.

Best practice example 3

Tea bags

Product characteristics, end-of-life options and benefits

> Compostable tea bags designed to brew single servings of tea.

> Compatible with common tea brewing equipment.

> Tea leaves can be disposed of with the bag, minimising the need for separating the leaves from the tea bag between which would be complex.

> Increased capture of food waste in the bio-waste stream for composting.

Best practice example 4

Vacuum films and bags for food packaging

Product characteristics, end-of-life options and benefits

> Vacuum bags for sealing and food storage.
> Suitable for freezer, microwave, sous-vide cooking.
> Any unused food or food residue inside a vacuum bag can be disposed together.
> Increased capture of food waste in the bio-waste stream for composting.

Best practice example 5

Ready meal food trays

Product characteristics, end-of-life options and benefits

> Compostable trays designed for hot ready meals, capable of withstanding heat and moisture.
> Durable enough to maintain integrity during the heating and serving process.
> Increased capture of food waste in the bio-waste stream for composting.
> Trays can be disposed of with food scraps (e.g. 3-D, baked-on food residue), eliminating the need for separating food waste from the tray.
> Note: Cold ready meal trays are excluded from consideration in this context, as the food does not adhere to the packaging in the same manner as with hot meals. For takeaway trays, see example 12.

Best practice example 6

Compostable plant pots with full coverage print

Product characteristics, end-of-life options and benefits

- Compostable plant pots suitable for composting with bio-waste.
- Full coverage print for branding and information visibility.

Best practice example 7

Flexible packaging for butter

Product characteristics, end-of-life options and benefits

- Flexible paper or cellulose-based packaging for animal- and plant-based butter packaging.
- Used butter packaging is greasy on the inner side and cannot easily be cleaned.
- Increased capture of food waste in the bio-waste stream for composting.

Best practice example 8

Baking paper

Product characteristics, end-of-life options and benefits

- Baking paper for cooking and baking food (pastry, pizza, gratin dish, etc.)
- Grease-resistant paper in direct contact with the food and resistant to high temperature.
- Used baking paper contains food residues that cannot easily be removed.
- Increased capture of food waste in the bio-waste stream for composting.

Best practice example 9

Compostable individual condiment sachets

Product characteristics, end-of-life options and benefits

- Compostable sauce sachets for food consumed on the go.
- Sauce sachets contain food residues which cannot be cleaned. With the compostable packaging, sachets can be disposed of together with food waste.
- Increased capture of food waste in the bio-waste stream for composting.
- Suitable for closed-loop scenarios such as arenas or football stadia where the sachets can be collected with the food waste.

Best practice example 10

Compostable bags for food waste

Product characteristics, end-of-life options and benefits

- Bags designed for collecting bio-waste. They can be composted together with food waste in industrial composting systems.
- Benefits include facilitating proper waste separation.
- The compostable bag is suitable for use by the hotel, restaurant, and café (HoReCa) sector as well as households.

Best practice example 11

Compostable cutlery (forks, knives, spoons)

Product characteristics, end-of-life options and benefits

> Compostable plastic cutlery designed to handle both hot and cold foods without compromising strength or usability.
> Suitable for takeaways.
> Relevant for closed-loop collection.

Best practice example 12

Food containers (e.g. for takeaway meals)

Product characteristics, end-of-life options and benefits

> Sturdy and leak-resistant containers designed to maintain the integrity of both hot and cold foods during transport.
> Offers a sustainable alternative to traditional plastic or expanded polystyrene containers, aligning with environmentally friendly practices.
> Avoids contamination of other recycling streams due to significant amounts of food residue on the containers after use.
> Relevant for closed-loop collection.

Best practice example 13

Compostable plate

Product characteristics, end-of-life options and benefits

- Grease-resistant plates suitable for serving both hot and cold foods without leakage.
- Offers a sustainable alternative to traditional plastic or expanded polystyrene plates, supporting sustainable dining practices.
- Avoids contamination of other recycling streams due to significant amounts of food residue on them after use.
- Relevant for closed-loop collection.

Best practice example 14

Hot or cold beverage cup and lid made of the same material

Product characteristics, end-of-life options and benefits

- Lightweight cups and lids designed specifically for hot or cold beverages, ensuring convenience and functionality for takeaway use.
- Relevant for closed-loop collection.

Best practice example 15

Flexible packaging for soft cheese

Product characteristics, end-of-life options and benefits

- Used soft cheese packaging is difficult to clean and cheese residues are often left on the inner side.
- Increased capture of food waste in the bio-waste stream for composting.

Glossary

Additive	A substance added to a material, to enhance its properties, improve its quality, or extend its shelf life.
Adhesive	A substance used to bind two or more materials together.
Aerobic	In the presence of oxygen.
Anaerobic	In the absence of oxygen.
Anaerobic digestion (AD)	Process that breaks down organic matter (e.g. food waste) by microbial activity in the absence of oxygen. It produces biogas which can be treated to produce biomethane or electricity and heat. The resulting material from the AD process is the digestate. AD technologies and process management differ in terms of whether and how they perform the anaerobic process but also how it treats digestate before removal from the facility. Digestate post-treatment examples are: in-situ direct composting; separation into liquid and solids fractions, followed by composting separated digested solids (with or without adding 'fresh' bio-wastes), or by drying and pelletising separated digested solids. Definition from the latest draft (October 2024) of EN 13432.
Barrier	A material or layer designed to prevent or reduce the passage of certain substances, typically gasses, into or out of a packaged product. The purpose of a barrier in packaging is to protect the product from external factors that could potentially affect its quality, safety or shelf life. Barriers can be incorporated into packaging in various forms, such as films, coatings, laminates or inserts. They are used to inhibit the transfer of moisture, oxygen, light, odours, gases or contaminants that could potentially degrade the product or compromise its integrity.
Bio-based	A material derived from biomass.
Biodegradable	Capable of undergoing biodegradation.

Biodegradable plastic	A plastic that is capable of undergoing biodegradation. The biodegradability of a plastic is linked to the chemical structure of the polymer chain and does not depend on the origin of the raw materials; hence biodegradable plastics may be derived from either petroleum or biomass precursors.
Biodegradation	The microbial conversion of the organic constituents of a material or substance to carbon dioxide, new microbial biomass and mineral salts under aerobic conditions or to carbon dioxide, methane, new microbial biomass and mineral salts, under anaerobic conditions. The rate of biodegradation depends on a variety of factors, such as environmental conditions and the type and properties of a material or substance.
Biogas	Gaseous product of an anaerobic digestion process which consists mainly of methane (CH_4), carbon dioxide (CO_2) and smaller quantities of other gases (e.g. hydrogen sulphide, H_2S). Biogas can be upgraded to produce biomethane or used in a generator to produce electricity and/or heat.
Biological treatment	See: 'bio-waste recycling'
Biomass	Material of biological origin excluding material embedded in geological formations and material transformed into fossilised material. Biomass includes trees, crops, grasses, algae, mycelium and waste of biological origin, e.g. manure.
Bioplastic	A generic term used for plastics that are either a) bio-based, b) biodegradable or c) both. Note: Due to the ambiguity of this term, it is not used in this Guideline document.

Bio-waste	Biodegradable garden and park waste, food and kitchen waste from households, offices, restaurants, wholesale outlets, canteens, caterers, and retail premises, and comparable waste from food-processing premises.
Bio-waste recycling	Recovery operation by composting and/or anaerobic digestion to reprocess bio-waste into compost, or digestate and biogas, respectively.
Blend	A mixture of two or more substances, polymers or compounds so they are physically combined. The compounds can be but do not necessarily need to be chemically combined together.
Certification	The provision by an independent body of written assurance (a certificate) that a product, service, or system meets specific requirements. Adapted from ISO/IEC 1700:2020.
Certification body	A third-party conformity assessment body operating certification schemes and issuing certificates. Definition from EN ISO/IEC 17065:2012.
Certification scheme	A certification system related to specified products, to which the same specified requirements, specific rules and procedures apply. Definition from EN ISO 17065:2012.
Circular economy	Economic system that uses a systemic approach to maintain a circular flow of resources, by recovering, retaining or adding to their value, while contributing to sustainable development. Definition from ISO 59004:2024.
Closed-loop	A system where materials are recycled and reused to create the same product. It is an integral part of the circular economy.
Coating	(Verb:) The process of applying a layer of material onto a surface in order to confer specific properties. (Noun:) A material applied to a surface; it is called 'a coating'. Coatings are typically applied for purposes of protection or decoration.

Colourant	A pigment or dye added to a polymer mix to change its overall colour.
Component	Part of a final product that can be separated by hand or by using simple physical means. An 'integrated component' is part of a product that is distinct from the main body but does not need to be removed in order to use the product. It is an integral part of the product and may be made out of a different material from the main body. It is typically discarded at the same time as the product, although not necessarily using the same disposal or recycling route. A 'separate component' is part of a product that is distinct from the main body and needs to be removed completely and permanently in order to use/access the product. It may be made out of a different material from the main body, and is typically discarded prior to, and separately from, the main product.
Composite	A material made by combining two or more constituent materials with different physical or chemical properties. These materials work together to create a new material with enhanced properties, such as improved strength, durability or lightweight characteristics, which are superior to the individual components. In composites, the constituent materials remain distinct and separate within the finished product.
Composition	A specific combination of constituents used to manufacture an intermediate material or final product.
Compost	Soil improver obtained by composting bio-waste (e.g. a mixture of plant waste, kitchen food waste) having a limited mineral content and a significant amount of organic matter. Definition in latest draft (Oct. 2024) of EN 13432. Note: Most composts also contain a range of nutrients at concentrations useful for supporting plant growth and development.
Compostability	See: 'compostable.'

Compostable	A material or finishsed product that undergoes degradation by biological processes during composting to yield carbon dioxide, water, inorganic compounds and biomass at a rate consistent with other known compostable materials, and leaves no visible, distinguishable or toxic residue. (ISO 17088: 2021).
Composting	The process of controlled decomposition of biodegradable materials under managed conditions that are predominantly aerobic and which allow the development of temperatures suitable for thermophilic bacteria as a result of biologically produced heat. Definition used in the JRC 'end of waste' report 2014. See also Home composting/Industrial composting
Conformance	Situation where specified requirements are fulfilled. In respect of compostable items, this usually means meeting the requirements specified in a harmonised standard such as EN 13432:2000.
Conformity assessment	Demonstration that specified requirements are fulfilled (ISO/IEC 17000:2020).
Constituent	A substance of which a material, component or final product is composed. Note: A material, component or final product can be composed of one or more constituents.
Contaminant	An undesirable item, substance or biological material in bio-waste, compost or digestate that has potential to adversely affect the recycling process and/or the recycled end product(s).
Conventional plastic	Plastic, typically derived from fossil-based feedstock sources, that is not considered to be biodegradable or compostable over any reasonable timeframe.

Degradation	Irreversible physical, chemical or microbiological process leading to a significant change in the structure of a material, typically characterised by a change of properties (e.g. integrity, molecular mass or structure, mechanical strength) and/or by fragmentation, affected by environmental conditions, proceeding over a period of time and comprising one or more steps (ISO 472:2013).
Digestate	Solid or liquid by-product of an 'anaerobic digestion' process. Digestate can be used in agriculture as a fertiliser.
Disintegration	The physical breakdown of a material into very small fragments due to physical, chemical or microbiological processes (ISO 21067-2:2015).
Ecotoxicity	The harmful effects of a substance or material on the environment and its inhabitants, including plants and animals. It is a measure of the potential or actual impact of a substance on ecological systems and is often used in the assessment and regulation of chemicals and products.
End-of-life	The final stage in the lifecycle of a 'product' or 'material', where it is no longer useful or functional. When a product or material reaches its end-of-life, it becomes 'waste' or a discarded item. At this stage, it needs to be managed appropriately to minimise negative environmental impacts and promote sustainability.
Fibre	Thread-like substances with a high length-to-width ratio. Fibres can be natural or artificial in origin and are often used in the manufacture of various products. Compostable fibres are usually derived from natural sources.

Flexibles	UK guidance on assessing packaging recyclability describes flexible plastic packaging as items that change shape when filled. Common examples of flexible plastic packaging could include bags, pouches, sachets, sleeves, wrappers, lidding film or liners, crisp packets and fruit nets. Plastic films can be made from various types of plastic polymers, including polyolefins (PO), polyethylene (PE), polypropylene (PP), and polyvinyl chloride (PVC) and also includes metallised films. Paper-based flexibles is not a term used in UK guidance on packaging but its guidance on 'fibre-based composite materials' in packaging defines the latter as 'fibre-based composite packaging with plastic content greater than 5% by mass' and examples given of 'flexible paper packaging' product formats are wrappers and pouches. Fibre-based composite packaging with plastic content less than or equal to 5% by mass should be assessed under guidance applicable to paper and board packaging.
Glue	See: 'Adhesive.'
Greenhouse gases	Gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of radiation emitted by the Earth's surface, by the atmosphere itself, and by clouds. This property causes the greenhouse effect. Water vapour (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4) and ozone (O_3) are the primary GHGs in the Earth's atmosphere. Human-made GHGs include sulphur hexafluoride (SF_6), hydrofluorocarbons (HFCs), chlorofluorocarbons (CFCs) and perfluorocarbons (PFCs); several of these are also O_3-depleting (and are regulated under the Montreal Protocol). Deep, rapid, and sustained GHG emissions reductions, reaching net zero CO_2 emissions and including strong emissions reductions of other GHGs, in particular CH_4, are necessary to limit warming to 1.5°C (>50%) or less than 2°C (>67%) by the end of century (high confidence).

Home composting	A 'composting' process carried out by householders in gardens. It involves relatively small volumes of bio-waste and is carried out at lower temperatures than industrial composting. The process takes longer than industrial composting to produce 'compost'.
Homopolymer	A 'polymer' where every monomer unit of the chain is the same.
Hotel, Restaurant and Catering (HoReCa)	Refers to the sector of businesses that prepare and serve food and beverages to consumers, such as hotels, restaurants, cafes, and bars, and is used by companies selling products to this specific industry. Marketing to HoReCa is a B2B (business-to-business) effort that focuses on meeting the unique needs of these establishments for everything from food and beverages to equipment and services.
Industrial composting	A 'composting' process that is carried out on a large-scale, treating hundreds to thousands of tonnes of bio-waste every year and reaching temperatures above 55 °C. It is typically a managed process with defined operational practices (e.g. temperature range, timeframe, oxygen supply) for industrial/commercial scale transformation of bio-waste into stable, hygienic 'compost' for use in suitable markets, e.g. agriculture.
Industrially compostable	Capable of being composted in an 'industrial composting' facility. Criteria for industrially compostable packaging are defined in EN 13432 and ISO 18606, while those for industrially compostable plastics (e.g. in final product formats that are not 'packaging') are defined in EN 14995 and ISO 17088. Materials and products complying with these standards can be certified and labelled accordingly.

Ink	A specially formulated liquid or paste-like substance applied to a surface to create text, images or designs. It typically consists of colourants (pigments or dyes), binders (resins), solvents (or water) and additives.
Integrated component	See: 'Component.'
In-vessel composting	'Composting' technology involving the use of a fully enclosed chamber or vessel in which the composting process is controlled by regulating the rate of mechanical aeration with fans. Aeration assists in temperature control and oxygenation of the organic mass. Some countries have in-vessel composting processes that also use at least one outdoor phase of composting.
Item (in the context of this Guideline)	Packaging and non-packaging products.
Landfill	A designated area or site where solid waste is disposed of and buried in the ground.
Liquid leachate	Any liquid that, in the course of passing through matter, extracts soluble or suspended solids, or any other component of the material through which it has passed. Composting can generate leachate as a result of high moisture levels in bio-waste and putrescible waste, and from natural precipitation seeping through active or curing (maturing) compost piles.
Material	A substance or matter used to create physical objects, products or structures. Materials can be natural or synthetic, and they can take various forms, including solids, liquids and gases. They can be raw materials, such as wood, metals, or minerals or they can be processed materials, such as plastics, ceramics or composites.
Mono-material	A material consisting of only one type of material.

Monomer	A small molecule that can react with other identical or similar molecules to form a larger 'polymer' chain or three-dimensional network through a process called polymerisation.
Multilayer structure	A structure in which multiple layers (laminate) of different materials are bonded together. Each layer contributes to the overall properties of the structure by, for example, enhancing the barrier, strength, stiffness, or other properties of the material.
Municipal waste	Mixed waste and separately collected waste from households and other sources (i.e. similar in nature and composition to waste from households).
Organic recycling	See: 'Bio-waste recycling'
Oxo-degradable plastics	Plastic materials that include additives which, through oxidation, lead to the fragmentation of the plastic material into micro-fragments or to chemical decomposition.
Packaging	Products made of any materials of any nature to be used for the containment, protection, handling, delivery and presentation of goods, from raw materials to processed goods, from the producer to the user/consumer.
Packaging system	A system that affects the manufacturing, placing on the market, use and end-of-life management of used packaging.
Paper	A thin, flexible material made from plant fibres, typically cellulose, which are processed into a pulp and then formed into a sheet. The fibres are usually derived from wood, cotton, bamboo or other plant sources. Paper may also contain 'additives' such as fillers, starch, coatings, colourants and binders. Paper is usually called board when it is heavier than 225 g/m^2.
Plastic	Material containing as an essential ingredient a high polymer and which, at some stage in its processing into finished products, can be shaped by flow. (ISO 472:2013)

Polyamide (PA)	The largest family of engineering plastics with a very wide range of applications. Polyamides are one of the major engineering and high-performance plastics because of their good balance of properties. Polyamides are very resistant to wear and abrasion, have good mechanical properties even at elevated temperatures, and have low permeability. Polyamides are not biodegradable. Also known as nylon.
Polybutylene adipate terephthalate (PBAT)	An aliphatic aromatic copolyester, PBAT is one of the largest volume polyesters on the market which is biodegradable and can be certified compostable.
Polybutylene succinate (PBS)	An aliphatic polyester. PBS is biodegradable and can be certified compostable.
Polycaprolactone (PCL)	A biodegradable polymer suitable for applications requiring years of stability. In recent years it is becoming of increased interest to manufacturers of medical devices and drug delivery particles. It can be certified compostable.
Polyethylene (PE)	A polyolefin. It is one of the world's most widely produced synthetic plastics. High density PE (HDPE) is used for milk bottles, bleach, cleaners and most shampoo bottles. Low density PE (LDPE) is used for carrier bags, bin liners and packaging films. Polyethylene can be made from renewable resources (Bio-PE) but is not biodegradable. Polyethylene can be recycled in mechanical recycling streams.
Polyethylene terephthalate (PET)	A form of polyester. It has important characteristics such as strength, thermo-stability, gas barrier properties and transparency. It is also lightweight, shatter-resistant and highly recyclable, and it is widely used for drink bottles. It is not compostable.

Polyhydroxyalkanoate (PHA)	A polymer that is typically produced in fermentation processes by bacteria from sugar. Typical representatives of this material class are PHB (polyhydroxy butyrate), PHBV (polyhydroxybutyrate valerate), and PBHB (polyhydroxybutyrate hexanoate). It can be certified compostable.
Polylactic acid or Polylactide (PLA)	A versatile polymer that is obtained from renewable raw materials (sugar). It is mainly used for the production of packaging (both rigid and flexible), but also as a coating for paper cups and for the production of fibres and durable goods like 3D printing filaments. It can be certified compostable.
Polymer	A polymer is a large molecule made up of repeating subunits called 'monomers'. Polymers can be natural or synthetic, and they are used in a wide range of applications, including plastics, rubber, fibres, adhesives, coatings and films.
Polypropylene (PP)	A widely used recyclable polymer commonly used for clear takeaway food containers, margarine tubs and microwaveable meal trays. It is also produced as fibres and filaments for carpets, wall coverings and vehicle upholstery. It is a conventional plastic. Polypropylene is available from renewable resources but is not biodegradable.

Product	An 'item' that is created to meet a specific need or want. An 'intermediate product' is a semi-finished item in a state between being a raw material and a final product, e.g. laminates consisting of several layers of material, plastic pellets or paperboard. A 'final product' is a packaging or non-packaging item ready for use by an end user. Material type(s) used in final products differ according to product function, technical requirements, aesthetics and other factors. Numerous final products include additives and some include intermediates.
Pulp	Fibrous material created during papermaking from cellulose raw material.
Recyclable	Characteristic of a product, packaging or associated component that can be diverted from the waste stream through available processes and programmes, and can be collected, processed and returned to use in the form of raw materials or products (ISO 21067-2:2015).
Recycling	Any recovery operation by which waste materials are reprocessed into products, materials and 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. Note: In this guide, for simplicity organic material is termed bio-waste. See above for definition of bio-waste recycling. Recycling is a key component of sustainable waste management and aims to reduce the consumption of virgin resources, minimise waste generation and mitigate environmental impacts.
Recycling process (physical or chemical)	Physical or chemical process which converts collected and sorted used packaging products or other products, together in some instances with other material, into secondary (recycled) raw materials, products or substances, excluding energy recovery and the use of the product as a fuel. Modified from (ISO 21067-2:2015).

Renewable	A 'material' derived from natural sources that can be replenished or regenerated within a relatively short timeframe, typically within a human lifespan. Renewable materials are characterised by their ability to be sustainably produced and consumed without depleting finite resources.
Resin	A loose term used to describe viscous 'materials' that convert into rigid polymers by the process of curing. Examples for polymers derived from resins are PLA, PHA, PBAT, PCL and PBS. Examples of materials not derived from resins are TPS, cellulose derivatives, and other fibre based materials.
Reusable packaging	Packaging or packaging component which has been designed to accomplish, or proves its ability to accomplish, a minimum number of trips or rotations in a system for reuse (ISO 21067-2:2015).
Reuse	For packaging: operation by which packaging is refilled or used for the same purpose that it was conceived, with or without the support of auxiliary products present on the market enabling the packaging to be refilled (ISO 21067-2:2015).
Sanitisation	Biological processes that together with conditions in the composting batch eradicate human and animal pathogens or reduce them to acceptably low, sanitary levels.
Sanitary/sanitised	Degree of processing and biodegradation at which any human and animal pathogens present have been reduced to acceptable levels.
Separate component	See: 'Component.'

Single-use plastic (SUP)	A product that is made wholly or partly from plastic and that is not conceived, designed or placed on the market to accomplish, within its lifespan, multiple trips or rotations by being returned to a producer for refill or re-used for the same purpose for which it was conceived (Directive (EU) 2019/904 SUP Directive).
Sustainability	A characteristic or state whereby the needs of the present population can be met without compromising the ability of future generations or populations in other locations to meet their needs.
Waste	Any substance or object which the holder discards, intends to discard or is required to discard.
Windrow	A long pile of bio-waste/material types that represent a composting batch, that is exposed to air and sized for regular turning by machinery to aid oxygen supply and diffusion throughout the windrow.

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PLATFORM

Further information about the Compostable by Design Platform, including our sponsors, can be found at www.compostablebydesign.com